

**MARKET-DRIVING INNOVATION:  
UNDERSTANDING THE CRITICAL SUCCESS FACTORS  
AT THE FRONT END OF THE DEVELOPMENT PROCESS**

Thesis submitted in fulfilment of the requirements for the Degree of  
DOCTOR OF PHILOSOPHY

**Onnida Thongpravati**

B.Bus (eCommerce), M.Bus & InfTech

School of Economics, Finance and Marketing  
College of Business  
RMIT University

June 2014

## **DECLARATION**

I certify that, except where due acknowledge has been made, this thesis is the original work of the author alone. The thesis has not been submitted previously, in whole or in part, to qualify for any other academic award. The content of thesis is the result of work that has been carried out since the official commencement date of the approved research program, and any editorial work, paid or unpaid, carried out by a third party is acknowledged.

Onnida Thongpravati

June 2014

# ACKNOWLEDGEMENTS

This journey to the PhD has been a long-engaging and worthwhile life experience. My gratitude is extended to many people who have come into my life. Some have left and some remain, but they have all provided me with the possibility to complete this thesis and have become a part of my journey.

At the top of the list I would like to gratefully acknowledge the guidance, support and encouragement of my main supervisor, Associate Professor Mike Reid, who has always had trust in me (even more than I myself do sometimes!) – a very understanding, knowledgeable and ever so patient person. His positive attitude, inspirational words and brilliant suggestions keep me motivated and influence my way of thinking and learning, growing up around this research.

Prior to the start of the PhD journey I would like to express my appreciation and thanks to Associate Professor Liliana Bove, Professor Michael Davern and Associate Professor Damien Power for being my referees and allowing me to get a scholarship for my PhD entrance. Not to forget Associate Professor Martin Davies who taught me how to write a good research proposal and to read backwards, in reverse. Here is also included Associate Professor Alex Maritz for seeing my potential as a researcher and kick-starting my career in the world of academia.

At the “front end” of the PhD journey, my deep gratitude goes to Professor Michael Beverland, my previous supervisor. His tremendous thoughts on breakthrough innovation started me thinking and changing the way I view the world since he took me on board with this research. I would also like to express my special thanks to Professor Erik Jan Hultink for shedding light on my thesis. His continued support, wisdom and advice on my research was invaluable. Another person I would like to thank is my second supervisor, Dr Angela Dobeles, who recently came on board and keeps me enthusiastic about my project. Her cheerful support and warm attitude has meant a lot for me to push through to the end of the journey.

Importantly, I would like to acknowledge and thank my family and my dear Thai friends both in Australia and in Thailand. Although there are too many to single out, I would especially like to thank Nardwadee Watanakij, my best-friend-sister-buddy, who has always been there to support me in times of hardship. I would also like to thank Maris Janepanich and Chuchart Sritangos for their great support and friendship. And one that cannot be missed is Wijitra Poonchokpanich for her mother-like kind support. I give the biggest thanks to my mother, Vanida, for her unconditional love and understanding and her belief that I could achieve anything, and also for feeding me and keeping me alive when things were all over the place. Equally, I would like to thank my father, Maitri, who gave me the incentive to strive towards my vision, and my brother Sorot, or DJ Ketchupboyz, who showed me the other side of the world when I was stressed out.

Lastly, I would like to thank myself for continuing to believe in the *vision* that one must have a purpose in life and make a contribution to the world. This thesis would not have been possible without the support of all those people whom I have mentioned (and those whom I have not mentioned) but the ability to follow the intuition enabled me to pass through episodes of sciatica, steroid treatments, cortisone injections and a ride in an ambulance to an emergency department and then being hospitalised. With regard to this, I would like to thank Dr Dennis Shifter, Dr Andrew Mitchell and Dr Khompakorn Limpasutirachata for their treatment that allowed me to get back on my feet and be able to finish my thesis. Yet all these words cannot express how grateful I am to have the strength and the opportunity to become a Doctor of Philosophy.

## **PUBLICATION**

Thongpravati, O. Reid, M. & Dobele, A. (2013). “Market-Driving Innovation: Understanding the Critical Success Factors at the Front End of the Development Process”, *Annual Australian and New Zealand Marketing Academy Conference*, Auckland, New Zealand, December.

# TABLE OF CONTENTS

<b>DECLARATION</b> .....	<b>I</b>
<b>ACKNOWLEDGEMENTS</b> .....	<b>II</b>
<b>PUBLICATION</b> .....	<b>III</b>
<b>TABLE OF CONTENTS</b> .....	<b>IV</b>
<b>LIST OF TABLES</b> .....	<b>X</b>
<b>LIST OF FIGURES</b> .....	<b>XIII</b>
<b>LIST OF ABBREVIATIONS</b> .....	<b>XIV</b>
<b>ABSTRACT</b> .....	<b>XVII</b>
<b>CHAPTER 1: INTRODUCTION</b> .....	<b>1</b>
1.1 Background and Significance .....	1
1.1.1 The Resource-Based View of the Firm and Product Innovation .....	1
1.1.2 The Importance of Market-Driving Innovation .....	2
1.1.3 The Front End of Market-Driving Innovation .....	4
1.1.4 The Emergence of Market Visioning Competence and Market Vision .....	5
1.1.5 The Emergence of Absorptive Capacity as Antecedent to Market Visioning Competence .....	6
1.2 Research Objectives and Questions .....	9
1.3 Research Methodology .....	11
1.3.1 Research Context: Thailand .....	11
1.3.2 Research Design.....	14
1.3.3 Unit of Analysis .....	15
1.4 Research Contributions .....	16
1.5 Outline of Thesis Chapters .....	17
1.6 Chapter Summary .....	22
<b>CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL MODEL</b> .....	<b>23</b>
2.1 Introduction.....	23
2.2 The Resource-Based Perspective and Dynamic Capabilities .....	23
2.2.1 The Resource-Based View of the Firm and Product Innovation .....	26
2.3 Introduction to Product Innovation.....	30
2.3.1 New Product Development and Product Innovativeness .....	30
2.3.2 Defining Types of Product Innovation.....	34
2.3.2.1 Classifying Market-Driving Innovation (Radical and Really New innovation)	39
2.4 The Nature of Market-Driving Innovation .....	40
2.4.1 Measuring the Final Outcomes of Market-Driving Innovation .....	40

2.4.2	The Critical Success Factors of Market-Driving Innovation .....	44
2.4.2.1	Section Conclusion.....	61
2.5	The Nature of the Front End of Market-Driving Innovation .....	62
2.5.1	Defining the Front End of Innovation .....	62
2.5.2	The Front End Challenges of Market-Driving Innovation.....	64
2.5.3	Measuring the Front End Outcomes of Market-Driving Innovation .....	66
2.5.4	The Front End Success Factors of Market-Driving Innovation .....	69
2.5.5	Section Conclusion.....	86
2.6	The Emergence of Critical Front End Success Factors .....	88
2.6.1	Market Vision and Market Visioning Competence .....	88
2.6.1.1	Defining Market Vision .....	89
2.6.1.2	Defining Market Visioning Competence .....	93
2.6.2	Absorptive Capacity .....	96
2.6.2.1	Defining Absorptive Capacity.....	96
2.6.2.2	Absorptive Capacity and Product Innovation .....	99
2.6.2.3	Absorptive Capacity and the Front End of Market-Driving Innovation .....	102
2.6.3	Section Conclusion.....	105
2.7	Conceptual Model and Hypotheses Development.....	106
2.7.1	Absorptive Capacity as an Antecedent to Market Visioning Competence .....	107
2.7.2	Market Visioning Competence and Market Vision .....	112
2.7.3	Performance Consequences of Market Vision .....	113
2.7.3.1	Before-Launch Stage Performance .....	113
2.7.3.2	Post-Launch Stage Performance .....	115
2.7.4	Market-Driving Innovation Performance.....	117
2.7.5	Proposed Moderation Effects .....	120
2.7.5.1	External Environment .....	120
2.7.5.2	NPD Process Rigidity .....	123
2.7.5.3	Firm Size (number of employees).....	125
2.7.6	Conceptual Model and Summary of Research Hypotheses .....	127
2.8	Chapter Summary .....	131
<b>CHAPTER 3: RESEARCH METHODOLOGY .....</b>		<b>132</b>
3.1	Introduction.....	132
3.2	Research Paradigm .....	132
3.3	Research Design .....	134
3.4	Quantitative Research .....	138
3.4.1	Development of Web-based Survey Tool .....	138

3.4.2 Sampling and Data Collection .....	144
3.4.2.1 Unit of Analysis .....	144
3.4.2.2 Sample Selection .....	145
3.4.2.3 Sample Size .....	147
3.4.2.4 Key Informants .....	147
3.4.2.5 Survey Design and Process .....	148
3.4.2.6 Survey Response .....	150
3.4.3 Survey Questionnaire Development .....	152
3.4.3.1 Measurement Scale .....	152
3.4.3.2 Survey Instructions .....	154
3.4.3.3 Survey Structure and Layout .....	155
3.4.3.4 Survey Pre-Testing and Translation .....	157
3.4.3.5 Considerations for Common Method Bias .....	159
3.5 Data Preparation and Analysis Procedure .....	161
3.5.1 Preliminary Data Examination .....	161
3.5.2 Data Analysis Procedure .....	162
3.5.3 Sample Characteristics .....	163
3.6 Ethical Considerations and Confidentiality .....	165
3.7 Chapter Summary .....	166
<b>CHAPTER 4: CONSTRUCT MEASUREMENT .....</b>	<b>167</b>
4.1 Introduction to Measurement Scale Development .....	167
4.1.1 Operationalisation of Constructs .....	168
4.1.1.1 Multiple-item Scales .....	169
4.1.1.2 Content Validity .....	169
4.1.2 Reliability and Validity of Constructs .....	170
4.1.2.1 Construct Reliability .....	171
4.1.2.2 Convergent Validity .....	172
4.1.2.3 Discriminant Validity .....	172
4.1.2.4 Measurement Models .....	173
4.1.2.5 Goodness-of-Fit Measures .....	176
4.2 Operationalisation, Reliability and Validity of Main Independent Measures .....	178
4.2.1 Absorptive Capacity (ACAP) .....	178
4.2.1.1 Operationalisation of ACAP .....	178
4.2.1.2 Reliability and Validity of ACAP .....	182
4.2.2 Market Visioning Competence (MVC) .....	185
4.2.2.1 Operationalisation of MVC .....	185

4.2.2.2 Reliability and Validity of MVC.....	189
4.2.3 Market Vision (MV) .....	195
4.2.3.1 Operationalisation of MV .....	195
4.2.3.2 Reliability and Validity of MV .....	198
4.2.4 Summary of Reliability and Validity for Main Independent Measures .....	204
4.3 Operationalisation, Reliability and Validity of Dependent Measures .....	205
4.3.1 Before-Launch Stage Performance (BLSP) .....	205
4.3.1.1 Operationalisation of BLSP .....	205
4.3.1.2 Reliability and Validity of BLSP .....	208
4.3.2 Post-Launch Stage Performance (PLSP) .....	210
4.3.2.1 Operationalisation of PLSP.....	210
4.3.2.2 Reliability and Validity of PLSP.....	213
4.3.3 Financial Performance (FP) .....	215
4.3.3.1 Operationalisation of FP .....	215
4.3.3.2 Reliability and Validity of FP .....	216
4.3.4 Summary of Reliability and Validity for Dependent Measures .....	216
4.3.4.1 Operationalisation of Market-Driving Innovation Performance (MDIP) .....	216
4.3.4.2 Reliability and Validity of MDIP.....	217
4.4 Operationalisation, Reliability and Validity of Moderation Measures .....	221
4.4.1 External Environment (EE).....	221
4.4.1.1 Operationalisation of EE .....	221
4.4.1.2 Reliability of EE.....	223
4.4.2 NPD Process Rigidity (NPDR) .....	224
4.4.2.1 Operationalisation of NPDR .....	224
4.4.2.2 Reliability of NPDR.....	225
4.4.3 Firm Size .....	226
4.4.3.1 Operationalisation of Firm Size .....	226
4.4.4 Summary of Reliability for Moderation Measures (EE/NPDR) .....	226
4.5 Summary of Properties of Measurement .....	227
4.5.1 Nomological Validity .....	227
4.5.2 Inter-Construct Correlation .....	229
4.6 Demographics .....	231
4.7 Chapter Summary .....	232
<b>CHAPTER 5: RESULTS AND DISCUSSION.....</b>	<b>233</b>
5.1 Introduction.....	233
5.2 Data Analysis .....	235



5.2.1 Multiple Regression .....	235
5.2.1.1 Assumptions of Multiple Regression .....	236
5.2.2 Partial Least Squares Structural Equation Modelling (PLS-SEM) .....	240
5.3 Absorptive Capacity and Market Visioning Competence .....	244
5.4 Market Visioning Competence and Market Vision .....	252
5.5 Performance Consequences of Market Vision.....	257
5.5.1 Before-Launch Stage Performance .....	257
5.5.2 Post-Launch Stage Performance .....	263
5.6 Market-Driving Innovation Performance .....	269
5.6.1 Before-Launch Stage and Post-Launch Stage Performance .....	269
5.6.2 Before-Launch Stage Performance and Financial Performance .....	273
5.6.3 Post-Launch Stage Performance and Financial Performance .....	276
5.7 Proposed Moderation Effects.....	279
5.7.1 External Environment (EE).....	280
5.7.2 NPD Process Rigidity (NPDR) .....	286
5.7.3 Firm Size (Number of Employees) .....	290
5.8 Section Conclusion .....	294
5.9 Partial Least Square Structural Equation Modelling: Integrated Model.....	295
5.9.1 Preliminary Model Testing .....	296
5.9.2 Structural Model Estimates .....	303
5.9.2.1 Hypothesis Testing.....	304
5.9.2.2 Testing Mediated Effects (Fully Mediated Model).....	307
5.9.2.3 Testing Moderating Effects.....	311
5.10 Overview of Chapter 5 Findings.....	314
<b>CHAPTER 6: CONCLUSIONS AND IMPLICATIONS .....</b>	<b>317</b>
6.1 Introduction.....	317
6.2 Absorptive Capacity, Market Visioning Competence and Market Vision .....	318
6.2.1 Potential Absorptive Capacity and Market Vision.....	318
6.2.2 Realised Absorptive Capacity, Market Visioning Competence and Market Vision .....	320
6.2.3 Section Conclusion.....	322
6.3 Market Visioning Competence and Market Vision .....	323
6.4 Performance Consequence of Market Vision .....	325
6.4.1 Market Vision and Before-Launch Stage Performance .....	325
6.4.2 Market Vision and Post-Launch Stage Performance .....	328
6.5 Market-Driving Innovation Performance .....	330

6.6	The Mediating Role of Market Vision.....	332
6.7	Moderation Effects .....	334
6.7.1	External Environment .....	334
6.7.2	NPD Process Rigidity .....	336
6.7.3	Firm Size (Number of Employees) .....	339
6.8	The Implications of the Study.....	342
6.8.1	Theoretical Implications.....	342
6.8.2	Managerial Implications.....	348
6.8.2.1	Implications for Business .....	348
6.8.2.2	Implications for Public Policy Makers.....	351
6.8.3	Limitations and Future Research .....	352
6.9	Conclusion and Personal Reflection .....	356
	<b>REFERENCES .....</b>	<b>357</b>
	<b>APPENDICES.....</b>	<b>395</b>
	Appendix 1: Project Information Statement .....	395
	Appendix 2: New Product Development Survey.....	403

## LIST OF TABLES

Table 2.1: Common Measurement Scales of Product Innovation Performance.....	41
Table 2.2: Summary of Critical Success Factors of Market-Driven Innovation and Market-Driving Innovation.....	45
Table 2.3: NPD Processes and Models.....	52
Table 2.4: Summary of Critical Success Factors at the Front End of Innovation .....	70
Table 2.5: Summary of Key Studies on Absorptive Capacity and Innovation.....	100
Table 3.1: Common Cause of Method Bias and Adopted Remedies.....	160
Table 4.1: Criterion of Model Fit.....	177
Table 4.2: Measure for ACAP Construct (adapted measure).....	180
Table 4.3: Reliability for ACAP measure.....	182
Table 4.4: Internal consistency, square roots of average variance extracted and correlation matrix and model fit of – ACAP.....	182
Table 4.5: Goodness-of-fit analysis – ACAP .....	183
Table 4.6: Measure for MVC Construct (adapted measure).....	188
Table 4.7: Reliability for MVC measure .....	189
Table 4.8: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – MVC .....	189
Table 4.9: Goodness-of-fit analysis – MVC.....	190
Table 4.10: Reliability for Final MVC measure.....	193
Table 4.11: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – Final MVC .....	193
Table 4.12: Goodness of fit analysis – Final MVC .....	194
Table 4.13: Measure for MV Construct (adapted measure) .....	197
Table 4.14: Reliability for MV measure.....	198
Table 4.15: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – MV .....	198
Table 4.16: Goodness-of-fit analysis – MV .....	199
Table 4.17: Reliability for Final MV measure.....	202
Table 4.18: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – Final MV .....	202

Table 4.19: Goodness of fit analysis – Final MV .....	203
Table 4.20: Overall Reliability for Main Independent Measures (Final) .....	204
Table 4.21: Measure for BLSP (adapted measure).....	207
Table 4.22: Reliability for BLSP measure.....	208
Table 4.23: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – BLSP .....	208
Table 4.24: Goodness of fit analysis – BLSP .....	209
Table 4.25: Measure for PLSP (adapted measure) .....	212
Table 4.26: Reliability for PLSP measure .....	213
Table 4.27: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – PLSP .....	213
Table 4.28: Goodness-of-fit analysis – PLSP.....	214
Table 4.29: Measure for FP (adapted measure).....	215
Table 4.30: Reliability for FP measure.....	216
Table 4.31: Reliability for MDIP measure .....	217
Table 4.32: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – MDIP.....	218
Table 4.33: Goodness of fit analysis – MDIP.....	219
Table 4.34: Measure for EE (adapted measure) .....	223
Table 4.35: Reliability for EE measure .....	224
Table 4.36: Measure for NPDR (adapted measure).....	225
Table 4.37: Reliability for NPDR measure.....	225
Table 4.38: Reliability for Moderation Measures.....	226
Table 4.39: Descriptive scales and correlations coefficients, and reliability estimates.....	228
Table 4.40: Inter-construct correlation .....	230
Table 5.1: Regression Models: Absorptive Capacity and Market Visioning Competence .	245
Table 5.2: Regression Models: Market Visioning Competence and Market Vision.....	253
Table 5.3: Regression Models: Market Vision and Before-Launch Stage Performance.....	258
Table 5.4: Regression Models: Market Vision and Post-Launch Stage Performance.....	264
Table 5.5: Regression Models: Before-Launch Stage Performance and Post-Launch Stage Performance.....	270
Table 5.6: Regression Models: Before-Launch Stage Performance and Financial Performance.....	274

Table 5.7: Regression Models: Post-Launch Stage Performance and Financial Performance .....	277
Table 5.8: Moderation Effects of External Environment between MV and Before-Launch Stage Performance .....	281
Table 5.9: Moderation Effects of External Environment between MV and Post-Launch Stage Performance .....	284
Table 5.10: Moderation Effects of NPD Process Rigidity .....	287
Table 5.11: Moderation Effects of Firm Size (Number of Employees) .....	291
Table 5.12: Final items for MVC Construct (adapted measure) .....	296
Table 5.13: Internal Consistency, Square Roots of Average Variance Extracted, and Correlation Matrix .....	298
Table 5.14: Comparison between PACAP/RACAP of ACAP and MV constructs .....	300
Table 5.15: Summary of Main Hypotheses Results (Fully-Mediated Model) .....	310
Table 5.16: Summary of Additional Analysis Results (Fully-Mediated Model) .....	311
Table 5.17: Summary of Moderating Effects Results (Fully-Mediated Model) .....	313

# LIST OF FIGURES

Figure 1.1: The Initial Conceptual Framework .....	10
Figure 1.2: Outline of Chapter 2 – Literature Review and Conceptual Model .....	18
Figure 1.3: Outline of Chapter 3 – Research Methodology.....	19
Figure 1.4: Outline of Chapter 4 – Construct Measurement .....	20
Figure 1.5: Outline of Chapter 5 – Results and Discussion.....	21
Figure 2.1: Operationalisation of Product Innovativeness.....	31
Figure 2.2: Defining Types of Product Innovation.....	36
Figure 2.3: The Changing Focus of Market Orientation .....	50
Figure 2.4: The Entire Innovation Process .....	54
Figure 2.5: Key relationships between MVC and MV .....	88
Figure 2.6: Intrinsic and Extrinsic Dimensions of Market Vision.....	90
Figure 2.7: Organisational and Individual Dimensions of Market Visioning Competence ..	93
Figure 2.8: Absorptive capacity, its potential and realised subsets and dimensions .....	97
Figure 2.9: Conceptual Model .....	128
Figure 3.1: Overview of the Research Activities.....	136
Figure 4.1: Measurement Model – ACAP.....	184
Figure 4.2: Measurement Model – Original MVC (adapted measure).....	191
Figure 4.3: Measurement Model – Final MVC .....	192
Figure 4.4: Measurement Model – Original MV (adapted measure) .....	200
Figure 4.5: Measurement Model – Final MV .....	201
Figure 4.6: Measurement Model – BLSP .....	209
Figure 4.7: Measurement Model – PLSP .....	214
Figure 4.8: Measurement Model – MDIP.....	220
Figure 5.1: Example of Normal Probability of Residual Scatterplot.....	239
Figure 5.2: Structural Model (hypothesis testing) .....	305
Figure 5.3: Structural Model Without Market Vision (MV) .....	308
Figure 5.4: Fully-Mediated Model (reconfigured model) .....	309

## LIST OF ABBREVIATIONS

### *Theoretical Abbreviations*

### *Terms*

ACAP	Absorptive Capacity
AQ	Acquisition (of knowledge)
AS	Assimilation (of knowledge)
BI	Breakthrough Integrity
BLSP	Before-Launch Stage Performance
CI	Competitive Intensity
CL	Clarity (of market vision)
EE	External Environment
ESC	Early Success with Customers
EX	Exploitation (of knowledge)
FEI	Front End of Innovation
FFE	Fuzzy Front End
FO	Form (of market vision)
FP	Financial Performance
ID	Idea Driving
IDNW	Idea Networking
MDIP	Market-Driving Innovation Performance
MG	Magnetism (of market vision)
ML	Market Learning Tools
MO	Proactive Market Orientation
MT	Market Turbulence
MV	Market Vision
MVC	Market Visioning Competence
NCD	New Concept Development Model
NOE	Number of Employees
NPD	New Product Development
NPDR	New Product Development Process Rigidity
NW	Networking
PACAP	Potential Absorptive Capacity
PLSP	Post-Launch Stage Performance
PML	Proactive Market Learning

*Theoretical Abbreviations*

RACAP

RBT

RBV

SC

SP

SPMG

STM

TR

TT

VOC

WO

*Terms*

Realised Absorptive Capacity

Resource-Based Theory

Resource-Based View

Scope (of market vision)

Specificity (of market vision)

Specific Magnetism (of market vision)

Speed-to-Market

Transformation (of knowledge)

Technological Turbulence

Voice of Customer

Windows of Opportunity

*Statistics Abbreviations*

AMOS

AVE

CB-SEM

CFA

CFI

CR

GoF

LISREL

MLE

MODPROBE

NFI

OLS

PLS-SEM

RMSEA

SPSS

VIF

*Terms*

Analysis of Moment Structures

Average Variance Extracted

Covariance-Based Techniques

Confirmatory Factor Analysis

Comparative Fit Index

Composite Reliability

Goodness-of-Fit

Linear Structural Relations

Maximum Likelihood Estimation

Moderator analysis in the form of a SPSS macro

Normed Fit Index

Ordinary Least Squares

Partial Least Square Structural Equation Modelling

Root Mean Square Error of Approximation

Statistical Package for Social Sciences

Variance Inflation Factor



*Organisation Abbreviations*

GEM

ITU

MSI

NIA

OECD

PDMA

PDMAA

WIPO

*Terms*

Global Entrepreneurship Monitor

International Telecommunication Union

Marketing Science Institute

National Innovation Agency

Organisation for Economic Co-operation and  
Development

Product Development and Management Association

Product Development Management Association of  
Australia

World Intellectual Property Organization

*Other Abbreviations*

GDP

ICT

R&D

SBU

SME

URL

*Terms*

Gross Domestic Product

Information and Communications Technology

Research and Development

Strategic Business Unit

Small and Medium-sized Enterprise

Uniform Resource Locator

## ABSTRACT

Although marketing scholars have investigated the significance of both radical and really new innovations to business success, the factors underpinning such “market-driving” innovations remain elusive, especially at the front end of the new-product development (NPD) process. Most research on the NPD process, particularly the dominant “stage-gate” theory of innovation, has focused on reinforcing the *status quo* by solving customers’ existing problems or stated preferences in current markets, often resulting in “me too” or incremental innovations. Ensuring that future potential market-driving innovations are able to emerge from the front end of the NPD process into the development and commercialisation stages without losing their innovativeness or breakthrough integrity is thus fraught with difficulty and is a key challenge for firms.

Drawing upon the resource-based view (RBV) and the dynamic capability theory of the firm, the present research responds to this research gap by examining the notion of Market Vision (MV) and its antecedent, Market Visioning Competence (MVC) (Reid & de Brentani, 2010), to improve the front end or “early performance” of market-driving innovations. This research focuses on market-driving innovations, which incorporate both radical and really new innovations—specifically, *radical* breakthroughs, *technological* breakthroughs and *market* breakthroughs new products. MV, in this research, relates to having a clear and specific early-stage mental model or image of a product-market that enables NPD teams to grasp what it is they are developing and for whom. MVC is the ability of individuals or NPD teams in organisations to link *new ideas* or *advanced technologies* to future market opportunities. Accordingly, the research extends the understanding of factors driving front end success and proposes Absorptive Capacity (ACAP), with its subsets, Potential Absorptive Capacity (PACAP) and Realised Absorptive Capacity (RACAP), as an emerging organisational dynamic learning capability that influences MVC and its resultant MV, and in turn, specific NPD performance outcomes. A model is developed that integrates ACAP, MVC and MV with market-driving innovation performance, which comprises before-launch stage performance, post-launch stage performance and financial performance. In addition, the research investigates the external structural factors associated with the firm’s turbulent and competitive environment as well as internal factors, including the degree of NPD process rigidity and firm size (number of

employees), as moderators that influence the impact of MV on before-launch stage performance and post-launch stage performance.

The data were derived from a web-based survey of 179 managers of top innovative firms in Thailand. The focus of the research was at the NPD program level of a strategic business unit or at the company level where there was no separate business unit. The sample was primarily drawn from the 2011–2012 database of the National Innovation Agency, operating under the umbrella of the Ministry of Science and Technology, Thailand (National Innovation Agency, 2011, 2012). Furthermore, the measurement instruments adopted were the existing scales in product innovation and management literature, slightly modified where appropriate. Several new items were developed to fit the specific context of the front end of market-driving innovation – most significantly, a breakthrough integrity measure. The constructs were assessed by using Cronbach’s alpha, confirmatory factor analysis and correlation analysis to determine their reliability and their convergent, discriminant and nomological validity. The assessment of the constructs in relation to the hypothesised relationships was tested using linear regression, while the overall set of relationships was modelled using SmartPLS (Ringle, Wende & Will, 2005).

A major contribution of this research is the finding that ACAP as a dynamic capability significantly and distinctly influences both MVC and MV at the front end of market-driving innovation. On one hand, a firm’s ability to acquire and assimilate knowledge, or PACAP, can lead to a discovery of new sources of knowledge for market-driving ideas, hence directly influencing MV but not MVC. On the other hand, a firm’s ability to transform and exploit knowledge, or RACAP, fosters the entrepreneurial mindset and actions of individuals or NPD team members, and can directly influence opportunity recognition in MVC, as well as generating the new initiatives and knowledge that are essential to develop a shared mental model of radically new or really new product for future markets (the MV itself). Moreover, the findings indicate that MVC significantly and positively influences MV and that both of these constructs significantly and positively influence certain aspects of before-launch stage performance and post-launch stage performance – specifically, the ability to maintain breakthrough integrity, to achieve early success with customers and speed-to-market, and to open windows of opportunity. The results also suggest that the best way to account for such performance outcomes is by considering MV as a mediating variable. Additionally, large firm size significantly and positively influences the translation

of MV into post-launch stage performance outcomes. With respect to before-launch stage performance and post-launch stage performance, a significant positive relationship is observed. In turn, the performance outcomes at both those stages significantly and positively influence the financial performance of market-driving innovations.

Overall, these findings are important in suggesting that the capability to visualise future potential product-markets (MVC/MV) and in combination with broader organisational level dynamic learning capabilities (ACAP and its subsets PACAP/RACAP) can lead firms to achieve better performance of market-driving innovations, from the front end of the development process and through to commercialisation. In line with the theoretical argument in the RBV and dynamic capability literature, the outcome of these capabilities contributes to achieving competitive advantage and superior performance through new product development. More importantly, this is the first empirical study to model the role of ACAP as a precursor to MVC/MV and specific performance outcomes (i.e., before-launch stage performance and post-launch stage performance). Further the research also helps extend the work of Reid and de Brentani (2010) on MVC and MV, whilst exploring this notion in a different research context (i.e., using sample from a developing country). The theoretical and managerial implications for the advancement of market-driving innovations apply not only to Thailand, but also more broadly to other countries and locations.

# CHAPTER 1: INTRODUCTION

*You can't just ask customers what they want and then try to give that to them.  
By the time you get it built, they'll want something new.*

Steve Jobs, 1989, Co-founder, former Chairman and CEO of Apple Inc.

## 1.1 Background and Significance

### 1.1.1 The Resource-Based View of the Firm and Product Innovation

In today's rapidly changing and highly competitive environment, firms require resources and capabilities to drive success and performance in order to sustain competitive advantage. Accordingly, recent studies have used the resource-based view (RBV) to investigate the role of a firm's resources in addressing the dynamic business environment (de Brentani, Kleinschmidt & Salomo, 2010; Paladino, 2007). The RBV of the firm, as proposed in the dynamic capabilities literature, provides an overall theoretical perspective (Eisenhardt & Martin, 2000). The RBV focuses on a firm's internal resources that are valuable, rare, inimitable and nonsubstitutable (Barney, 1991). Importantly, these resources need to be modified, integrated and reconfigured to adapt to the changing environment. This is the dynamic nature of the capability of a firm to alter its internal resources in advantageous ways to improve firm performance (Teece, Pisano & Shuen, 1997). Internal resources, particularly the intangible resources (skills and knowledge) and an entrepreneurial orientation (proactiveness and innovativeness), are essential for creating sustainable advantage (Bakar & Ahmad, 2010).

The Marketing Science Institute (MSI) has considered the topic of Connecting Innovation with Growth as a top-tier research priority for almost a decade (MSI, 2006, 2008, 2014). Innovation is viewed as "the prime engine of growth" in economies. New product development (NPD) and product innovation are viewed as one of the most important, value-creating activities required for a firm to succeed, or even survive, in the competitive and dynamic business environment. Eisenhardt and Martin (2000) argued that the link between RBV and product innovation can strengthen RBV and its empirical grounding. Cast in RBV,

product innovation has been regarded as an engine of corporate renewal and is a dynamic capability of the firm (Danneels, 2002; Knight & Cavusgil, 2004; McNally & Schmidt, 2011; Zahra, Sapienza & Davidson, 2006). The abilities of a firm to exploit its existing resources and skills and to change the routines for product development can enhance new product performance and firm performance, and are therefore important for scholarly examination (Cooper & de Brentani, 1991; Cooper & Kleinschmidt, 1993; De Clercq, Thongpapanl & Dimov, 2011; Kleinschmidt & Cooper, 1991; Song & Parry, 1997a, 1997b; Zirger & Maidique, 1990).

### **1.1.2 The Importance of Market-Driving Innovation**

Breakthrough product innovations are argued to be a source of sustainable competitive advantage that can importantly contribute to a firm's growth and profitability in the current dynamic business environment (e.g. Chandy & Tellis, 1998; Cho & Pucik, 2005; Hauser, Tellis & Griffin, 2006; Sorescu, Chandy & Prabhu, 2003). This type of product innovation has been designated as a significant research topic by the MSI (Story, Hart & O'Malley, 2009). Breakthrough innovations can revolutionise an industry and fundamentally redefine the market structure, preferences and even behaviour of all players in the market (customers, competitors and other stakeholders) (Jaworski, Kohli & Sahay, 2000). Respectively, breakthrough innovations are also sometimes referred to as "market-driving innovations" because they drive the market in nature (Zortea-Johnston, Darroch & Matear, 2012). Firms that focus on developing market-driving innovations are considered to be "market-driving" as opposed to being "market-driven" (Kumar, Scheer & Kotler, 2000; Schindehutte, Morris & Kocak, 2008). Market-driving firms change the rules of the competitive game, enabling them to transcend "the zero-sum game that characterises many industry battlegrounds" (Bessant, Birkinshaw & Delbridge, 2004, p.33).

For the purpose of this study, "market-driving [product] innovation" is defined as a breakthrough product innovation which *explores* new ideas or technologies that significantly transform existing markets or create new ones and therefore require *market-driving* competencies (Jaworski et al., 2000; Leifer et al., 2000; Mohr, Sengupta & Slater,

2005). “Market-driving competencies” mean “getting outside the immediate voice of the customer” to proactively reshape customers’ product preferences (Jaworski et al., 2000, p.45). The definition of market-driving innovation is in contrast to “incremental” (“market-driven”) innovation, which is defined in the study as an improvement of an existing product, which *exploits* existing ideas/technologies in the existing market, and therefore requires *market-driven* competencies (Garcia & Calantone, 2002; Jaworski et al., 2000; Leifer et al., 2000). Market-driven competencies are about listening to the voice of the customer and being reactive to articulated product preferences in existing (predictable) markets (Jaworski et al., 2000; Varadarajan, 2009).

By definition, market-driving innovations are composed of both “radical” innovations and “really new” innovations—specifically, *radical* breakthroughs new products, and *technological* breakthroughs and *market* breakthroughs new products (Chandy & Tellis, 1998, 2000; Garcia & Calantone, 2002; Zortea-Johnston et al., 2012). This research is focused on these three types of ‘tangible’ breakthrough new products rather than ‘intangible’ services or process innovations. An example of a *radical* breakthrough is the first consumer microwave oven (an entirely new product category). Examples of really new innovations are the Apple iPhone3 and iPod (a *market* breakthrough using existing technologies within a new platform) and the Canon LaserJet printer (a *technological* breakthrough using new technology to extend the existing product line from the InkJet printer).

Despite the importance of market-driving innovations for attaining superior performance, firms continue to face challenges in developing the capabilities required for market-driving innovations (O'Connor, Ravichandran & Robeson, 2008). Wind and Mahajan (1997, p.3) stated that “the challenge is how to increase an organization’s ability to develop breakthrough products”. The literature on the management of innovation highlights the critical success factors for managing the development of market-driving innovations. Several recent studies have identified that managing market-driving innovations needs capabilities in various dimensions: a clearly identified organisational structure and market-driving culture, a flexible NPD process, an appropriate strategic focus (NPD strategy), research and launch tactics, including appropriate innovation metrics and performance measurements (Barczak & Kahn, 2012; Cooper, 2011; Cooper & Edgett, 2008; Cooper &

Kleinschmidt, 2010; Kahn, Barczak, Nicholas, Ledwith & Perks, 2012; O'Connor, 2008; Rangan & Bartus, 1995; Sethi & Iqbal, 2008). The factor of particular importance related to NPD best practice is the strategy for “the defining and planning of a vision and focus for research and development (R&D), technology management, and product development efforts” at all organisational levels (Barczak & Kahn, 2012, p.294). This strategic focus reflects the front end of the NPD effort and is viewed as distinct from the other capability dimensions (Kahn et al., 2012).

### **1.1.3 The Front End of Market-Driving Innovation**

This thesis focuses on understanding the critical success factors at the front end of market-driving innovations. Practitioners, expert consultants and researchers identify the front end of innovation (FEI) as the root of NPD success. FEI is a significant area for further research on product development management (e.g. Backman, Borjesson & Setterberg, 2007; Khurana & Rosenthal, 1998; Kim & Wilemon, 2002b; Koen et al., 2001; Verworn, Herstatt & Nagahira, 2008). The front end is especially important for market-driving innovations (Leifer, O'Connor & Rice, 2001; McDermott & O'Connor, 2002; Reid & de Brentani, 2004; Schindehutte et al., 2008). The highest level of ambiguity and uncertainty is at the front end of market-driving innovations due to the least understanding of this phase and the fewest strategies available for effective management (de Brentani & Reid, 2012). There is, however, no consensus on the constructs that drive the front end success of market-driving innovations (McDermott, 1999). This area of research remains a perplexing topic to theorists because of the “fuzziness” of the idea generation and evaluation stages of the NPD process (Broring, Cloutier & Leker, 2006; Verworn et al., 2008). The MSI has thus highlighted its continued interest in this area and the need for novel or new approaches to new product development, particularly regarding generating radical or really new (market-driving) product ideas (MSI, 2008).



Generating market-driving ideas and getting them across the stages from opportunity discovery (FEI) and into product development (through “the Valley of Death”), whilst retaining their innovativeness remain challenging for many firms (Markham, Ward, Aiman-Smith & Kingon, 2010). The dominant “stage-gate” theory of innovation may be too rigid for market-driving innovations, especially at the front end of the development process (Hammedi, van Riel & Sasovova, 2011; O'Connor, 1998; Seidel, 2007; Sethi & Iqbal, 2008). Although different versions exist and it acknowledges the need for iteration, the stage-gate process primarily relies on the traditional market orientation or market-driven NPD and reinforces the *status quo* by solving customers’ existing problems or stated preferences in current markets, often resulting in “me too” or incremental innovations (Beverland, Ewing & Matanda, 2006; Jaworski et al., 2000; Wind & Mahajan, 1997). Further, the generally linear stage-gate process involves gates which act as quality control or go/kill decision check points before a new product idea can progress to the next stage (Cooper, 2008). With a lack of clear market vision to anchor product development, the more innovative market-driving ideas that could potentially create new markets are often dumped or squelched by managers and therefore fail to emerge into the development stage and then into commercialisation (Backman et al., 2007; Hill & Rothaermel, 2003; Kumar et al., 2000).

#### **1.1.4 The Emergence of Market Visioning Competence and Market Vision**

Drawing on the RBV of the firm as proposed in the dynamic capabilities literature, recent research suggests that market visioning competence (MVC) and its resultant market vision (MV) (Reid & de Brentani, 2010) are instrumental in ensuring that market-driving innovations are able to emerge into the development process whilst retaining their breakthrough integrity. This research further examines this notion and defines MVC as “the ability of individuals or NPD teams in organisations to link *new ideas* or *advanced technologies* to future market opportunities”. This results in MV, “a clear and specific early-stage mental model or image of a product-market that enables NPD teams to grasp what it is they are developing and for whom”. MVC and MV are expected to have a strong impact on program level performance, especially during the early activities or the front end of the NPD

effort of market-driving innovations. As MV acts as an indicator for early strategic direction influencing early performance or before-launch stage performance (BLSP), this study also proposes the condition under which MV has the potential to impact on post-launch stage performance (PLSP), and ultimately financial performance (FP).

Further, both external and internal environments of the firm are considered to have moderating influences on the relationship between effectiveness of the emergent MV and BLSP/PLSP outcomes. Recent research has specifically highlighted the importance of factoring in a firm's competitive environment and the firm's internal resources as moderators on the way in which "MV unfolds and on its capacity for impacting performance" (Reid & de Brentani, 2012, p.125). Accordingly, this study determines that the relevant moderating factors are the firm's external environment and the internal factors of the degree of rigidity inherent in the NPD process and the firm size (number of employees). The effect of firm size, for instance, is the subject of much dispute in the innovation literature, particularly on market-driving innovations; thus, investigating this factor may provide further insights (Chandy & Tellis, 2000).

### **1.1.5 The Emergence of Absorptive Capacity as Antecedent to Market Visioning Competence**

Recent literature on product innovation has also highlighted absorptive capacity (ACAP) as one of the most significant constructs to emerge in strategic organisational research (Bertrand & Mol, 2013; Flatten, Engelen, Zahra & Brettel, 2011; Lane, Koka & Pathak, 2006; Zhou & Wu, 2010). ACAP, as firm-specific learning, resource and capability, is part of "a wider literature on the contribution of knowledge processes to organizational performance, located within the RBV of the firm, and its sub-set of dynamic capabilities" (Harvey, Skelcher, Spencer, Jas & Walshe, 2010, p.83). Accordingly, ACAP can be defined as "the organizational routines and process by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability" (Zahra & George, 2002, p.186). Empirical studies have pointed out that firms with high levels of ACAP perform well in developing product innovations to achieve superior business performance

and competitive advantage in changing environmental conditions (e.g. Chen, Lin & Chang, 2009; Cohen & Levinthal, 1990; Daghfous, 2004; Kostopoulos, Papalexandris, Papachroni & Loannou, 2011; Tsai, 2001; Vinding, 2006).

More specifically, ACAP is strongly related to market-driving innovations (Hill & Rothaermel, 2003; Kostopoulos et al., 2011; Zahra et al., 2006). As market-driving innovations involve novel combinations of new or existing ideas/technologies and know-how, such innovations are argued to be best supported by ACAP through exploratory learning and a broad range of loosely related knowledge domains (Kogut & Zander, 1992; Van den Bosch, Volberda & de Boer, 1999). At the broader organisational level, ACAP has a high likelihood of fostering the entrepreneurial mindset and actions of individuals or NPD team members at the NPD program level, and can directly influence opportunity recognition in linking new ideas or advanced technologies to future markets (MVC) at the front end of market-driving innovations.

The organisational influence at the front end of market-driving innovations in relation to information processing and knowledge management is not well understood or managed (Reid & de Brentani, 2004). In the case of market-driving innovations, individuals or NPD team members often have a limited ability to perceive, understand and make decisions with respect to novel and new information (O'Connor & Rice, 2001). As such, opportunities must be given to the individuals or NPD team members to encourage exploratory learning, specifically through acquiring, transferring and sharing information or using tacit knowledge (intuition) to deal with the uncertainty and the requirement for creativity at the front end of market-driving innovations (Bertels, Kleinschmidt & Koen, 2011). The sharing of information at the organisational level helps to make an individual's tacit knowledge more explicit, thus building collective intuition (Eisenhardt, 1999). Bertels et al. (2011, p.759) stated "it is in our tacit knowledge that our intuition, insight, and 'gut feel' originate – all of which are crucial to innovation in general and the front end of innovation in particular".

Goffin and Koners (2011, p.300) further highlighted that:

Tacit knowledge is a popular management concept but one that is poorly understood, as empirical evidence to demonstrate the validity of the theoretical concepts is sadly lacking. This provides a unique opportunity for NPD scholars – they have the ideal arena in which a deeper understanding of tacit knowledge can be generated.

This thesis proposes that absorptive capacity (organisational dynamic learning capabilities) is an antecedent to market visioning competence and its resultant market vision, particularly at the front end of the NPD process, and influences a firm's ability to develop and commercialise market-driving innovations. Through absorptive capacity, organisational routines and processes may help to manage and support the individual pattern recognition (MVC) and resultant decision initiatives (MV) associated with the front end of market-driving innovations (de Brentani & Reid, 2012). Individuals undertaking NPD and market-driving innovation related tasks may go by no means without support from top management at the broader organisational level, where strategic, structural and resource planning occurs (Khurana & Rosenthal, 1997). Reid and de Brentani (2004, p.175) supported this view by stating that “it is important therefore to see whether there are any structures or processes that can be put in place to help organizations better manage, where possible, the early stages of the fuzzy front end of discontinuous innovation”.

## 1.2 Research Objectives and Questions

The primary objective of this thesis is to examine the degree to which absorptive capacity acts as an antecedent to market visioning competence and its resultant market vision. These factors are expected to have a significant influence on the front end and the final success of the NPD efforts, namely: the before-launch stage performance, the post-launch stage performance and the ultimate financial performance of market-driving innovations. The study builds on and extends the work of Reid and de Brentani (2010) by examining market visioning competence and market vision at the strategic business unit level (NPD program), not limited to radically new high-tech products but also capturing really new innovations in different industry contexts.

Accordingly, the main research question to be investigated is:

***To what extent does a firm's absorptive capacity, market visioning competence and its resultant market vision influence the firm's success at developing market-driving innovations?***

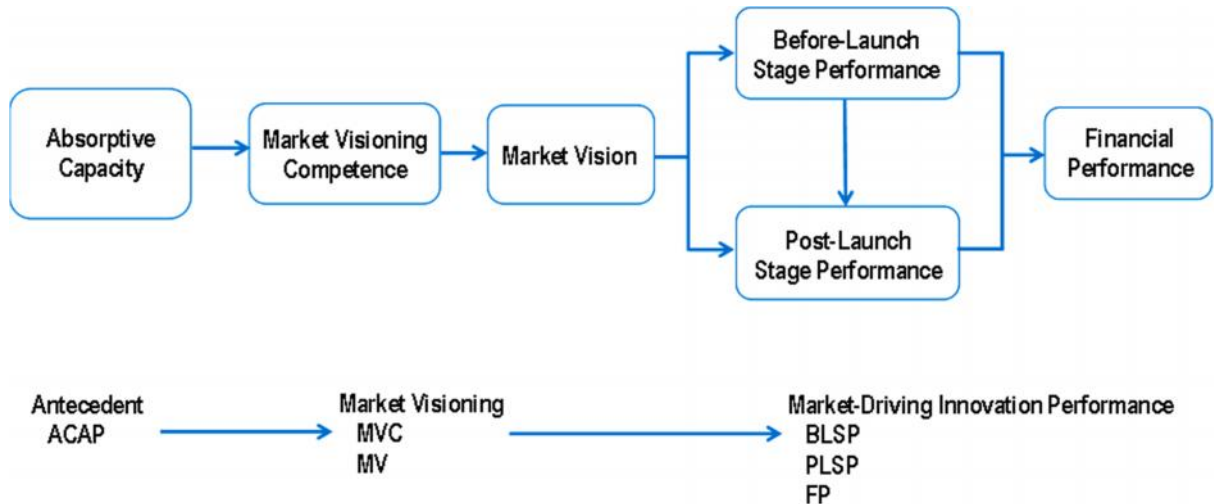
The sub-research questions ask:

1. Does absorptive capacity have a positive impact on market visioning competence?
2. Does market visioning competence have a positive impact on market vision?
3. Does market vision have a positive impact on before-launch stage performance and post-launch stage performance?
4. Do before-launch stage performance and post-launch stage performance have a positive impact on financial performance?

These relationships are explained in detail with theoretical justification in Chapter 2.

Figure 1.1 presents the initial conceptual framework of the thesis.

**Figure 1.1: The Initial Conceptual Framework**



**Legend:**

ACAP = Absorptive Capacity	MDIP = Market-Driving Innovation Performance
MVC = Market Visioning Competence	BLSP = Before-Launch Stage Performance
MV = Market Vision	PLSP = Post-Launch Stage Performance
	FP = Financial Performance

→ Hypothesised significant relationship

In addition to the main research question and its associated sub-research questions, the thesis examines the influence of external and internal (firm) environmental factors on the way in which market vision translates into specific performance outcomes of market-driving innovations.

The questions to be examined are:

- Does a turbulent and competitive external environment negatively influence the impact of market vision on before-launch stage performance and post-launch stage performance?
- Does the degree of rigidity inherent in the NPD process negatively influence the impact of market vision on before-launch stage performance and post-launch stage performance?
- Does a large firm size (number of employees) positively influence the impact of market vision on before-launch stage performance and post-launch stage performance?

## 1.3 Research Methodology

### 1.3.1 Research Context: Thailand

Studies on NPD and product innovation, particularly those published in the *Harvard Business Review* (HBR) and the *Journal of Product Innovation Management* (JPIM) have used data from developed countries such as the USA, the UK and Europe (Lieberman & Montgomery, 1998; Zhou, 2006). Most of the pertinent research on market-driving innovation has utilised large mature firms in Silicon Valley (e.g., Apple, Hewlett-Packard) or those on the Fortune 500 list (e.g., Walmart, General Motors). An emphasis has also been placed on radically new, technology-intensive research settings, as in the study by Reid and de Brentani (2010). The high-tech industries are commonly used as the context in studies on NPD success factors (Suwannaporn & Speece, 2003). This leaves the generalisability of the findings to developing countries and to small-to-medium-sized firms developing radically new or really new products and to low-tech industries an open question.

This study adopts Thailand as the research context. Thailand is of particular interest for five reasons. First, the context of Thailand offers the research perspective of NPD and innovation in a developing country. Developing countries often play a role of technological catching-up. This implies that the development of the technological capabilities related to NPD in developing countries are often influenced by the technologies generated in developed countries (Chen, Guo & Zhu, 2012). Thailand is among the developing countries that are characterised as being in the middle ground in terms of technological capability (Klochikhin & Shapira, 2012). To a certain extent, NPD-related activities in Thailand require the import of sophisticated technology and high value-added components from developed countries (Intarakumnerd, Chairatana & Tangchitpiboon, 2002; Suwannaporn & Speece, 2003). Further, the development of Thailand involves unprecedented transitions of social, legal and economic institutions. This includes the recent transition of its economic structure from an agriculture-based economy to a newly industrialised economy (Intarakumnerd et al., 2002). The economic restructuring in Thailand and the country's unique cultural characteristics may pose different challenges for NPD and innovation that cannot be fully explained by theories and practices embedded in the developed countries

(Cho, Kim & Rhee, 1998; Hoskisson, Eden, Lau & Wright, 2000; Li & Atuahene-Gima, 2001; Zhou, Yim & Tse, 2005).

Second, Thailand offers a diversified manufacturing sector ranging from agriculture to technology-based industries. Thailand is among the world's top exporters in global food and agriculture markets for products such as rice, cassava and rubber (Intarakumnerd et al., 2002). According to the United Nations Conference on Trade and Development (UNCTAD) World Investment Report 2012, Thailand is the 12th largest food exporting nation in the world. The country ranks 17th for manufacturing output and 11th for agriculture output, according to the World Economic Forum (WEF) *Global Competitiveness Report 2012–2013* (Thailand Board of Investment, 2013). In addition, Thailand is a world-class production and R&D hub for multinational corporations, especially those involved in the electrical appliance, electronics and automotive industries such as Electrolux, Seagate and Toyota (Brimble, 2006; Thailand Board of Investment, 2012, 2013; Youngsuksathaporn, 2005). In the automotive industry, for instance, Thailand has been regarded as the “Detroit of the East” for being the 15th largest automotive producer in the world in the year 2011, based on *The Economist's 'Pocket World in Figures 2013'* (Thailand Board of Investment, 2012, 2013). Thus, Thailand offers a mixture of new products of different types, providing a good context for studying the underlying success factors related to NPD and innovation practices.

Third, Thailand is the second largest economy in South-east Asia and is recognised as “one of the great development success stories” by The World Bank (2011). The diversified manufacturing sector in Thailand has contributed to the country's economic performance and growth of gross domestic product (GDP), with approximately 78% accounted for by exports of goods and services. GDP performance in Thailand has been impressive, with an average of 5%–6% year-on-year, including an increase to 6.4% in the year 2012 (Thailand Board of Investment, 2013).

Fourth, there is an increasing number of small and medium-sized enterprises (SMEs) in Thailand involved in NPD and innovation. The data collected by the Global Entrepreneurship Monitor (GEM) showed a more than three-fold increase in Thai SMEs to 2.8 million from 1997 to 2008. The growth of the SME business sector has driven economic growth by stimulating businesses to undertake innovation and competition to improve their



productivity and performance (OECD, 2011). According to the Organisation for Economic Co-operation and Development (OECD), “the challenge is that Thai SMEs face a very turbulent and dynamic business environment in the Asian region. Innovation is one way to survive and continually adapt in such an environment” (OECD, 2011, p.35). As a result, Thailand had the highest level of early-stage entrepreneurial activities (29%) among 42 countries in 2007, as measured by GEM, compared to rates of 4.4% in China, 9.6% in the USA and 16.4% in Japan. The level of early-stage entrepreneurial activities in Thailand indicates the high number of small businesses in the economy, many of which are less than three and a half years old (OECD, 2011). Additionally, a national survey by GEM Thailand (2011) showed an increase in new product early-stage entrepreneurial activities from 42% in 2007 to 58% in 2011, suggesting a positive trend to the development of new products and/or services (Global Entrepreneurship Monitor, 2011).

Lastly, innovations in Thailand have been fostered by the Thai royal family and increasingly promoted by Thai government organisations, including the cabinet, ministries and specialised agencies. The Thai royal family is known for its active encouragement of inventors. The current King of Thailand, Bhumibol Adulyadej, also known as “the king of invention”, is the world’s first monarch to be granted a patent. That was in 1993 for the Chai-Pattana slow speed surface aerator (Pakaworawuth, 2007). The King has been a true inventor, holding more than 20 patents and 19 trademarks, and has been a role model for Thai communities to develop concrete and practical benefits from innovations, such as artificial rainmaking and the use of palm oil as a fuel (Government Public Relations Department, 2009). His Majesty won the Best Inventor Award in 2001 and recently received a Global Leader Award “in recognition of his extraordinary commitment to promoting intellectual property and his important contribution to society as a prolific inventor” from the World Intellectual Property Organization (WIPO) in 2009 (WIPO, 2009, para. 1). In a similar vein, Princess Maha Chakri Sirindhorn received a WIPO Gold Medal for the Best Woman Inventor Award in 2008 for her research on digital high resolution imagery to aid map accuracy in the study of land use (WIPO, 2008).

An important aim of the Thai government is to motivate Thai businesses and local communities to be more enthusiastic in recognising the significance of new product development and innovation (National Innovation Agency, 2010a; Youngsuksathaporn,

2005). Recent government activities related to innovation include Inventors' Day and National Innovation Day. To commemorate the King's first patent allocation, Inventors' Day is set by the Thai Cabinet. Thailand is the only country in South-east Asia and one of only seven countries in the world that recognises such a day. The National Innovation Day is set by the National Innovation Agency (NIA) to honour the King as 'the Father of Thai Innovation' (National Innovation Agency, 2010b). Several product innovation showcases, exhibitions, research funds and awards have also been organised by the NIA such as the Top Ten Innovative Businesses, National Innovation Awards and Rice Innovation Awards. In addition, Japan's successful One-Village-One-Product scheme was adopted by the Thai government to encourage each village community to develop their own innovative products utilising indigenous skills, craftsmanship and available local resources and raw materials (Youngsuksathaporn, 2005). With all these activities related to innovation, there has been a strong innovative momentum, demonstrated by an increasing number of Thai patent applications from 631 to 4196 and granted patents from 101 to 768 during the period of 1995 to 2009, according to the data collected by Thai authorities (OECD, 2011).

### **1.3.2 Research Design**

The research design of the study consists of two sequential phases as follows.

***Phase One*** is an exploratory review of the literature in the fields of marketing, management and product innovation in order to gain information about the nature of the research problem and to formulate the specific research objectives and questions for the study (Burns & Bush, 2009; Malhotra, Hall, Shaw & Oppenheim, 2004).

***Phase Two*** is quantitative descriptive research through the use of a web-based cross-sectional survey. This approach was adopted as it appeared to be the most appropriate technique for responding to the "what proportion" nature of the stated research question: *To what extent does a firm's absorptive capacity, its market visioning competence and market vision influence the firm's success at developing market-driving innovation?* (Emory & Cooper, 1991). The descriptive research design supports the investigation of meaningful

relationships, the testing of validity and discovering whether true differences exist (Hair, Lukas, Miller, Bush & Ortinau, 2012a). The use of a web-based survey also provides efficiency in data collection and database management, particularly in terms of obtaining the required information from the target respondents within the time span of the research (Zikmund & Babin, 2007).

### **1.3.3 Unit of Analysis**

This study uses the term “firm” to capture an overall type of respondents and entities. The unit of analysis is the company level or the strategic business unit (SBU) level where research, development and commercialisation of market-driving innovations are undertaken. The study focuses on product innovation at program level NPD rather than project level NPD. The key informants were identified as managers with responsibility for the development and commercialisation of market-driving innovations (as defined in this study). Examples of the key informants were senior management, including a vice president of marketing and product managers. The target respondents were seen as the most suitable persons to participate in the survey due not only to their understanding of organisational routines in general and NPD processes in particular, but also to their knowledge about the activities associated with the front end and final launch of market-driving innovations. In line with the unit of analysis, the informants were asked to refer to their SBU or, when the company had no dedicated SBU, to their company.

## **1.4 Research Contributions**

By providing answers to the research questions, the study develops a theoretically derived model and empirically tests the model that integrates absorptive capacity and market visioning competence and its resultant market vision to better explain NPD performance-related to market-driving innovation. The premise of this study is grounded in the resource-based view of the firm, as proposed in the dynamic capabilities literature.

The study makes a number of contributions of value to academics, practitioners and public policy makers:

### ***Theoretical Implications***

- (1) Advancing knowledge about the front end of innovation in relation to market vision and associated competencies and, through absorptive capacity, specifically adding to theory development.
- (2) Bridging the gap in the traditional market orientation to NPD through the resource-based view and dynamic capability theory and the notion of “market-driving”.
- (3) Improving the understanding of NPD performance-related market-driving innovation relative to before-launch stage, post-launch stage and financial performance outcomes, specifically adding to theory development through the newly formed breakthrough integrity measure.
- (4) Broadening the scope of the pertinent research on market-driving innovations by using and testing data from a developing country, which includes both large sized and small-to-medium sized firms developing market-driving innovations.
- (5) Addressing the debate on the influence of firm size on the development of market-driving innovation.

### ***Business Implications***

This study highlights the importance of firms engaging in the development of market-driving innovations as a competitive necessity for survival by achieving sustainable competitive advantage. The study unfolds the concepts of absorptive capacity, market

visioning competence and its resultant market vision as a firm's dynamic and exploratory learning capabilities, specifically in relation to market-driving innovations, in order to increase the chance of success of radically new and really new products. These insights are crucial for managers, entrepreneurs and NPD team members related to how they can best redesign, facilitate and manage the capture and dissemination of information related to the development of market-driving innovations, especially in terms of maintaining breakthrough integrity from the front end through to launch.

### ***Implications for Public Policy Makers***

This study proposes modes of facilitating and improving the development of market-driving innovation for policy makers, particularly those at the National Innovation Agency (NIA) Thailand, the primary source of the sample. The policies can be formulated in terms of stimulating a firm's dynamic learning capability (absorptive capacity) and knowledge exchange across industry networks and information resources. This can advance the traditional array of policy interventions by supporting future knowledge inflows and innovation activities that may ultimately lead to the increased development of market-driving innovations at the national level.

## **1.5 Outline of Thesis Chapters**

This thesis comprises six chapters. The structure of each chapter is as follows.

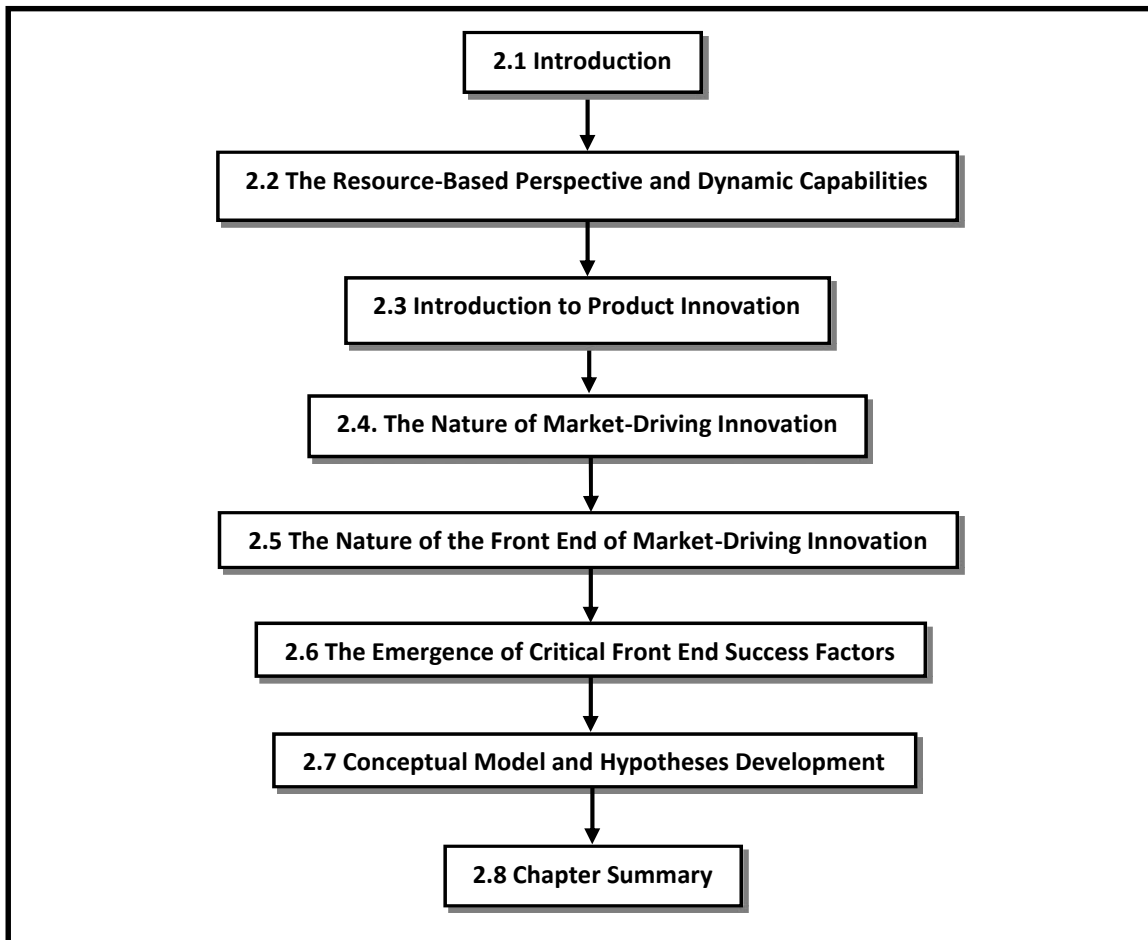
### **Chapter 1: Introduction**

This chapter provides an introduction and overview of the research background to the thesis.

### **Chapter 2: Literature Review and Conceptual Model**

Chapter 2 presents an extensive review of the relevant literature associated with the research area of the study, see Figure 1.2.

**Figure 1.2: Outline of Chapter 2 – Literature Review and Conceptual Model**



Source: developed from this research

The discussion commences with a review of the resource-based perspective and dynamic capabilities and in relation to the resource-based view of the firm and product innovation. This is followed by the introduction to product innovation, which includes a review of new product development and product innovativeness, the definitions of product innovation types and in particular a classification of market-driving innovation for this research. The nature of market-driving innovation is also reviewed in terms of the final outcome measures and the critical success factors/dimensions for NPD best practice, which are particularly related to the important front end of innovation. The nature of the front end of market-driving innovation is then explored and explicated in a review of the general front end of innovation (defining) and in relation to market-driving innovation, reviewing the front end challenges, the front end outcome measures and the front end success factors within which the concepts of market visioning competence, market vision and absorptive capacity have

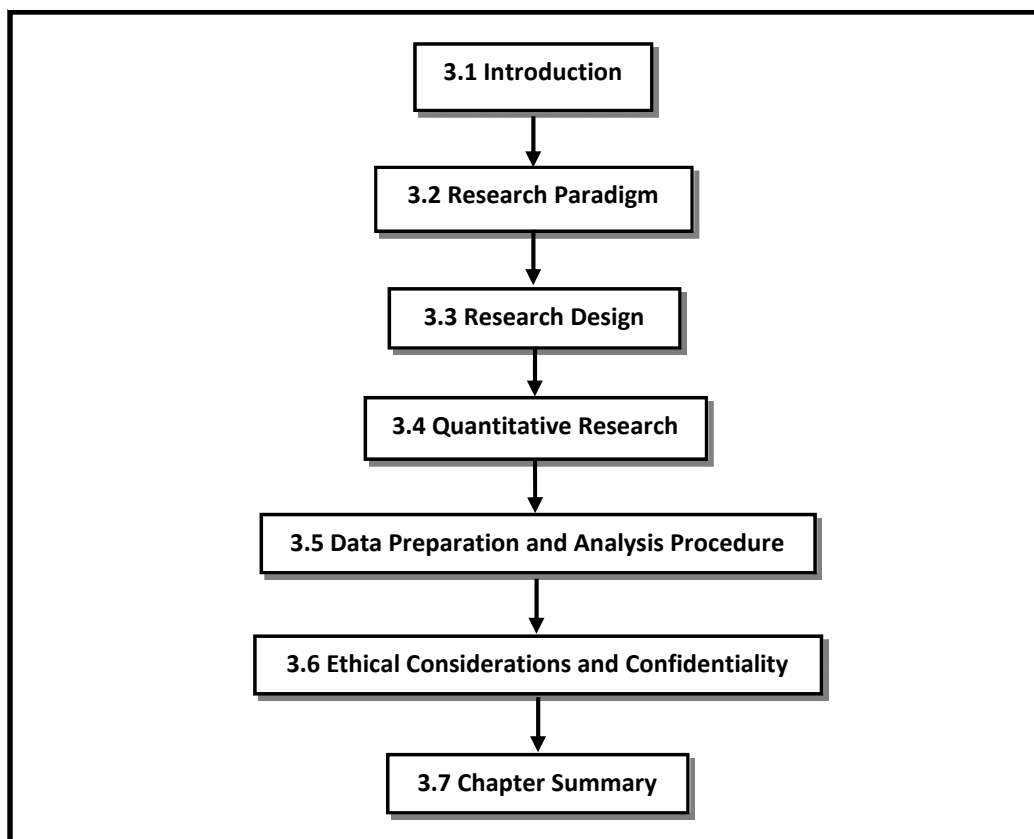
emerged from recent literature. These concepts are further reviewed and defined for the purpose of this study.

In setting up the theoretical framework, the relationships between market visioning competence and its resultant market vision, and potential antecedent absorptive capacity and performance consequences are drawn and analysed. In addition, potential moderating conditions are considered in terms of their effects on the relationships between market vision and performance consequences. The chapter concludes with a conceptual model identifying a number of variables and their relationships derived from the literature review and translated into a series of relevant hypotheses for empirical testing.

### **Chapter 3: Research Methodology**

Chapter 3 provides a detailed plan of the research methodology employed to examine the proposed hypotheses, see Figure 1.3.

**Figure 1.3: Outline of Chapter 3 – Research Methodology**



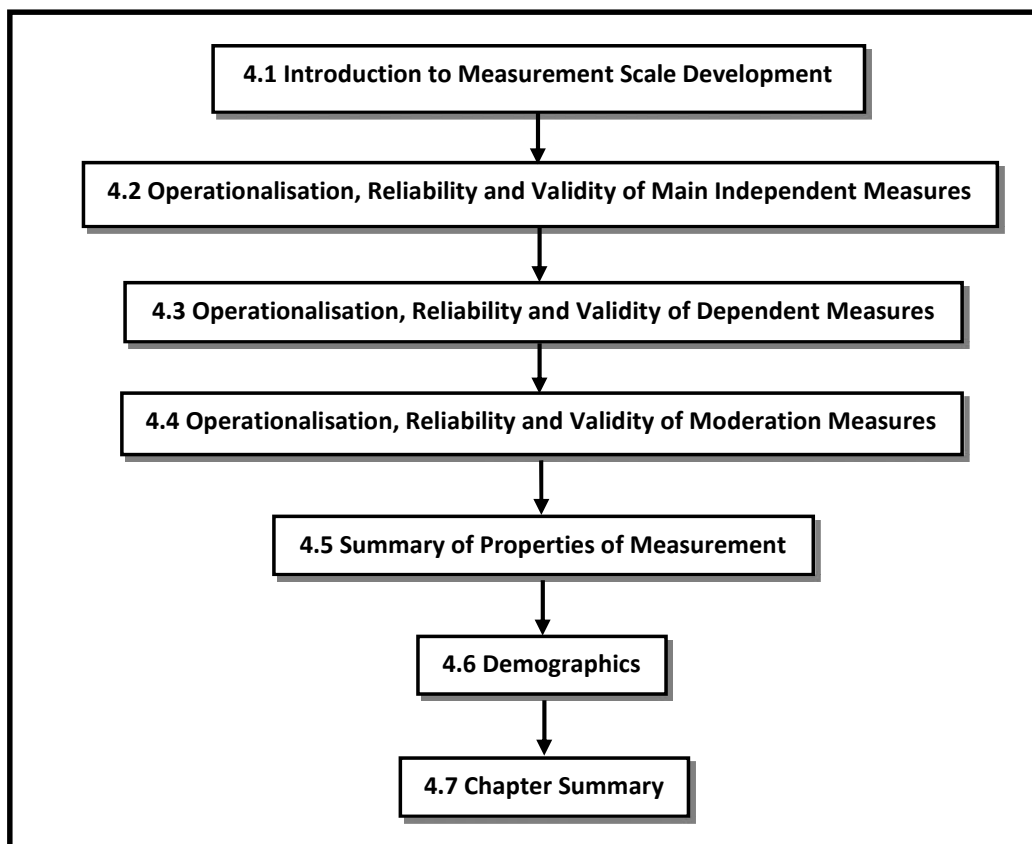
Source: developed from this research

The chapter discusses and justifies the rationale for adopting the quantitative approach and presents the research paradigm, the research design and the procedures utilised. The steps in the research process are then described, with the details of the development of the questionnaire instrument via a web-based survey. The sampling and data collection processes, comprising the unit of analysis, the sample composition and size, key informants, the survey design and process, and the subsequent response rate, are discussed. Survey questionnaire development and design considerations are then presented, including that of method bias and the remedies adopted for the study. The chapter concludes with a preliminary examination of the data and a description of the analysis procedure, including sample characteristics of the survey respondents and ethical considerations.

#### **Chapter 4: Construct Measurement**

Chapter 4 describes the development of the measurement scale relative to the operationalisation, reliability and validity of the constructs, see Figure 1.4.

**Figure 1.4: Outline of Chapter 4 – Construct Measurement**



Source: developed from this research

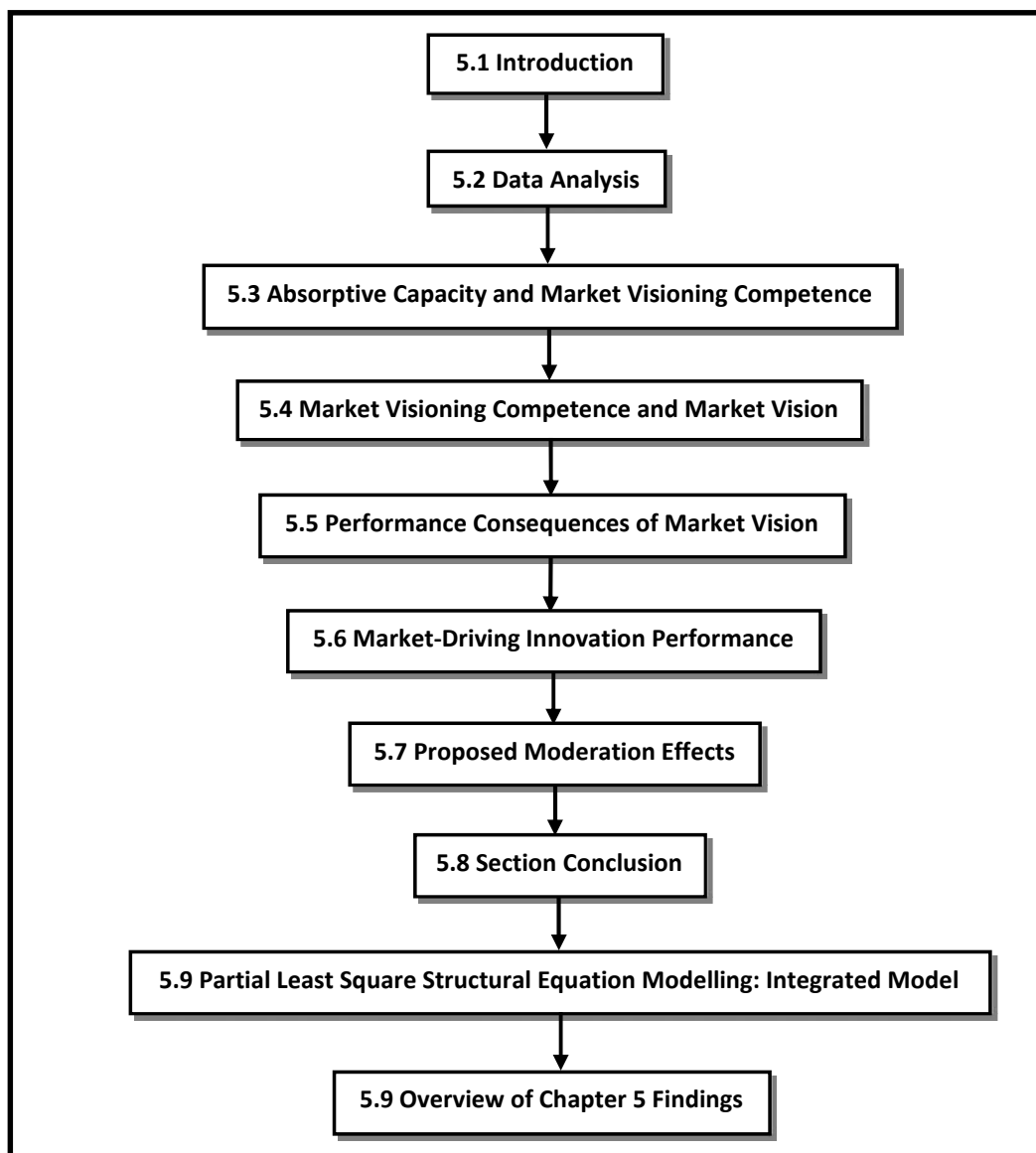


The chapter details how the main independent, dependent and moderating constructs were operationalised through indicators with the presentation of the measurement scale adopted and the source of each identified. In addition, each construct is assessed on the basis of the empirical data in terms of its reliability and validity by examining the coefficient alphas and by undertaking confirmatory factor analysis and correlation analysis.

## Chapter 5: Results and Discussion

Chapter 5 investigates the research hypotheses and presents the results of the analysis related to the research problem, see Figure 1.5.

Figure 1.5: Outline of Chapter 5 – Results and Discussion



Source: developed from this research

Simple bivariate and multiple regression analyses are utilised to examine the direct relationships between absorptive capacity, market visioning competence and its resultant market vision, and the impacts on market-driving innovation performance including the associated moderation effects. Then the chapter presents an integrated model using Partial Least Square Structural Equation Modelling (PLS-SEM) to further examine the relationships simultaneously and assess the fit between the empirical data and the conceptual model derived from the literature review.

## **Chapter 6: Conclusions and Implications**

This final chapter presents the key findings and main conclusions of the study associated with each of the hypotheses and the additional analysis results. The theoretical and managerial implications are identified along with implications for public policy makers. The chapter concludes with an acknowledgement of the limitations of the study and recommendations for future research arising from this study.

### **1.6 Chapter Summary**

This chapter has provided an overview of the thesis, outlining the background and significance of the research, and presenting the research objectives and questions. An outline of the research methodology including the research context, research design and unit of analysis was also presented. This was followed by a list of the research contributions and an outline of the thesis chapters.

The following chapter provides an extensive review of the relevant literature, the foundation upon which the conceptual framework was developed.

# **CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL MODEL**

## **2.1 Introduction**

Chapter 1 provided an overview of the thesis, explaining the background and significance of the research, and presenting the subsequent research objectives and research questions. This was followed by the research methodology, the research contributions and an outline of the thesis chapters.

This chapter reviews the product innovation and management literature on market-driving innovation, particularly at the front end of the innovation process. The perspective is grounded in the resource-based view (RBV) of the firm as proposed in the dynamic capabilities literature. The types of product innovation are first defined and classified, including that of a market-driving innovation. The common success factors associated with a market-driving innovation and its final outcome measures are identified and reviewed from the relevant studies. The front end of innovation is then examined as an important area of focus for market-driving innovation, particularly in relation to its critical success factors and outcome measures. This is followed by a presentation of the conceptual model and the research hypotheses, proposing the relationships between the constructs that emerged from the literature review to form the foundation and frame the area of study.

## **2.2 The Resource-Based Perspective and Dynamic Capabilities**

Over the past decade, resource-based theory (RBT) (Penrose, 1959) has been an important although somewhat controversial perspective used in strategic management literature to explain a firm's success. RBT postulates that a firm's resources are the primary determinants of sustainable competitive advantage and superior performance (Conner, 1991; Penrose, 1959). Competitive advantage can be measured by economic rents, that is, the return on resources invested or, more broadly, profits (Grant, 1991). According to Porter

(1980, 1985), competitive advantage relates to superior differentiation and/or low-cost position. This derives from a firm's combination of unique resources that are valuable, rare, nonsubstitutable and imperfectly imitable (Barney, 1991; Collis & Montgomery, 1995; Smith, Vasudevan & Tanniru, 1996).

Resources are firm-specific assets or inputs into the production process (Grant, 1991). These resources are owned, controlled or accessed by a firm, and give the firm the capacity to "exploit opportunities or neutralize threats" as well as to improve the efficiency and effectiveness of its performance (Barney, 1991, p.106). Typically, resources are categorised as tangible, such as capital and equipment, and intangible, such as the skills, talent and tacit knowledge of individual employees. The key resources are the intangible skills and knowledge that are developed over time and are difficult to transfer across firms. A firm equipped with such resources is superior to its competitors (Teece et al., 1997).

The fundamental source of competitive advantage is a firm's capability to adapt, integrate, build and reconfigure "internal and external organisational skills, resources and functional competences" to address the changing environment (Teece et al., 1997, p.515). The term "capability" refers to the combination and accumulation of resources for producing any kind of work or activity and is, in essence, "a routine, or a number of interacting routines" (Grant, 1991, p.122). "Organisational capabilities" are the embedded processes, routines and current practices of learning, organising and getting specific activities done in a firm (Eisenhardt & Martin, 2000; Teece et al., 1997). A unique combination of both strategic and complementary key resources, particularly those with the potential to generate rents, may allow a firm to develop inputs to organisational capability, critical competences and embedded routines (Tallman, 2005). The resources in themselves, however, appear to be less valuable without the organisational capabilities to manage them. Porter (1991, 1996) stated that the processes and activities for creating advantage are more important to focus on and analyse than the firm's resources.

This broader capabilities view of RBT reflects the resource-based view (RBV) of the firm as proposed in the dynamic capabilities literature (Barney, 1986; Montgomery, 1995; Rumelt, 1984; Wernerfelt, 1984). The RBV of the firm has emerged as one of the most fruitful trends within the RBT (Acedo, Barroso & Galan, 2006). This is because the traditional RBT

does not provide an adequate explanation of how and why firms achieve superior long-term performance in rapidly changing and unpredictable situations. Accordingly, the importance of the RBV perspective in explaining the sources of a firm's performance is recognised by many authors (e.g. Amit & Schoemaker, 1993; Barney, 1991; Mahoney & Pandian, 1992; Peteraf, 1993; Peteraf & Barney, 2003). A central premise of RBV is that a certain set of resources and capabilities enables firms to survive in highly challenging settings. Numerous RBV researchers have focused on "look within the enterprise and down to the factor market conditions that the enterprise must contend with, to search for some possible causes of sustainable competitive advantages", holding constant all other factors outside the firm (Peteraf & Barney, 2003, p.312). This inward-looking perspective has proved to be useful for analysing various strategic issues and diversification (Foss & Knudsen, 2003). In addition, recent research on RBV has emphasised intangible assets, which include dynamic capabilities (Teece et al., 1997).

Dynamic capability theory extends RBV to incorporate the process dimension of gaining and sustaining advantage over time (Teece, 2007; Teece et al., 1997). According to Winter (2000), dynamic capabilities can be strategically defined as effecting organisational change by changing the path of evolution and development to match the requirements of the changing environment. The term "dynamic" refers to:

the capacity to renew competences so as to achieve congruence with the changing business environment; certain innovative responses are required when time-to-market and timing are critical, the rate of technological change is rapid, and the nature of future competition and markets difficult to determine. (Teece et al., 1997, p.515)

In this view, "dynamic capabilities" refers to "a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness" (Zollo & Winter, 2002, p.340). The dynamic capabilities of firms are heterogeneous in respect to resources, capabilities and endowments that are difficult to modify (Amit & Schoemaker, 1993; Barney, 1991; Mahoney & Pandian, 1992; Penrose, 1959; Wernerfelt, 1984). For this reason, the RBV of a firm and its dynamic capabilities reflect the firm's ability to develop new capabilities through constant reconfiguration, recombination and the accumulation of different types of resources (i.e.,

skill acquisition, learning and other intangible assets). The firm can therefore develop new applications and attain new and innovative forms of competitive advantage to meet changing market demands (Eisenhardt & Martin, 2000; O'Regan & Ghobadian, 2004; Teece et al., 1997).

### **2.2.1 The Resource-Based View of the Firm and Product Innovation**

The Marketing Science Institute (MSI) has highlighted the continuing development of new approaches to the topic of new product development (NPD) and innovation for nearly a decade (MSI, 2008, 2014). NPD and product innovation are among the core capabilities for a firm's success and sustainable growth (Beverland et al., 2006; Brown & Eisenhardt, 1995; Cousins, Lawson, Petersen & Handfield, 2011; Jaruzelski & Dehoff, 2009; McNally, Akdeniz & Calantone, 2011; McNally & Schmidt, 2011). Developing product innovation is important for firms to survive in the modern world. Accenture Research (2009) found that 89% of the firms surveyed view innovation as a top priority to achieve future growth. A Boston Consulting Group Senior Executive Innovation Survey (2010) found that 71% of firms view product innovation among their top three strategic priorities and that 70% consider new-to-the-world products to be important or very important to a firm's future (Andrew, Manget, Michael, Taylor & Zablit, 2010). Statistical evidence has shown product innovation to account for up to 33% of a firm's sales (Cooper & Kleinschmidt, 2010).

Despite the importance of product innovation to a firm's success, many new products are not commercially successful. The American Productivity & Quality Center (2003) reported that only about one in ten product concepts emerge into launch and only 51% of those are launched within the original schedule. The Product Development Management Association's Best Practices Study found that only 59% of new products commercialised by firms are generally successful, and only 54% are regarded as profitable (Barczak, Griffin & Kahn, 2009). In a similar vein, Cooper and Kleinschmidt (2010) asserted that commercial success for new products is found in only one of four development projects and up to \$80 billion of annual losses are incurred for having to abandon one-third of NPD projects. This raises the questions of why some firms are more efficient and effective than others in

undertaking NPD and what the organisational resources and capabilities are that account for a firm's success.

A number of recent studies have used RBV to investigate the role of resources as the fundamental source of competitive advantage through NPD and innovation (e.g. de Brentani et al., 2010; Knight & Cavusgil, 2004; Zou & Cavusgil, 2002). In relation to product development and management, the RBV of the firm provides a perspective that explains how the resources of the functional and integrative capabilities of the firm influence its process efficiency and product effectiveness (Verona, 1999). As resources are the inputs into the production process (Grant, 1991), the firms that realise a uniqueness and superiority of resources and capabilities can engage in NPD and innovations that “produce more economically and/or better satisfy customer wants by creating greater value or net benefits” (Peteraf & Barney, 2003, p.311). This can lead a firm to achieve a competitive advantage over its competitors by means of attaining aggressive pricing and high sales volume (cost leadership) and/or differentiated products that facilitate premium pricing, positive brand image and customer loyalty (Porter, 1980, 1985). Cast in RBV, NPD capabilities are therefore the principal functions of a firm that enable it to create superior, unique and novel product offerings (Atuahene-Gima & Ko, 2001; Autio, Sapienza & Almeida, 2000).

In highly competitive and dynamic marketplace, firms require different approaches, a paradigm beyond RBV (Eisenhardt & Martin, 2000; O'Connor, 2008; Teece et al., 1997). Previous research on RBV has often viewed resources as a stable concept that can be identified at a point in time and will endure over time (Dunford, Snell & Wright, 2003). The RBV perspective thus applies to known markets where the industry/market structure, boundaries and value chain are relatively stable and clear. As previously stated, it has been argued that dynamic capabilities have become increasingly important as a source of sustainable competitive advantage (Eisenhardt & Martin, 2000). Effective dynamic capabilities focus on intangible resources, particularly the creation of new, situation-specific knowledge (tacit knowledge) and “learning before doing” (Pisano, 1994) where this resource base is modified over the course of its changing environment (Eisenhardt & Martin, 2000; Smith et al., 1996; Teece et al., 1997).

The perspective forwarded in the RBV of the firm proposed in the dynamic capabilities literature has become one of the dominant and most robust contemporary approaches for analysing sustainable competitive advantage in recent studies, particularly for breakthrough innovation (O'Connor, 2008; Reid & de Brentani, 2010). The approach is suitable for investigating breakthrough innovation since its market is unknown and therefore it involves a high level of ambiguity and uncertainty in the development process. Indeed, breakthrough innovation appears to constitute the dynamic capability. Successful breakthrough innovation requires superior resources in regard to value, rarity and the inimitability of embedded skills and tacit knowledge (Barney, 1991).

Breakthrough innovation has been argued to be an important source of sustainable competitive advantage. The benefits of breakthrough innovation can be huge and enduring for both new and established firms (e.g. Chandy & Tellis, 1998; Hamel & Prahalad, 1994a; Hauser et al., 2006; Schumpeter, 1934; Wind & Mahajan, 1997). Breakthrough innovation sets the stage for future product development and creates a new platform that drives the market (Chandy & Tellis, 2000; McDermott & O'Connor, 2002). It is evident that firms can gain greater depth and breadth in their product portfolio through breakthrough innovations than from a single product line. These firms are also more successful than highly diversified firms (Sorescu et al., 2003). Schindehutte et al. (2008, p.7) claimed that firms that engage in market-driving behaviour by focusing on breakthrough [market-driving] innovation can “create entirely new markets, produce discontinuous leaps in customer value, design unique business systems, develop new channels, raise service to unprecedented levels, and fundamentally change the rules of the competitive game”.

Despite the significance of breakthrough innovation as a crucial source for corporate growth and survival, achieving its successful development remains an elusive goal for many firms (O'Connor et al., 2008). As Spanjol, Tam, Qualls, and Bohlmann (2011) stated, “the NPD portfolio in most companies is dominated by incremental innovations, as evidenced in statistics showing that up to 90% of new product introductions are incremental” (p.627). In other words, only 10% of new product introductions are real breakthroughs (Griffin, 1997b; Reid & de Brentani, 2004). Those real breakthroughs, however, generate 24% of profits (Martin, 1995). Sorescu et al. (2003) found that a minority of firms develop a large majority of the breakthrough innovations. A strong financial performance is found in firms which



develop breakthrough innovations, especially those with high pre-product levels of marketing and technology support. Thus, strong evidence has been found that successful breakthrough innovation pays off more than proportionally (Cooper, 1990a; Kleinschmidt & Cooper, 1991). Indeed, breakthrough innovation continues to “consistently generate more positive performance outcomes than incremental innovations” (Rubera & Kirca, 2012, p.143).

Accordingly, the assumption of this research is based on the perspective of the RBV of the firm and dynamic capabilities. The perspective focuses on firm-specific organisational resources, capabilities and functional competences that could help to explain how firms achieve success in developing market-driving innovations. The resource-based dynamic capabilities highlight the importance of exploratory learning processes and knowledge creation for firms operating in dynamic markets. Firms assemble and share new information in order to create discontinuities in the environment, as provided by market-driving innovation, and to build further capabilities and resources. The result is a competitive advantage that can lead to a firm’s superior performance, particularly in a highly challenging setting (Teece et al., 1997).

In addition, it is also important to differentiate the terms “capability”, “competence” and “capacity” when analysing a firm’s ability to innovate. Generally, “capability” refers a collaborative process that can be deployed or improved and through which an individual’s know-how – that is, competence – can be exploited. “Competence” is about getting the right people with certain skills (sufficient knowledge, strength and abilities) to successfully perform and process critical work functions, through capability, in a defined work setting (Vincent, 2008). The relevant questions for firms to ask themselves in relation to “capability” are: “How can we get done what we need to get done?” and “How easy is it to access, deploy or apply the competencies we need?” (Vincent, 2008, para. 4-5), and importantly “What can the firm do more effectively than its rivals?” (Grant, 1991, p.115). The questions related to “competence” are: “Who knows how?” and “How well do they know?” (Vincent, 2008, para. 4-5). The questions “Do we have enough?” and “How much is needed?” refer to the “capacity” to hold, receive or accommodate amount/volume (Vincent, 2008, para. 6).

## 2.3 Introduction to Product Innovation

### 2.3.1 New Product Development and Product Innovativeness

In general, the new product development (NPD) process or product innovation process is about bringing new products to market. A new feasible product idea can be called an invention. An invention that has progressed through the stages of production, marketing and diffusion into the marketplace, and has been adopted by customers can be called a product innovation (Garcia & Calantone, 2002). According to Garcia and Calantone (2002, p.112), “the innovation process comprises the technological development of an invention combined with the market introduction of that invention to end-users through adoption and diffusion”.

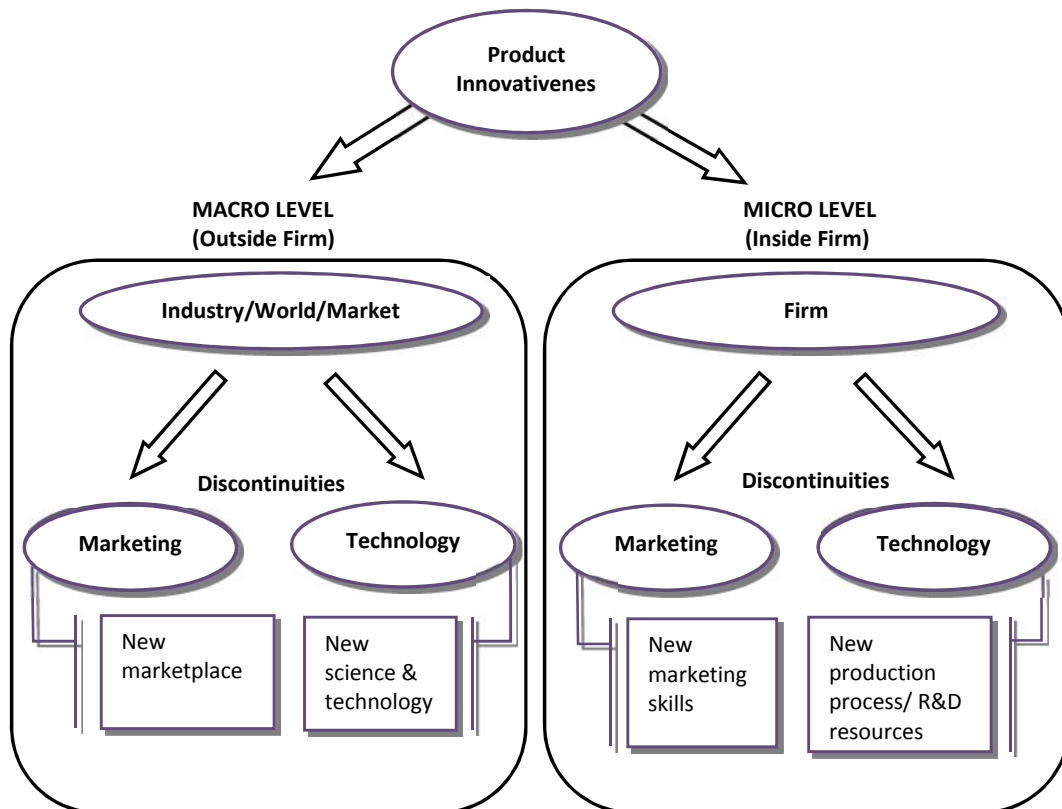
The NPD process is iterative, which involves the first introduction of a product innovation followed by subsequent reintroduction of an improved version. The degree of newness of a product innovation is often measured by its innovativeness. Product innovativeness has been measured according to both the product’s newness to the marketplace (macro level) and the product’s newness to the firm (micro level) (Garcia & Calantone, 2002; Harmancioglu, Dröge & Calantone, 2009; Song & Montoya-Weiss, 1998). More specifically, Johnson and Jones (1957) suggested that the term “newness” can be measured in *technological* and *market* dimensions. On one hand, the technological dimension verifies a paradigm shift in the science and technology of a new product. On the other hand, the market dimension verifies the extent to which the new product generates a paradigm shift in the market structure in an industry (Chandy & Tellis, 1998; Garcia & Calantone, 2002). The technological and market dimensions have become widely recognised in studies of new product success factors and related NPD strategies, development processes and performance (Harmancioglu et al., 2009).

Accordingly, the degree of newness of a product at both macro and micro levels can be measured by its discontinuity in technological and/or marketing dimensions (Garcia & Calantone, 2002). The discontinuity of a new product at the macro level causes “a paradigm shift in the science and technology and/or market structure in an industry” (Garcia & Calantone, 2002, p.113). The discontinuity of a new product at the micro level influences

“the firm’s existing marketing resources, technological resources, skills, knowledge, capabilities, or strategy” (Garcia & Calantone, 2002, p.113).

Figure 2.1 presents an operationalisation of product innovativeness.

**Figure 2.1: Operationalisation of Product Innovativeness**



Source: adapted from Garcia and Calantone (2002)

The varying degree of newness or innovativeness explains different types of product innovations. In the marketing literature, a new-product breakthrough is the principal meaning of the term “innovation” (Han, Kim & Srivastava, 1998). Many terms have been used by researchers to identify different types of product innovations. Product innovation primarily ranges from “continuous” to “discontinuous” innovation. Continuous innovation can be referred to terms such as “evolutionary”, “sustaining”, “incremental” and “minor” innovation. Discontinuous innovation can be referred to terms such as “revolutionary”, “disruptive”, “breakthrough”, “radical”, “really new” and “major” innovation (Garcia & Calantone, 2002; Harmancioglu et al., 2009; O'Connor, 2008; Song & Montoya-Weiss, 1998; Story et al., 2009). Some highly innovative firms such as 3M and Corning have

categorised the degree of product innovativeness as “horizon 1, 2, 3” and “today, tomorrow and beyond” (O'Connor, 2010, p.2). These different expressions create a lack of clear distinction between the terms and difficulties in their interpretations (Danneels & Kleinschmidt, 2001; de Brentani, 2001). Researchers and firms are thus far from a consensus regarding the definition of “innovation”, particularly for breakthrough types (McDermott & O'Connor, 2002).

According to March (1991), radical innovation can be differentiated from incremental innovation by its *exploration* competencies. Leifer et al. (2000) described exploration as involving “something fundamentally new, including *new products, processes, or combinations of the two*” (p.5). In contrast, incremental innovation is based on *exploitation* competencies, and has to do with refining and improving the cost or features of existing products. This terminology has been used by the majority of the researchers to make the distinction between radical and incremental innovation (Leifer et al., 2000).

Following Atuahene-Gima (2005), “radical innovation” refers to new products that “involve fundamental changes in technology for the firm, typically address the needs of emerging customers, new to the firm and/or industry, and offer substantial new benefits to customers” (p.65). In contrast to radical innovation, “incremental innovation” refers to “product improvements and line extensions that are usually aimed at satisfying the needs of existing customers. They involve small changes in technology and little deviation from the current product-market experience of the firm” (Atuahene-Gima, 2005, p.65).

Product innovation is also related to being market focused or market leading. Jaworski et al. (2000) suggested that firms can be *market driving* (driving markets) or *market driven*. Being market driving means that firms challenge the *status quo* to discover latent or unarticulated needs of customers to develop breakthrough innovations in a new (unpredictable) market (Deszca, Munro & Noori, 1999; Kumar et al., 2000; O'Connor, 1998; Varadarajan, 2009). The market structure and the behaviour of market players are manipulated, which increases the competitiveness of the industry. The market structure can be changed in three ways: “(1) eliminating players in a market (deconstruction approach), (2) building a new or modified set of players in a market (construction approach) and (3) changing the functions performed by players (functional modification approach)” (Jaworski et al., 2000, p.45). Further,

changing the mindset of customers, competitors and other stakeholders may directly influence market behaviour. As opposed to being market driving, market driven means that a firm reactively responds to customer's preferences and follows other players' behaviour to develop incremental innovations within a given market structure (Jaworski et al., 2000; Kumar et al., 2000).

According to Zortea-Johnston et al. (2012), "those innovations that create new customers, lead existing customers, meet latent needs, and reshape product/market spaces" are referred to as "driving markets innovations" (p.146). Zortea-Johnston et al. (2012) advocate that driving markets innovations drive the market and are considered to be *radical* or *breakthrough* in nature (i.e. new to the world innovations or those innovations that either change consumer behaviour or market structures). These types of innovations enable firms to "renew their competitive position and delay eventual firm decline" (Zortea-Johnston et al., 2012, p.146). Other researchers have also described driving markets innovation as "market-driving innovation" (e.g. Kumar et al., 2000; Schindehutte et al., 2008). Schindehutte et al. (2008, p.17) state "market-driving firms must search for their next market-driving innovation, or lose its competitive advantage to a new incumbent" (p.17). In contrast to market-driving innovation, "market-driven innovation" is considered to be incremental in nature. This type of product innovation is developed within the confine of the existing market structure and does not, or at most very little, alter consumers' usage pattern or behaviour (Zortea-Johnston et al., 2012).

Past empirical research has leaned towards an internal firm perspective rather than an external customer perspective to measure innovativeness (Harmancioglu et al., 2009; Song & Montoya-Weiss, 1998). The firm perspective is consistent with the RBV of the firm or inward-looking view grounded in this study. Innovation has been extensively identified in both the technological and the market dimensions and the perspectives on changes made in an organisation (Damanpour, 1991; Garcia & Calantone, 2002). Innovative products that are new to both dimensions necessitate more learning/unlearning and organisational changes. In this regard, radical innovations require a greater variety of resources, new skills, learning/unlearning, flexibility and capabilities quite apart from existing technology and practices (McDermott & O'Connor, 2002). Radical innovations therefore involve more uncertainty and a higher proportion of experimentation than incremental innovations that

involve only extensions, refinements or adaptations of established product designs (Kessler & Chakrabarti, 1999; Ottum & Moore, 1997; Sethi, 2000; Sivadas & Dwyer, 2000). Mohr et al. (2005, p.18-19) considered that “breakthrough (radical) innovations are so different that they cannot be compared to any existing practices or perceptions. They employ new technologies and create new markets. Breakthroughs are conceptual shifts that make history”.

### **2.3.2 Defining Types of Product Innovation**

The terminology and theoretical work of other researchers has provided value in terms of distinguishing the types of innovations. However, a practical definition is required based on the resource-based view of the firm to gain insights into market-driving innovation. A clear definition and set of criteria are important to provide structure to the body of the research and the intended meaning of the innovation construct and its domains, including the operationalisation implications (Varadarajan, 1996).

Accordingly, this research merges views from previous studies and defines “market-driving [product] innovation” as “*breakthrough* product innovation, which *explores* new ideas or technologies that transform existing markets or create new ones, and therefore require *market-driving* competencies” (Jaworski et al., 2000; Leifer et al., 2000; March, 1991; Mohr et al., 2005). Market-driving competencies are about getting “outside the immediate voice of the customer” and proactively reshaping customers’ product preferences (Jaworski et al., 2000, p.45).

As the majority of definitions of product newness describe the two common dimensions of (1) technology and (2) markets, this research has correspondingly adopted criteria on these dimensions to measure the newness of product innovation. For the purpose of this study, the merged definition of “market-driving innovation” refers to a product identifiable by one or both of the following criteria:

- (1) builds on a very new idea or very new technology that has never been used in the industry or market before, and/or;
- (2) is one of the first of its kind introduced into the market and/or has an impact or causes significant changes in the industry or product category (either offers 5 to 10 times improved benefits or 30% cost reduction compared with the previous generation) (Leifer et al., 2000; O'Connor, 1998; O'Connor & Rice, 2001; Song & Montoya-Weiss, 1998).

These criteria identify what makes a product new to a firm. The first criterion verifies the extent to which the idea or technology embedded in a new product is different from existing ideas or technologies. Firms must have technological competence or very new ideas to develop advanced technology or products that are able to drive the market. The second criterion verifies the extent to which the new product is new to the market and/or impacts on the current markets or industries or creates new ones. Firms must have market competence to offer products better than existing products by discovering additional or unarticulated needs of customers (Chandy & Tellis, 1998; Damanpour, 1991; Danneels & Kleinschmidt, 2001; Veryzer, 1998a).

Correspondingly, the two levels (low and high) for each criterion conceptually lead to four types of product innovations (see Figure 2.2): (1) radical [breakthrough] innovation, (2) technological breakthrough, (3) market breakthrough and (4) incremental innovation. This study adopts one of the most prevalent typologies in innovation research (Harmancioglu et al., 2009), primarily based on the work by Chandy and Tellis (1998), Garcia and Calantone (2002), Song and Montoya-Weiss (1998) and Zortea-Johnston et al. (2012).

Figure 2.2 presents the types of product innovation defined in the thesis.

**Figure 2.2: Defining Types of Product Innovation**

		NEWNESS OF IDEAS/ TECHNOLOGY	
		<i>Low</i>	<i>High</i>
NEWNESS/ IMPACT TO MARKET/ INDUSTRY	<i>Low</i>	(4) Incremental innovation <i>(Market-driven innovation)</i>	(2) Technological breakthrough/ Really new innovation <i>(Market-driving innovation)</i>
	<i>High</i>	(3) Market breakthrough/ Really new innovation <i>(Market-driving innovation)</i>	(1) Radical [breakthrough] innovation <i>(Market-driving innovation)</i>

Source: adapted from Chandy and Tellis (1998, 2000); Garcia and Calantone (2002); Zortea-Johnston et al. (2012)

As shown in Figure 2.2, technological breakthroughs and market breakthroughs are also referred to as really new innovations (Garcia & Calantone, 2002). Both *technological* breakthroughs and *market* breakthroughs, along with *radical* [breakthrough] innovation can be classified as market-driving innovations. The remaining incremental innovation is classified as market-driven innovation (Chandy & Tellis, 1998, 2000; Zortea-Johnston et al., 2012).

The following section explains the types of product innovations defined in this thesis in more detail.

### **Market-Driving Innovation**

#### **1) Radical [breakthrough] innovation**

In radical innovation, discontinuities happen at both macro and micro levels and along sublevels in both marketing and technological dimensions by requiring: (1) a new state of science and technology embedded in a product (“never used in the industry before”), (2) a new marketplace (“the first of its kind and totally new to the market”), (3) a new production process and/or new R&D resources and (4) new marketing skills (Song & Montoya-Weiss, 1998, p.126).



A radical [breakthrough] innovation meets all the described criteria, requiring changes in both existing technology and market infrastructure (Garcia & Calantone, 2002). In other words, “radical innovations” in this study are breakthrough new products that create significant discontinuities and are new for both the firm and the marketplace – a new line of business or new product line. Radical innovation provides an entirely new level of functionality to customers and substantially transforms the way the current markets/industries operate or forms new ones (Leifer et al., 2000). An example of a radical innovation is the first consumer microwave oven; the many subsequent improvements were not radical innovations.

## **2) Technological breakthrough and 3) Market breakthrough as “Really New Innovation”**

For really new innovation, discontinuity happens at the macro level, either in the technological dimension through a new state of science and technology embedded in a product (“never used in the industry before”) or in the marketing dimension through a new marketplace (“the first of its kind and totally new to the market”); whereas at the micro level discontinuities can happen in any combination by requiring new a production process/R&D resources and/or new marketing skills (Song & Montoya-Weiss, 1998, p.126).

A really new innovation can be either a technological breakthrough or a market breakthrough but will not incorporate both. In this study, “*technological breakthroughs*” refer to products that build on a new or novel idea/technology that has never been used in the industry before. The product may not be new to the market but the technology application is. An example of a technological breakthrough is the Canon LaserJet printer, which used new technology to extent the existing product line of the InkJet Printer (Garcia & Calantone, 2002). “*Market breakthroughs*” refer to products that build on an existing idea or technology and create a new market, being the first of their kind and totally new to the market, and/or causing significant changes in the industry or product category (Song & Swink, 2009). An example of a market breakthrough is the iPod, which used existing technology (MP3) within a new platform to create a new market.

## **Market-Driven Innovation**

### **4) Incremental innovation**

For incremental innovation, discontinuity happens only at the micro level, from a technological dimension which requires new production process/R&D resources and/or from a marketing dimension which requires new marketing skills (Garcia & Calantone, 2002; Song & Montoya-Weiss, 1998). In other words, an incremental product is new either to the firm or to the customer. This type of product innovation can also be referred to as “*market-driven innovation*” (Jaworski et al., 2000; Zortea-Johnston et al., 2012) because it is an adaptation of an existing product which only provides “new features, benefits, or improvements to the existing technology in the existing market” (Garcia & Calantone, 2002, p.113).

This study refers to “incremental” (“market-driven”) innovation as “an improvement of an existing product, which *exploits* existing ideas/technologies in the existing market, and therefore requires *market-driven* competencies” (Garcia & Calantone, 2002; Jaworski et al., 2000; Leifer et al., 2000). Market-driven competencies are about listening to the voice of the customer and being reactive to articulated product preferences in existing (predictable) markets (Jaworski et al., 2000; Varadarajan, 2009). An example of an incremental innovation is the Apple iPhone4, where incremental improvements to the iPhone3 introduced new benefits based on the existing platform.

### **2.3.2.1 Classifying Market-Driving Innovation (Radical and Really New innovation)**

By defining the types of product innovation, radical innovations and really new innovations are discontinuous and can be distinguished from the others. Most discontinuous innovations are often classified as really new innovations—specifically, technological breakthroughs or market breakthroughs. This is because new product development seldom results in both new marketing and technical infrastructures at the macro level, as occurs in radical innovation. A really new innovation is not as innovative as a radical innovation and is less able to influence the market and/or reshape the nature of competition in the industry. According to Garcia and Calantone (2002), really new innovations are considered as moderately innovative products, as defined by Kleinschmidt and Cooper (1991, p.243) as “consisting of lines to the firm, but where the products were not as innovative (that is not new to the market) and new items in existing product lines for the firm”. There may also be fewer risks and uncertainties associated with the development of a really new innovation than with the development of a radical innovation (Garcia & Calantone, 2002; Kleinschmidt & Cooper, 1991).

For generalisation and simplification of term, “market-driving” (“breakthrough”) innovation in this study is composed of both radical and really new innovations (that is, *radical* breakthroughs, *technological* breakthroughs and *market* breakthroughs new products) (Chandy & Tellis, 1998, 2000; Garcia & Calantone, 2002; Zortea-Johnston et al., 2012). The focus of this research is specifically on these three types of ‘tangible’ breakthrough new products rather than ‘intangible’ services or process innovations. The remaining incremental innovation classified as market-driven innovation is thus not central to the thesis. The classification of market-driving innovation is consistent with that of O'Connor (2008), who treated and labelled radical and really new innovations collectively as “major innovation”. Although radical innovation and really new innovation involve different degrees of product newness, the strategic challenges of these two types of innovation are of like kind. A firm engaged in developing radical or really new innovation is required to shift outside its realms of knowledge and experience (O'Connor, 1998). This means that the firm cannot rely completely on its current technology and customers, as in the NPD scenario of incremental innovation (O'Connor, 2008).

## **2.4 The Nature of Market-Driving Innovation**

### **2.4.1 Measuring the Final Outcomes of Market-Driving Innovation**

In general, NPD or product innovation performance has been viewed in multidimensional terms, comprising both financial and non-financial (strategic) measures (Samiee & Roth, 1992). It reflects the final outcome measures of product success, as a result of a firm's new product development and innovation efforts (Cooper, 1984; Cooper & Kleinschmidt, 1987b; Hise, O'Neal, Parasuraman & McNeal, 1990). Firms can evaluate their financial returns through subjective outcome perceptions (Cavusgil & Zou, 1994; Griffin & Page, 1996) or by strategic proxies that are more easily determined in the shorter term (Crawford & di Benedetto, 2003). This view is consistent with the RBV of the firm and the dynamic capabilities literature. According to RBV studies, performance involves a firm's ability to achieve a competitive advantage and ultimately leads to superior financial returns. In the longer term, financial measures reflect the firm's achievement of quantifiable performance objectives (Doyle, 1994; Heidt, 2008). The most frequently used financial measures are profitability, return on investment and sales growth (Page, 1993). In the short term, performance is gauged at the post-launch stage in terms of improved efficiency, market share/position or breaking into new arenas (Griffin & Page, 1996; Kapelko, 2006; Smith et al., 1996).

Table 2.1 presents the common measurement scales of product innovation performance that have been developed and/or used in product innovation literature.

**Table 2.1: Common Measurement Scales of Product Innovation Performance**

Product Innovation Performance (final outcome/success measures)		Sources
<b>Financial</b>	Financial performance i.e. profitability, return on investment, sales growth	Cooper, 1990a, 1998; Cooper & Kleinschmidt, 1987a, 1987b, 1987c, 1993, 1995a, 1995b, 1995c; de Brentani, 1989; Dwyer & Mellor, 1991a, 1991b; Griffin, 1997b; Griffin & Page, 1996; Song & Parry, 1996, 1997a
<b>Non- financial (strategic)</b>	Speed-to-Market	Griffin, 1993; Lynn, Abel, Valentine & Wright, 1999; Lynn, Skov & Abel, 1999  Cooper & Kleinschmidt, 1994, 1995b, 1995c (Time efficiency)  Griffin & Pages, 1996b; Tatikonda & Montoya-Weiss, 2001 (Time-to-market)  Kessler & Bierly, 2002; Kessler & Chakrabarti, 1996, 1999 (Innovation speed)
	Windows of Opportunity, i.e., new arenas – categories/market)	Cooper & Kleinschmidt, 1987a, 1987b, 1987c, 2000; Dwyer & Mellor, 1991a, 1991b; Kleinschmidt & Cooper, 1991; Knight & Cavusgil, 2004; Song & Parry, 1996
	Market Share i.e., domestic, foreign	Cooper, 1986, 1988, 1990a; Cooper & Kleinschmidt, 1987b, 1987c, 1993, 1995b; de Brentani, 1989; Song & Parry, 1996, 1997b

Several NPD studies have examined how product innovation performance is measured by researchers (Griffin & Page, 1993). Researchers have used the measurement scales of product innovation performance at either the *program* level or the *project/product* level, which are the two distinct levels of analysis in the innovation literature (Craig & Hart, 1992; Harmancioglu et al., 2009; Montoya-Weiss & Calantone, 1994). At the program level, the performance of new product development has been analysed over a long period and over a number of projects or products (e.g. Cooper & Kleinschmidt, 1995a; Johne & Snelson, 1988). The purpose of focusing on new product program performance is to assess “the totality of new product efforts of the company or division” (Cooper & Kleinschmidt, 1995a, p.378). For instance, the financial performance in terms of profitability is measured by how

profitable the company's or division's/business unit's total new product efforts are (previous three years) relative to the amount spent on them (Cooper, 1998). At the project level, researchers have analysed the outcome and success of the development of a specific new product (e.g. Cooper, 1984; Cooper & Kleinschmidt, 1987b; Dwyer & Mellor, 1991a; Maidique & Zirger, 1984; Myers & Marquis, 1969; Rubenstein, Chakrabarti, O'Keefe, Souder & Young, 1976; Zirger & Maidique, 1990). Profitability, for instance, is measured by the extent to which the new product's profit meets its profit objective.

The significance of market-driving innovation to superior performance has been shown in numerous empirical studies (Cho & Pucik, 2005; Christensen, 1997; Lawless & Anderson, 1996; Sorescu et al., 2003; Zahra, 1996). However, only a limited number of studies have dealt specifically with the performance measures of market-driving innovation (O'Connor et al., 2008). Competitive advantage has been considered the most strategically useful measure for performance-based success, particularly for new-to-the-world product (Bertels et al., 2011; Griffin & Page, 1996). Consistent with the defined criteria of market-driving innovation, the term "new-to-the-world" refers to products that offer customers new solutions to problems that have never been solved before and thus create an entirely new market (Griffin & Page, 1996).

Cast in RBV, competitive advantage is the ultimate key for firm performance, and can be used to strategically and financially measure the success of market-driving innovation. The commonly used financial measures of market-driving innovation are revenue and profit growth due to new products (Chan, Musso & Shankar, 2008). The development of most market-driving innovations can take many years (usually ten years or more) and millions of investment dollars. Thus, superior financial returns for market-driving innovation can only be expected in the long term (Chandy & Tellis, 2000; Morone, 1993; Sorescu et al., 2003). This is less likely to please top management than short-term gains. The strategic or interim measures of success (that is, at the post-launch stage) are becoming increasingly prevalent for market-driving innovation (Bakar & Ahmad, 2010; McDermott & O'Connor, 2002).

The notion of "windows of opportunity" as a strategic measure signifies a relevant performance objective in the context of market-driving innovation. The measure is a common way of viewing new product success by capturing an exploitation of unique market

and/or product opportunities (Cooper & Kleinschmidt, 1987c). Given the high competition and dynamism of today's market, firms that are able to gain a foothold in new markets or new product categories through market-driving innovation are likely to achieve competitive advantage and succeed in the longer term (Cooper & Kleinschmidt, 2000; Knight & Cavusgil, 2004). In line with the RBV of the firm, opening up windows of opportunity can lead firms to attain market and/or technological leadership, which is a precursor to competitive advantage and superior financial performance (Hunt, 1997; Peteraf & Barney, 2003). O'Connor et al. (2008) study on radical innovation success supported these contentions by capturing the elements of windows of opportunity and financial performance as "output" – that is, the degree to which "the investment in radical innovation has brought commercial success, both financially and through market expansion" (p.74).

"Speed-to-market" is another strategic measure that captures the context of market-driving innovation (Prajogo & Sohal, 2003). Different terms have been used as success measures related to speed such as "innovation speed", "time-to-market" and "time efficiency". In general, "speed-to-market" refers to the development cycle time from idea generation to formal product launch or use by a lead user. This measure relates to accelerating activities, including the tasks involved throughout the NPD process (Griffin, 1993). In line with the RBV, the premise of speed-to-market is that it enables firms to achieve a competitive advantage by being the first in the market (first-mover advantage) (Kessler & Chakrabarti, 1999). If a firm can develop a new product faster than its competitors or if development takes less time than what is considered normal and customary in the industry, there is a greater chance for the firm to establish an advanced strategic position and reap pioneering advantage through market-driving innovation (i.e., being the first of its kind introduced to the market).

## 2.4.2 The Critical Success Factors of Market-Driving Innovation

In recognising the significance of market-driving innovation to firm growth and survival, researchers have begun to focus on success factors to explain the effects of various internal and external factors on market-driving innovation performance (e.g. Herrmann, Tomczak & Befurt, 2006; O'Connor, 2008; O'Connor et al., 2008). The understanding of the success factors associated with the development of market-driving innovation is, nevertheless, considerably limited as the studies associated with the success factors of NPD have predominantly focused on incremental innovation, which provides little value when it comes to managing the success of market-driving innovation (McDermott & O'Connor, 2002; Story et al., 2009). Several studies have clearly highlighted that managing market-driving innovation requires approaches, processes, structure, people and competencies that are different from those of the conventional incremental or market-driven innovation (e.g. Bessant, Von Stamm, Moeslein & Neyer, 2010; Lindgren & O'Connor, 2011; O'Connor, 1998; O'Connor & Ayers, 2005; Story et al., 2009).

Accordingly, this section reviews a number of studies associated with the success of NPD and categorises several important characteristics into seven critical success factors/dimensions for both *market-driven* and *market-driving* innovations (see Table 2.2).

Table 2.2 presents the critical success factors of market-driven innovation and market-driving innovation



**Table 2.2: Summary of Critical Success Factors of Market-Driven Innovation and Market-Driving Innovation**

Factors/Dimensions		Market-Driven Innovation (incremental)	Market-Driving Innovation (breakthrough)
1	<b>Organisational structure</b>	Single structure (only one NPD program for all products)  Cross-functional team between departments	Clearly identified structure (strategic business units, loosely coupled to mainstream organisation)  Multifunctional skilled employees with entrepreneurial characteristics
2	<b>Organisational culture/behaviour</b> (market orientation)	Market driven (reactive market orientation)  Top management involvement	Market driving (proactive market orientation)*  Top management involvement (visionary leaders), external linkages with potential customers and constituents
3	<b>NPD process</b>	Stage-gate process, strong market orientation and rigorous go/kill decision points	Next generation stage-gate process (“full”, “xpress” and “lite”)
4.	<b>Front End of Innovation Strategic focus</b> (NPD strategy)	<i>Reactive</i> NPD strategy: Market sensing: what does the market want? - Focus on existing consumer needs - Address existing demand	<i>Proactive</i> NPD strategy*: Forward sensing: how can the marketplace evolve? - Focus on latent consumer needs - Build and create demand
5.	<b>Research</b>	Market research: - Customer insight (market pull)	Research and development (R&D): - Executive foresight* (technology push)
6	<b>Commercialisation</b> (launch tactics)	Mass market: Intensive distribution strategy: - Low expenditure - Product-market fit - Current channels	Niche market: Exclusive distribution strategy: - High expenditure - Customer education and service - New channels
7	<b>Metrics and performance measurement</b>	Traditional measures for product development performance	Activity- and performance-based measures

\*Emerging success factors of market-driving innovation

Source: Barczak & Kahn, 2012; Cooper, 1988, 1994, 1996, 1998, 2011; Cooper & Edgett, 2008; Cooper & Kleinschmidt, 2010; Kahn et al., 2012; Kumar et al., 2000; O’Connor, 2008; Rangan & Bartus, 1995; Sethi & Iqbal, 2008

The following sections explain the seven multidimensional success factors in more detail.

## 1) Organisational structure

“Organisational structure” refers to the structure that underlies the establishment of a firm’s product development and intra-company integration at the individual and team levels (Barczak & Kahn, 2012; Kahn et al., 2012).

Predominantly, firms that focus on developing incremental innovations often have a single structure or only one NPD program for all products (MacCormack, Crandall, Henderson & Toft, 2012). In terms of organising and structuring NPD, the notion of multi-disciplinary, cross-functional integration has been identified as a driver of NPD success (Salomo, Keinschmidt & de Brentani, 2010). A cross-functional product development team may consist of individuals with function-specific knowledge such as R&D, engineering, purchasing, manufacturing, operations, sales and marketing. These individuals are closely integrated to cooperate and exchange ideas and values about NPD activities in their functional areas through both formal and informal communication (Cooper & Kleinschmidt, 2010; Gatignon & Xuereb, 1997). Market information can be collected and synthesised from team members for making decisions related to NPD (Berchicci & Tucci, 2010). Importantly, team members must be accountable from the start of the project through to the end. Such cross-functional teams can undertake concurrent NPD and push new products through to commercialisation (Cooper & Kleinschmidt, 2010).

Going beyond cross-functionality, an identified team of individuals or an institutionalised group, department or other entity of the firm is structured for the development of market-driving innovations. Market-driving innovations require an institutionalised group of highly multifunctional individuals who are broadly skilled, knowledgeable and have entrepreneurial characteristics to enable to work well in circumstances of high risk and market/technical uncertainty (Lynn, Morone & Paulson, 1996; O'Connor, 1998; O'Connor & McDermott, 2004; Simon, McKeough, Ayers, Rinehart & Alexia, 2003). According to Olson, Walker, Ruekerf, and Bonnerd (2001), a high level of cooperation across different functions, particularly between individuals in marketing and operations, can negatively influence the early performance of highly innovative projects. The approach appears to kill highly innovative product ideas and prevent them from emerging into development and commercialisation. Entrepreneurial individuals have a mindset and vision that drive the

development of market-driving innovations while non-entrepreneurial individuals might not be able foresee future potential opportunities and find it stressful to adapt to changing circumstances (O'Connor, 2008).

In contrast to the organic environment of incremental innovation, the principal mechanisms for managing these multifunctional and entrepreneurial individuals are flexibility, consensus building and fluidity (Jelinek & Schoonhoven, 1993). Accordingly, having a clearly identified organisational structure can ensure clear roles, responsibilities and reporting relationships for both discipline and creativity (O'Connor, 2008). O'Connor (2008, p. 319) stated that “an identified organisation with accumulated common experiences can compensate for the memory loss that is likely when routines are simple and there is little structure for managers to grasp”. Market-driving innovation needs to eventually be embedded in an SBU where the business models, processes, resources, networks and operating systems are loosely coupled to the mainstream operating model. An SBU allows market-driving competencies to develop without being stamped out by concrete rules (Hill & Rothaermel, 2003; Leonard-Barton, 1992; Rice, Leifer & O'Connor, 2002).

## **2) Organisational culture/behaviour (market orientation)**

“Organisational culture” refers to the management value system of the firm and the top management involvement that drive product development thinking and external linkages/collaboration with partners, suppliers, customers and constituents (Barczak & Kahn, 2012; Kahn et al., 2012). In the strategic marketing literature, the aspect of organisational norms, values and culture is referred to as “market orientation”. Market orientation inherently specifies organisational learning and decision-making behaviour, activities, resources and capabilities (Slater & Narver, 1995). According to Jaworski and Kohli (1993, p.53), market orientation is “the organization-wide generation of market intelligence, dissemination of the intelligence across departments, and organization-wide responsiveness to it”.

Top management support is an important factor that has a direct positive impact on the climate and innovative culture of a firm and its new product performance (Cooper, 2001; Cooper & Kleinschmidt, 1996; de Brentani & Kleinschmidt, 2004; Kleinschmidt, de Brentani & Salomo, 2007). Top management support can lead a firm to innovate more highly in market-driving innovations (Cooper, 2011). Managers must have the values and beliefs to be visionary leaders to empower project teams and individuals to generate product newness by encouraging an atmosphere of entrepreneurship and risk taking (de Brentani & Kleinschmidt, 2004; Kleinschmidt et al., 2007). The role of top management is to act as executive champions, mentors or facilitators to articulate a new product strategy, to foster the commitment to the required product development resources and to discipline the process for developing new products (Hill & Rothaermel, 2003).

### ***“Market Driven” versus “Market Driving”***

Several studies have explored the paradigm of market orientation (e.g. Deshpandé, Farley & Webster, 1993; Jaworski & Kohli, 1993; Kohli & Jaworski, 1990; Narver & Slater, 1990). Day (1993, 1994) developed a theoretical basis for the relationship between market orientation and firm performance. It has also been found that firms engaging in an appropriate market orientation by means of having the right culture of innovation can achieve successful product innovation, sustainable competitive advantage and superior financial performance (Baker & Sinkula, 1999; Kleinschmidt et al., 2007).

According to Jaworski et al. (2000, p.45), there are two approaches to being market oriented: “market driven” versus “driving markets. The notion of driving markets has been described as “market driving” by other researchers (e.g. Carrillat, Jaramillo & Locander, 2004; Kumar et al., 2000). At the organisational level, the view of the market-driven approach and the market-driving approach is consistent with the perspective of “reactive” and “proactive” market orientation, respectively (Narver, Slater & MacLachlan, 2000). On one hand, firms engaging in market-driven behaviour learn and respond to changes in stakeholder perceptions, preferences and behaviour (competitors, channel members, partners, suppliers, influencers and distributors) within a given market structure. On the other hand, market-driving firms unlearn received wisdom and proactively “shape” customers and the market to create discontinuity or a fundamental industry shift (Jaworski et

al., 2000; Kumar et al., 2000). Hills and Sarin (2003, p.14) supported that “market driving could be regarded as a firm’s ability to lead fundamental changes in the evolution of industry conditions by influencing the value creation process at the product, market, or industry levels”.

In today’s dynamic and highly competitive environment, firms are required to engage in market-driving behaviour rather than market-driven behaviour to be successful. The importance of market-driving orientation has been identified in the research on NPD success (e.g. Carrillat et al., 2004; Hurley & Hult, 1998; Kumar, 1997; Schindehutte et al., 2008). The success of market-driving firms is based on the design of the innovative activities that would result in a dramatic leap of benefits that exceeds customers’ expectations and advances existing product experiences, thus requiring major changes in consumer behaviour (Kumar et al., 2000). Schindehutte et al. (2008, p.5) stated that “market-driving is a dynamic advantage-creating capability and a disruptive advantage-destroying performance outcome, and it reflects a strong entrepreneurial orientation”.

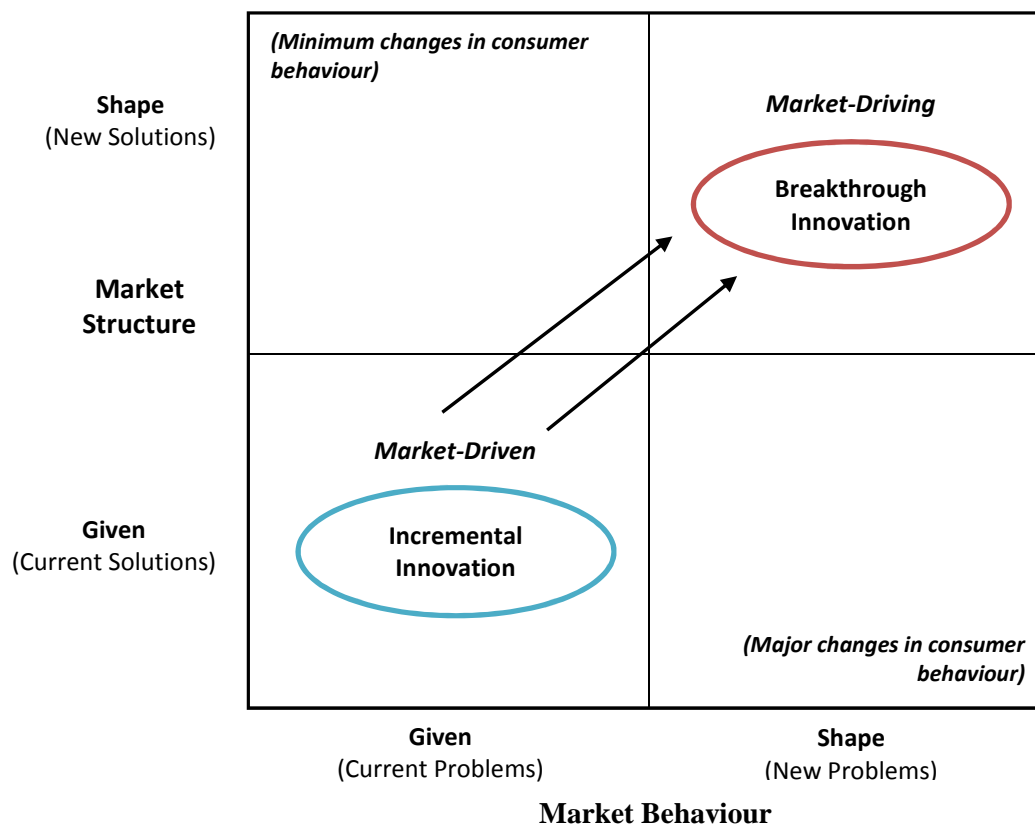
Market-driving firms have a greater capacity to innovate highly than market-driven firms (Beverland et al., 2006). The capacity to innovate is related to what Cohen and Levinthal (1990) called “absorptive capacity”. The innovativeness of a firm’s culture is an aspect that, when acting in concert with various other organisational resources and capabilities, can increase the innovative capacity of the firm (Hurley & Hult, 1998). This also involves the firm’s formal and informal interactions with potential customers and external constituents (Dougherty, 1995; Eisenhardt & Martin, 2000). The linkage between the focal firm and external sources is the key to NPD and breakthrough innovation as part of a knowledge creating process (O’Connor, 2008; Reid & de Brentani, 2004). The external knowledge brought into the firm combined with existing information leads to richer information stocks that allow individuals and NPD teams to discover future market opportunities (Shane, 2000). The ability to assess and exploit external knowledge is a principal function of the level of existing related knowledge (Cohen & Levinthal, 1990). Corning, one of the world’s top innovative firms, for instance, has identified product opportunities through its exploratory marketing function. The aim is to connect to completely new customers and to exploit the rich technical competencies in the central research group (O’Connor, 2008).

### *From “Market-Driven” to “Market-Driving” Orientation*

The concept of market-driven is predominantly considered in the marketing literature in regard to its influence on firm performance (Kohli & Jaworski, 1990; Slater & Narver, 1998). Although several firms (e.g., Apple, Corning, 3M) have driven the market by revolutionising their industry to gain a more sustainable competitive advantage, the market-driving approach has been largely neglected by researchers (Carrillat et al., 2004; Kumar et al., 2000). It is only recently that researchers have begun to focus on the essential behaviour of firms to strategically become market-driving (Schindehutte et al., 2008). Market-driving firms develop new solutions to problems that have not been solved previously; this enables them to shape the market structure (Jaworski et al., 2000). Thus, there is a need to move the focus of research away from market-driven orientation to market-driving orientation (Hills & Sarin, 2003; Kumar et al., 2000).

Figure 2.3 illustrates the changing focus of market orientation.

**Figure 2.3: The Changing Focus of Market Orientation**



Source: adapted from Jaworski et al. (2000, p.46); Wind and Mahajan (1997, p.3)

The changing focus of market orientation from market-driven to market-driving is shedding light on the development process of breakthrough innovation that has remained elusive to date. While market-driven firms are excellent at developing incremental innovations, market-driving firms are excellent at developing breakthrough innovations (Hills & Sarin, 2003; Leifer et al., 2001; Stolper, Blut & Holzmueller, 2009).

### **3) NPD process**

A further known factor to new product development (NPD) success is the NPD process. “NPD process” generally refers to the stages and gates of product development from product concept through to launch (Barczak & Kahn, 2012; Kahn et al., 2012). Although many processes have been proposed for managing NPD, there appears to be a fundamental sequence of activities over the path of the development. In the early stage of the development process, market opportunity and customer needs are evaluated to frame a product concept. After refining the product concept, firms examine its technical feasibility and move through the design, development and commercialisation phases (Crawford, 1994; Hughes & Chafin, 1996; Ulrich & Eppinger, 1995; Urban & Hauser, 1993; Veryzer, 1998b).

In the marketing literature since the 1970s, many processes for NPD practices have been documented. Historical processes such as the phased program planning (PPP) approach used by NASA have been modified by firms for their use. Firms have used approaches such as phased development process, structured development process and particularly stage-gate or phased review process to provide templates for the stages of their NPD processes (Veryzer, 1998b). These processes delineate a formalised, rational step-by-step disciplined system with a defined scope, the extent of activities for each stage, the required personnel and the expected outcomes. This approach aims to provide high quality and to control some of the technical and marketing uncertainty and risks associated in NPD (Zhang & Doll, 2001). NPD personnel, team leaders and senior managers are required to be involved in the NPD process and product innovation. Additional requirements are:

- i. explicit and tacit knowledge of applying the process to different product and market scenarios;
- ii. understanding by different functions in the firm;
- iii. knowledge of its limitations; and
- iv. steady adjustment to help speed up the development cycle, to increase flexibility, and to ensure its relevance to changing technological and market conditions (Kleinschmidt et al., 2007, p.425).

Table 2.3 summarises the NPD processes and models in the marketing management literature

**Table 2.3: NPD Processes and Models**

NPD Processes	Source
Stage-gate process (activities undertaken in parallel)	Cooper, 1990b, 2001
Concurrent development (concurrent engineering)	Pawar & Riedel, 1994; Wheelwright & Clark, 1992
Diffusion models (from manufacturer to final adopters)	Bass, 1969; Fourt & Woodlock, 1960; Mahajan & Wind, 1990; Mansfield, 1961; Norton & Bass, 1989
Phase-review process (sequential phases with defined inputs and outputs)	Hughes & Chafin, 1996; Urban & Hauser, 1980
Product and cycle-time excellence (facilitator-implemented stage-gate system)	Millson, Raj & Wilemon, 1992
Value proposition process (continuous learning and continuous cycling)	Hughes & Chafin, 1996
Structure development process (action-oriented stage reviews and integrated set of: <ul style="list-style-type: none"> <li>- Decision Tools (including expert system) and creativity</li> <li>- Development Tools:               <ul style="list-style-type: none"> <li>- Quality function deployment (QFD-The House of Quality, incremental improvements and information structure)</li> <li>- Rapid Prototyping (CAD)</li> </ul> </li> </ul>	Griffin, 1997; Pittiglio, Rabin, Todd & McGrath, 1995 Rangaswamy & Lilien, 1997; Thomas, 1993  Akao, 1990; Clausing, 1986; Eureka, 1987; Griffin, 1989; Hauser & Clausing, 1988; King, 1987; Kogure & Akao, 1983; McElroy, 1987; Sullivan, 1986 1987  Dodgson, Gann & Salter, 2005



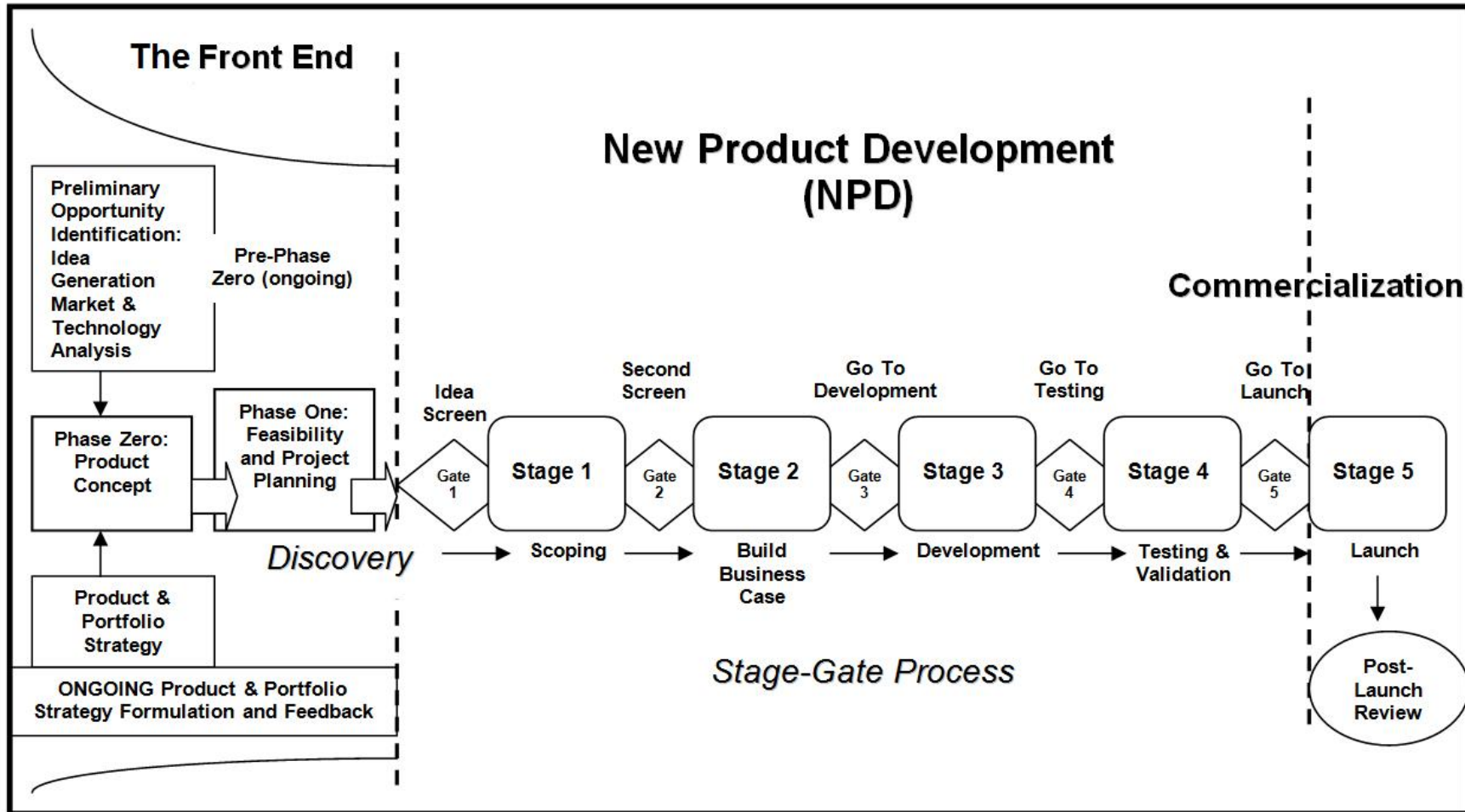
### *The Dominant Stage-Gate Theory*

The stage-gate innovation process, introduced by Cooper (1990b), appears to be the main NPD idea-to-launch model. The model is often used as the foundation of a multistage, multi-disciplinary new product process and has been modified by firms in order to overcome the deficiencies that plague their NPD projects and programs (Cooper, 1993, 2001). A survey of 60 automotive firms including Ford, GM and Toyota, approved by the Product Development and Management Association (PDMA), found that 48.6% of firms utilised the traditional stage-gate process and 30% utilised a modified stage-gate process, while the rest did not have any formal process (Ettlie & Elsenbach, 2007). These figures suggest that approximately 80% of well-managed firms have some form of stage-gate process in place. The American Productivity & Quality Center (2003) benchmarking supported the finding that it is mostly the top-performing companies that have implemented a stage-gate process.

The dominant stage-gate innovation process is “a conceptual and operational map for moving new product projects from idea to launch and beyond – a blueprint for managing the new product development (NPD) process to improve effectiveness and efficiency” (Cooper, 2008, p.214). The process goes through different stages of known deliverables and gates as checkpoints or go/kill decision points before passing through the next stage (Cooper & Kleinschmidt, 2010). The entire innovation process can be separated into three general areas: the front end (the fuzzy front end), new product development and commercialisation (Koen, 2005; Koen et al., 2002).

The entire innovation process is shown in Figure 2.4.

Figure 2.4: The Entire Innovation Process



Source: adapted from Cooper (2008); Khurana and Rosenthal (1998); Koen et al. (2002)

The dominant stage-gate theory of innovation with its highly structured gating, evaluation, monitoring and control processes may be incomplete and inappropriate for breakthrough innovation (O'Connor, 1998; Seidel, 2007; Wind & Mahajan, 1997). The gates that act as quality control or go/kill decision checkpoints may inhibit learning and the generation of novel ideas, reduce flexibility and delay the development and commercialisation of breakthrough innovation (Kelley, 2009; Sethi & Iqbal, 2008). The development of breakthrough innovation can be very fuzzy, risky and uncertain. According to the traditional stage-gate process, the first order of market assessment is to determine the potential of the market, its size and the likelihood of market acceptance (O'Connor, 1998). However, O'Connor (1998, p.153) stated that:

It is not clear, however, that this series of questions is appropriate for a market that requires “creation” or may not have emerged, whose applications are unknown, and for which issues of technical feasibility come into question every time a new application is considered.

The traditional stage-gate process is deemed to support exploitative/incremental innovation rather than exploratory/breakthrough innovation (Benner & Tushman, 2003; Brown & Eisenhardt, 1997; Jaworski et al., 2000; Sethi & Iqbal, 2008; Veryzer, 1998a; Wind & Mahajan, 1997). This is because incremental innovations are “sustaining innovations” or product improvements that provide additional benefits to existing products (Christensen, 1997). The market environment, operational strategies and circumstances for the development of incremental innovations are steady and can be clearly defined, allowing the assessments of market size and market potential (McCarthy, Tsinopoulos, Allen & Rose-Anderssen, 2006; Phillips, Noke, Bessant & Lamming, 2006). The traditional approach to NPD can stabilise routines and increase efficiency in the short term because it may help firms to develop incremental innovation quickly (Benner & Tushman, 2003). This type of incremental product, nevertheless, does not offer a long-term competitive advantage (Brown & Eisenhardt, 1997). To mitigate this problem, the addition of a discovery stage to the stage-gate process was an attempt to optimise the traditional stage-gate process for the generation of breakthrough ideas. All proposed development projects needed to enter the discovery stage at the front end of the process prior to entering the initial screening or Gate 1 of the stage-gate process. While the discovery stage allowed new product ideas and new opportunities to be uncovered and captured, the initial screening stage acted as a clearinghouse for decisions about bringing new product ideas through development and into market (Cooper, Edgett & Kleinschmidt, 2002b).

The next generation version of the stage-gate process, “NexGen systems”, was introduced to handle different types of new product ideas and associated risk levels. Once a new product idea passes through the idea-screening stage, three versions of the stage-gate process are available: “stage-gate full”, “stage-gate xpress” and “stage-gate lite” (Cooper, 2008, p.223). The decision to elect one version over another depends on the level of risk associated with the new product idea (project). The stage-gate full has a five-stage, five-gate process for projects involving a high level of risk and complex platform developments. The stage-gate xpress is suitable for projects involving moderate risk such as extensions and modifications. The stage-gate lite is a streamlined approach, efficient and lean, which is often used for very small projects or for bringing innovative products to market rapidly. The stage-gate lite approach reflects the three competencies of a radical product development innovation capability identified by O'Connor and Ayers (2005) and O'Connor and DeMartino (2006). These competencies are: (1) the *discovery* stage of developing novel ideas and recognising breakthrough possibilities, (2) the *incubation* stage of exploring potential market/partnership opportunities and complementary technologies and turning opportunity into a business proposition and (3) the *acceleration* stage of refining a breakthrough innovation project with commercial potential for it be self-sustaining (Cooper, 2008).

Cooper (2008) argued that the NexGen systems are scalable, flexible and adaptable versions of stage-gate with a spiral development process and simultaneous execution. Loops or spirals are built in from the front end stages through to development and into the testing stage. These spirals allow the back-and-forth play of activities and overlapping of stages for product iterations and improvements (Cooper, Edgett & Kleinschmidt, 2002a; Kotler & Keller, 2009). The aim of the process is to facilitate an open innovation model that incorporates the pooling of knowledge assets, complementary capabilities and risk sharing for innovative purposes (Chesbrough & Appleyard, 2007). This may allow a firm to develop an evolving but distinct development process for breakthrough innovation (Kelley, 2009).

The different versions of the stage-process are utilised and often modified by well-managed firms practising and optimising design-process management. However, it must be noted that “there was no direct evidence that firms historically more likely to report new product launches that were new to the world or industry were also more likely to use a modified Stage-Gate NPD process” (Ettlie & Elsenbach, 2007, p.32). Although highly innovative firms are likely to be more creative with the stage-gate process, the process is not viewed as

way to further introduce radically new or really new products per se. NPD strategy is a key element of this pattern (Ettlie & Elsenbach, 2007) and is discussed in the next section.

#### **4) Strategic focus (NPD strategy)**

“Strategic focus” (NPD strategy) is a key NPD success factor, which refers to the vision and focus that define the direction for research and development (R&D), and the management of technology and product development efforts at all organisational levels including a strategic business unit (SBU) and a product line and/or individual projects (Barczak & Kahn, 2012). At the front end of the development process, the organisation should clearly define NPD as a long-term strategy, and have visible goals that align with the organisational mission and strategic plan (Kahn et al., 2012). Having a new product strategy is strongly related to positive business performance (American Productivity & Quality Center, 2003).

The approaches underlying market-driven and market-driving orientation can be employed to formulate NPD strategies (Beverland et al., 2006). As previously noted, research on NPD management has extensively captured market-driven activities, particularly market-sensing stance (Kumar et al., 2000; Mishra, Kim & Lee, 1996; Parry & Song, 1994). Accordingly, being market driven involves a *market-sensing, reactive* NPD strategy and a focus on existing consumer needs to address existing demand (Christensen, 1997; Narver, Slater & MacLachlan, 2004). A market-driven reactive strategy reflects “adaptive organisational learning capabilities in terms of market intelligence generation” (Tuominen, Rajala & Moller, 2004, p.214). Firms adopting a reactive strategy often have strong operational ties with their dependent suppliers and key customers. They are, however, known to achieve only evolutionary, incremental innovation and short-term business success (Carrillat et al., 2004; Hills & Sarin, 2003; Schindehutte et al., 2008). Carrillat et al. (2004, p.2) asserted that “if every actor in the market follows a market-driven strategy and every firm adapts to competitors’ strategic moves and stays aligned with consumers requirements, then no actor will be able to offer a value proposition superior to the competition”.

To counter the criticism of market-driven orientation and its conceptualisation as being too reactive to the market, research on NPD has identified market-driving orientation that involves a *forward-sensing, proactive* strategy as the key to success (Jaworski et al., 2000;

Kumar et al., 2000). A market-driving proactive strategy is a future-looking frame of reference and a long-term perspective that guides a firm's innovation efforts (Kelley, 2009). The strategic focus is on unarticulated or latent consumer needs in the untapped market space to create demand for a new level of functionality (Baker & Sinkula, 2002; Carrillat et al., 2004). Latent needs are real needs that customers do not recognise or were not previously aware of. This strategic focus requires generative organisational learning capabilities involving collaborative learning with lead users in term of anticipatory market intelligence.

Firms adopting proactive NPD strategy leverage to compete innovatively outside their comfort zone (Hamel & Prahalad, 2005; Tuominen et al., 2004). They engage in entrepreneurial behaviour such as risk management, proactiveness, innovativeness and opportunity focus (Jaworski et al., 2000; Kumar et al., 2000; Narver et al., 2004). The entrepreneurial behaviour can redirect the strategic plan involving market forces and new ideas/technologies that are not evident to competitors (Tellis, Prabhu & Chandy, 2009). In so doing, an emphasis is placed on a firm's capability to develop radical or really new innovations that are able to influence or even pioneer new markets (Andriopoulos & Lewis, 2009; Atuahene-Gima, Slater & Olson, 2005). This also induces other industry members to introduce new products with improved standard features (Mohr, 2001; Moriarty & Kosnik, 1989; Narver et al., 2000). Baker and Sinkula (1999) stated that "such breakthroughs, or radical innovations, require the ability to suspend restrictive marketplace beliefs and to explore openly the potential of new technologies to satisfy existing needs in unique ways" (p.297).

## **5) Research**

While strategic focus (NPD strategy) provides a general framework to direct a firm's innovation efforts, "research" refers to methods and techniques that can be used to sense, study and understand customers' needs and problems, competitors, technologies and other macro-environmental forces in the market. The research, particularly at the front end of the development process, portrays the use of the knowledge and information that underlie a firm's innovative capacity (absorptive capacity) (Barczak & Kahn, 2012; Kahn et al., 2012).

Predominantly, the scope of NPD strategy involves two research perspectives of “customer insight” (market pull) and “executive foresight” (technology push) (Wind & Mahajan, 1997, p.6). The perspective of customer insight is shaped by the traditional market research tools, primarily customer feedback. This implies that customers are pulled into the NPD process as the key source of knowledge and ideas/concepts for new products. The perspective of customers, however, is often shaped by short term and current experience, which only result in incremental innovations. In contrast, executive foresight is important for the development of breakthrough innovation. The perspective of executive foresight means that the NPD team and individuals involved in research and development (R&D), particularly for new technologies, can develop highly innovative products based on their foresight (often without direct customer input) and push them out to the market (Kumar et al., 2000; Wind & Mahajan, 1997).

#### **6) Commercialisation (launch tactics)**

Having a proficient launch strategy is cited in product development and marketing literature, both theoretically and empirically, as one of the important factors for new product development. “Commercialisation” (“launch tactics”) refers to new product launch and post-launch activities including tactical launch decisions involving marketing mix adjustments (that is, how to launch) to stimulate adoption and diffusion of the new product into the consumer market (Barczak & Kahn, 2012; Hultink, Griffin, Hart & Robben, 1997). Tactical launch decisions involving marketing mix (product and branding, pricing, distribution, promotion) are made during product launch and are influenced by strategic launch decisions made regarding product innovativeness and market targeting early in the NPD process (Hultink et al., 1997).

Accordingly, launch tactics should reflect the degree of product innovativeness, whether the product is market-driven or market-driving. For market-driven innovation, firms are essentially driven by the market in their overall approach to new product development and thus often use mass market focus and intensive distribution due to numerous competitive offerings in the market but with low overall distribution expenses. It must, however, be noted that the launch tactics are different and more difficult when customers have limited experience and familiarity with a new product concept that is highly innovative or market

driving, as opposed to an incremental extension of an existing product (Hultink et al., 1997; Olson, Walker & Ruekert, 1995).

More innovative firms that launch market-driving innovations using an exclusive distribution strategy are the most successful. Firms making tactical launch decisions associated with this strategy focus on niche market and combine technological possibilities with a market need to produce more innovative products in a market where there are few incumbent competitors (Hultink et al., 1997). Market acceptance and the diffusion rates of market-driving innovations are, in fact, hard to predict (McDermott & O'Connor, 2002). Thus, the more innovative, market-driving innovations are launched exclusively with high distribution expenditure through the firm's new channels to ensure appropriate customer education about the product attributes and service (di Benedetto, DeSarbo & Song, 2008; Slater & Olson, 2001).

## **7) Metrics and performance-based measurement**

The last dimension of new product success factor is the metrics and performance measurement, which is the measures, tracking of progress and reporting of product development performance at both project and program levels (Kahn et al., 2012).

Different NPD processes, operating systems and expectations are needed for incremental innovation and breakthrough innovation. Having clear milestones, review mechanisms and traditional financial measures may be sufficient to track the progress and success of the development of incremental innovation (Hamel & Prahalad, 2005). However, different performance metrics must be established for breakthrough innovation (Rice, O'Connor, Leifer, McDermott & Standish-Kuon, 2000; Stringer, 2000). Measuring the commercial success of a breakthrough innovation may require both activity-based and performance-based measures. An example of the appropriate metrics for breakthrough innovation might include the evaluation of the program activities in terms of how effectively the market is informed of the initiative through direct linkages with external constituents such as potential customers and partners. For performance indicators, strategic measures are more likely to be used than financial measures to assess whether the breakthrough innovation moves the firm into a new strategic domain or creates new market connections, technological advantage and capabilities or new partnerships (Manion & Cherion, 2009; Olson & Slater, 2002).



### 2.4.2.1 Section Conclusion

This section has reviewed the characteristics associated with the success of both market-driven innovation and market-driving innovation and classified seven critical success factors based on the multidimensional nature of NPD best practice. These factors/dimensions are: (1) organisational structure, (2) organisational culture/behaviour (market orientation), (3) NPD process, (4) strategic focus (NPD strategy), (5) research, (6) commercialisation (launch tactics) and (7) metrics and performance measurement (Barczak & Kahn, 2012; O'Connor, 2008). In fact, the innovation practices and capabilities for market-driven innovation often do not work well for market-driving innovation (Leifer et al., 2000; Rice et al., 2002). The section has also highlighted the different structure, process, skills/mindsets and capabilities entailed in the development of market-driven innovation and market-driving innovation within the seven multidimensional success factors.

Notwithstanding the multidimensional success factors, recent research has identified “strategy” as the most important dimension related to NPD best practice, followed by research (Barczak & Kahn, 2012; Kahn et al., 2012). Strategy (a strategic focus, in this study) and research are related to the front end of innovation in terms of identifying and planning (vision) for new product strategies to guide the firm’s innovation efforts and the research perspective of using the traditional market research tools (customer insight) or research and development (executive foresight) (Kahn et al., 2012; Wind & Mahajan, 1997). With respect to the front end of market-driving innovation, the strategic focus and research reflect a firm’s continuing endeavours of engaging in market-driving behaviour and a *forward-sensing, proactive* strategy to discover latent consumer needs and/or new technologies and to link them to future market opportunities. Market-driving firms develop highly innovative products based on their foresight by acquiring new technical/market knowledge and information that underlie their innovative capacity (absorptive capacity). This clearly highlights the importance of NPD efforts at the front end of the innovation process, particularly for market-driving innovation.

## 2.5 The Nature of the Front End of Market-Driving Innovation

### 2.5.1 Defining the Front End of Innovation

In the innovation management literature, several terms have been used to describe the front end or the early stages of the innovation process (early development phase). “Front end of innovation” (FEI) (Koen et al., 2001), “fuzzy front end” (FFE) (Smith & Reinertsen, 1991), “pre-phase 0” (Khurana & Rosenthal, 1997, 1998), “pre-development” (Cooper & Kleinschmidt, 1994a), “up-front homework” (Cooper, 1994), “pre-project activities” (Verganti, 1997) and “up-front activities” (Crawford, 1980) also denote the same concept.

This study uses the term “**front end of innovation**” (FEI) to describe the front end or the early stages of the innovation process instead of using what is commonly referred to as the “fuzzy front end” (FFE), which, from the perspective of Koen et al. (2001), implies that the front end is a mysterious, unknowable and uncontrollable part of the innovation process that is impossible to manage. FEI involving early activities and decisions can in fact be managed and defined by “those activities that come before the *formal and well-structured New Product and Process Development (NPPD) or Stage Gate™* process” (Koen et al., 2001, p.49). The front end activities commonly involve opportunity identification and exploration, information collection and concept development (Crawford & di Benedetto, 2000; Koen et al., 2001). According to Khurana and Rosenthal (1998), FEI includes “product strategy formulation and communication, opportunity identification and assessment, idea generation, product definition, project planning, and executive reviews”, which occur through pre-phase zero/product and portfolio strategy and into phase zero and phase one (p.59). FEI primarily involves a two-step decision-making process as the evaluation (go/no-go) points: “(1) the awareness step and resulting information collection for idea generation and (2) the information evaluation step regarding the opportunity, resulting in a decision about the selection or rejection [of that idea]” (Broring et al., 2006, p.490).

A number of studies have highlighted the importance of managing the front end of the innovation process as a key to new product success and a firm’s competitive advantage (e.g. Backman et al., 2007; Bertels et al., 2011; Cooper, 1988, 1997, 1998; Khurana & Rosenthal, 1998; Kim & Wilemon, 2002b; Verworn et al., 2008). The front end activities and decisions have the strategic importance of influencing the business unit’s options and costs for designing, developing and ultimately commercialising a product at the later phases of the

innovation process (Bertels et al., 2011). Thus, the greatest opportunities for time saving (at the least expense) and for improving the overall innovation process are at the front end of innovation (Backman et al., 2007). The efforts and time spent at FEI have been found to result in a reduction of development time and a sharper and more stable early product definition, thereby reducing uncertainty and ambiguity in the NPD project (Cooper, 2001; Cooper & Kleinschmidt, 1995b; Urban & Hauser, 1993). The cost of generating several potential ideas is also relatively lower than the cost of actual development for any one idea (Smith & Reinertsen, 1991; Urban & Hauser, 1993). “Managers and researchers claim the benefits resulting from improvements in the front [end] are likely to far exceed those that result from improvements aimed directly at the design engineering process” (Koen et al., 2001, p.2).

Recent research has found that successful businesses spend twice as much time and money as unsuccessful ones on the front end or pre-development activities prior to moving to the development stage (Cooper & Kleinschmidt, 2010). Cooper and Kleinschmidt (1994b, p.26) stated that “the greatest differences between winners and losers were found in the quality of execution of pre-development activities”. A high quality of execution of predevelopment activities results in a success rate of 75% and a high rate of profitability (7.2 out of 10). In contrast, when predevelopment activities are lacking or poorly undertaken, the success rate is only 31.3% and profitability is only 3.7 out of 10 (Cooper, 2001).

Despite the importance of the predevelopment activities to business success, FEI continues to be “one of the weakest areas of the innovation process” (Koen et al., 2002, p.29). There is only limited research on how best to manage the idea generation and evaluation phases of NPD (Koen et al., 2001; Martinsuo & Poskela, 2011). The later phases of NPD activities are, however, relatively well researched as evident by the dominant stage-gate process (Brown & Eisenhardt, 1995; Cooper, 2001; March, 1991). This leaves FEI as the least well-structured part of the NPD both theoretically and practically, especially in the case of market-driving innovation (de Brentani & Reid, 2012).

## **2.5.2 The Front End Challenges of Market-Driving Innovation**

Drawing upon a review of the literature on the FEI, “the front end” of market-driving innovation in this study refers to the following sequence of activities: the recognition of a breakthrough possibility (new idea or advanced technology), information collection, an assessment of future market opportunity, the translation of the breakthrough possibility into a clear and specific early-stage concept, and finally either its approval for formal, structured new product development or its termination (Kim & Wilemon, 2002a; Koen et al., 2002; Koen et al., 2001; Murphy & Kumar, 1997).

The greatest weakness and uncertainty is found at the front end of the development process, especially for market-driving innovations (Reid & de Brentani, 2004). The high level of uncertainty associated with highly innovative ideas and visioning for future market application creates the “upstream creative challenge” for developing market-driving innovations (Koen et al., 2002; Kumar et al., 2000; Reid & de Brentani, 2010). In the early stages of developing market-driving innovation, it is difficult to assess customers’ future needs with no obvious market sight (Thomke & von Hippel, 2002). Nevertheless, firms would still like to find out who their target customers are, what exactly customers need, which new technology will succeed, and what skills and capabilities are required for the new product being developed (Khurana & Rosenthal, 1998). With a lack of clear market vision, firms can spend a lot of time and activities trying to generate market-driving ideas/concepts and anchor product development (Phillips et al., 2006).

### ***Difficulties in maintaining breakthrough integrity***

The real challenge for firms is the ability to move market-driving innovations through the NPD process, especially through the stages between opportunity discovery and product development, or the “Valley of Death” , whilst retaining their breakthrough integrity (Cooper, 2011; Markham et al., 2010). Market-driving innovations are revolutionary, risky and disruptive (O'Connor & Veryzer, 2001). Christensen and Overdorf (2000, p.73) described the disruptive nature of market-driving innovations as that they “promise lower profit margins per unit sold, are not attractive to the company’s best customers, and inconsistent with the established company’s values”. A market-driving idea/concept is inherently outside the existing strategic domain and may even damage the current “cash cow” mainstream business and target market. Further, turning a market-driving idea into an

innovation can take up to ten years or more to develop and cost millions of investment dollars. The longevity of projects also implies a turnover of NPD team members and a senior management that may put pressure to modify the market-driving idea and dumb down its innovativeness given the risk of the project. These factors, coupled with other exogenous events, mean that market-driving ideas are often regarded as too difficult and too costly because of the need to stretch into unfamiliar business processes, new areas of organisational and technical competency, and unpredictable markets (McDermott & O'Connor, 2002; O'Connor & Veryzer, 2001).

Established firms and their accumulated decision-making experiences usually favour investment in new product development projects that align with the organisational direction, technology, resources and sunk costs invested in R&D, particularly those projects with a certainty of payoff (Levinthal & March, 1993; March, 1991; Teece et al., 1997). Business investments are prioritised aggressively in high-margin products that potentially have a market size large enough to attract them (Christensen, 1997). Hence, there is a tendency for firms to channel funds repeatedly into the *status quo* that supports incremental innovations over market-driving innovations to avoid the risk of damaging the existing industry and market. Kumar et al. (2000, p.136) asserted that “the greater the threat of cannibalization, the more intense is the resistance to market driving ideas”.

As a consequence, the more innovative market-driving ideas that might create new markets are often squelched and soundly rejected at the outset, or otherwise face a number of stops and starts, deaths and revivals before moving through to launch (Hill & Rothaermel, 2003; McDermott & O'Connor, 2002). On average, the success of market-driving innovation is estimated as one in 300 at the idea submission stage (or the patent disclosure stage) and one in 125 at the small project stage (or after a patent is granted); and only one in nine projects (11%) is commercially successful (Stevens & Burley, 2003). For every successful market-driving innovation, there are thus possibly hundreds of highly innovative, breakthrough ideas that fail to emerge into the development process and through to commercialisation.

### **2.5.3 Measuring the Front End Outcomes of Market-Driving Innovation**

Although the importance of the front end of innovation has been recognised, the relationship between the front end activities and the front end performance has attracted little empirical investigation. The front end or early performance, as a measure, captures the front end outcome of new product success (that is, at the before-launch stage). The front end performance is predicted by a set of front end activities – R&D and concept development; the existence of a front end process and relevant NPD team members; and the development plan (time, costs, and resources, including technologies and regulatory requirements) – for bringing a new product to market (Kim & Wilemon, 2002b; Koen et al., 2001). The PDMA’s comparative practice surveys have shown that a substantial number of front end activities has taken place in NPD practices but are not assessed in relation to new product performance (Barczak et al., 2009). Most NPD success measures use standard financial-based measures such as ROI, profitability, revenue and the break-even time (Griffin & Page, 1993, 1996). These traditional financial measures have a high time-lag in regard to front end activities. Any positive effect on financial performance may appear only after several years of a new product concept being launched, particularly for market-driving innovation (O’Connor et al., 2008). Measuring financial results at the front end stage thus appears to be irrelevant or less important in the short term (O’Connor, 1998; Reid & de Brentani, 2010).

The primary determinants of the front end outcome (deliverables) include “a well-defined product concept” developed from a new product idea that can be validated and evolved into a commercial product (Cooper & Kleinschmidt, 2010; Kim & Wilemon, 2010). According to Seidel (2007, p.524), a “product concept” refers to “the desired outcome of the development process, the form, need and technology for the new product”. A well-defined product concept provides a preliminary identification of the needs of customers, potential market opportunities and associated risk, and a management vision for the product, including its quality, performance and features (Khurana & Rosenthal, 1997). Research on the execution of the front end suggests that new products which have an explicit, sharp, stable and early defined product concept are three times more successful and profitable than poorly defined products (Cooper, 1999; Cooper & Kleinschmidt, 2010).

Noting the importance of having an early, well-defined product concept, an extensive literature review has indicated that none of the existing measures captures how successful the front end is in delivering highly innovative concepts into development and

commercialisation phases. The first half of the front end battle is about generating great product ideas. Most studies on market-driving innovation typically capture the number of product ideas or concepts in the pipeline as the outcome measure of this front end activity (Chan et al., 2008). Product innovativeness or the level of innovativeness can be an important measure for capturing the scope of market-driving ideas but this measure is most frequently used to capture the degree of newness of an innovation (the final outcome in both market and technological aspects) (Danneels & Kleinschmidt, 2001; Garcia & Calantone, 2002; Griffin, 1997b; Prajogo & Sohal, 2003). The study by Verworn (2009) captured the degree of newness of an initial product concept by focusing on the resource aspect. While the study identified two items of the degree of newness factor, it measured resources only in terms of unusually high capital needs and the new skills required to execute the project.

In addition, the other half of the front end battle, previously described as the Valley of Death, is “the gap between conception or invention versus moving that concept or invention through to a commercialized product – the gap where so many projects die” (Cooper, 2011, p.6). Having many great product ideas does not mean that these ideas are able to emerge into the formal development process. Rather, the ideas are further evaluated, defined, refined and developed before ultimately being commercialised. The impact of highly innovative ideas will not be evident either in front end performance or financial performance. In addition to financial objectives being inappropriate measurements at the front end stage, the number of product introductions can only be used to generally indicate more ideas moving from the front end into the formal NPD. Similarly, evaluating new product successes as they are introduced into the market can be used as a general indicator to seeing the front end as successes when the product ideas move through development into commercialisation (Barczak et al., 2009; Griffin, 1997a; Markham & Griffin, 1998; Page, 1993). It appears that the existing measures do not adequately capture evidence of highly innovative ideas flowing from the front end into the more formal development and through to launch.

Although an idea’s entry or acceptance of breakthrough innovation into the formal NPD process is an important element for measuring the front end performance (before-launch stage performance), this element seems to have gained little, if any, consideration in the literature. This type of measurement requires a delicate balance for breakthrough innovation in terms of trying to validate a concept for a market that has had no previous experience

with such a product, as well as obtaining internal support for turning it into a NPD project (O'Connor & Veryzer, 2001). The before-launch stage performance of a breakthrough innovation is highly dependent on a firm's ability to maintain the high level of innovativeness of the original product concept from the initial idea through to final product launch. This ability is related to what is called "product integrity", which is "a clear vision of the product's intended image, performance" (Brown & Eisenhardt, 1995, p.363). The *Concise Oxford English Dictionary* describes the term "integrity" as "the condition of having no part of element taken away or wanting" or "the condition of not being marred or violated". Churchman's theory refers to the notion of "integrity" in product design as "the conditions of its wholeness, soundness and virtue" (Swanson, 1994, p.55). To adequately capture the concept of integrity in the context of breakthrough innovation, this study therefore proposes "**breakthrough integrity**" (BI) as a front end outcome measure. It refers to the extent to which a clear and highly innovative concept of a potential new product is maintained after it enters the development and commercialisation phases (Clark & Fujimoto, 1990, 1991; Reid & de Brentani, 2010; Seidel, 2007).

Furthermore, customer-related measure is an important measure for capturing the front end outcome of market-driving innovation. Typically, the success of a market-driving innovation in the marketplace is assessed in terms of customer acceptance and satisfaction with the new product (Chan et al., 2008). According to Griffin and Page (1996), the customer-related measure is regarded as the most appropriate for new-to-the-world products. This is because when a firm commercialises something radically new or really new (never before available), customer acceptance and satisfaction can influence sales and product adoption by others. In the same vein, recent research by Reid and de Brentani (2010) captured a customer-based measure to deal with the front end or "early performance" of a radical innovation. The study referred to the measure as "**early success with the customers**" (ESC), that is, satisfaction with and acceptance of a new product concept by early customers (Reid & de Brentani, 2010, p.507). This ESC measure was adopted based on the concept of "lead user" (von Hippel, 1978) and the findings by Griffin and Page (1996) in a project level success measurement study.



## **2.5.4 The Front End Success Factors of Market-Driving Innovation**

In recognising the importance of managing the front end of innovation (FEI), this section reviews the common success factors which have been found to significantly affect the front end of the development process. Past research on the FEI has focused primarily on the success factors of market-driven innovations, as opposed to market-driving innovations. In fact, a focus on the front end of market-driving innovation is the critical root of success for innovative firms and yet fewest strategies are available for its effective management (de Brentani & Reid, 2012; Reid & de Brentani, 2004). The main focus of this study is therefore to understand the critical success factors at the front end of market-driving innovation.

Based on the seven multidimensional NPD success factors previously identified in Table 2.2, Table 2.4 then identifies the five NPD success factors/dimensions and associated characteristics that are relevant to the front end of innovation of both market-driven innovation and market-driving innovation.

**Table 2.4: Summary of Critical Success Factors at the Front End of Innovation (Market-Driven Innovation and Market-Driving Innovation)**

Factors/Dimensions		Front End of Innovation	Front End Characteristics (Market-Driven Innovation/Market-Driving Innovation)
1	<b>Organisational culture/behaviour</b> (market orientation)	Organisational learning process  Front end individuals	Exploitative learning process vs exploratory learning process (absorptive capacity)*  Top management commitment, internal communication and knowledge networks of individuals and NPD teams including product champions/visionaries, gatekeepers, and boundary spanners (boundary spanning-gatekeeping interface, pattern recognition), as well as informal/external networks of people*  Specific rewards and incentives to individuals/team members, e.g., awards, performance appraisal, peer recognition, to stimulate idea generation/enrichment
2	<b>NPD process</b>	Front end development process and related aspects	Stage-gate sequential process: idea/concept screening and evaluation (preliminary technical/market assessment)  Non-sequential process model (new concept development): opportunity analysis and identification, idea generation and selection, and concept and technology development – building a business case
3	<b>Strategic Focus</b> (NPD strategy)	Front end product portfolio strategy	Front end product portfolio management and formalised decision processes over portfolio and over specific projects: - strategic alignment - portfolio balancing - resource allocation (centralised/decentralised R&D budgets and venture capital fund) - maximisation of portfolio value (traditional financial measures vs real option theory)
4	<b>Research</b>	Market learning	Market listening: Voice of the customers (VOC) – early involvement with customers  Market visioning* (market visioning competence/market vision): Technology voice/techno-market insight and end-user-product interaction (lead users)
5	<b>Metrics and performance measurement</b>	Front end performance metrics	Performance metrics to track idea generation and enrichment, i.e., number of ideas generated and/or entered the NPD process

\*Emerging front end success factors of market-driving innovation

Sources: Bertels et al., 2011; de Brentani & Reid, 2012; Khurana & Rosenthal, 1997, 1998; Kim & Wilemon, 2010; Koen et al., 2001; Leifer, 1998; Martinsuo & Poskela, 2011; Reid & de Brentani, 2004

The next section compares and contrasts, where applicable, the front end issues and specific success factors associated with the development of market-driven innovation and market-driving innovation in more detail.

## **(1) Organisational culture/behaviour**

The first front end success factor is related to the organisational culture/behaviour, specifically, the organisational learning process and the roles of key individuals at the front end of innovation.

### ***Organisational learning process***

An important aspect of an innovative firm's organisational culture/behaviour is the strength and style of its learning orientation. A learning orientation influences "the propensity of the firm to create and use knowledge" (Sinkula, Baker & Noordewier, 1997, p.309). Two critical learning styles that influence the front end development of innovations are *exploitative* market learning and *exploratory* market learning (Kim & Atuahene-Gima, 2010; March, 1991). On one hand, exploitative market learning focuses on refining and extending information already acquired and it is more likely to be associated with incremental innovation (Atuahene-Gima, 2005; Danneels, 2002). On the other hand, exploratory market learning requires "a firm to engage in the pursuit of very new and radical market information, going beyond the current product market knowledge domain" (Kim & Atuahene-Gima, 2010, p.522). This type of market learning is more likely to be associated with breakthrough innovation (Atuahene-Gima, 2005; Danneels, 2002).

Exploratory market learning is related to the concept of "absorptive capacity" (Cohen & Levinthal, 1990) in that "outside sources of knowledge are often critical to the innovation process, whatever the organization level at which the innovating unit is defined" (p.128). According to Zahra and George (2002), absorptive capacity is "a set of organizational routines and process by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability" (p.186). Researchers have acknowledged the importance of instituting organisational processes as drivers to initiate and enhance vision creation and market intelligence at the front end of breakthrough innovation (Deszca et al., 1999; O'Connor & Veryzer, 2001; Reid & de Brentani, 2004). Accordingly, information processing is at the core of the organisational process of innovation. A firm's capability to process and manage the information flow by acquiring and assimilating external information and combining it with existing, in-house knowledge as well as sharing the information at the organisational level (that is, absorptive capacity) creates a high chance of leading to new

product ideas and their transformation into new products, particularly for breakthrough innovations (de Brentani & Reid, 2012; O'Connor & Rice, 2001).

The external environment is the main source of new ideas for breakthrough innovations (Cousins et al., 2011). Wind and Mahajan (1997, p.7) described external linkages as the “forefront of the changing dynamics of competition and cooperation, especially in the R&D arena”. New information acquired from the external environment regarding markets, and competitors, thus, has an impact on the very early decisions made by individuals in the firm in visioning the general adoption pattern and how a new idea could be adopted or used by their firm. Despite great ideas that may come from in-house, there is still likely to be some degree of input from external sources (Reid & de Brentani, 2004). This is especially true when breakthrough innovations (that open up a new market) tend to be initiated from outside the current industry (Utterback, 1994).

In addition, the process of sharing the newly acquired and assimilated information at the organisational level (product, program and firm) may enable individuals and NPD teams to build collective intuition as well as formulating and sustaining the vision for the development of market-driving innovation (Eisenhardt, 1999; O'Connor & Veryzer, 2001). The sharing of information also kick-starts organisational level awareness of market-driving innovations (de Brentani & Reid, 2012). The establishment of “knowledge networks” is imperative to support information sharing and the visioning process to avoid missing potentially great product ideas and opportunities. A knowledge network may consist of multifunctional-skilled employees and cross-functional teams particularly between R&D and marketing, including other informal/external networks of people who exchange ideas, information and other resources at the front end of market-driving innovation (Brem & Voigt, 2009; Kim & Wilemon, 2002b; O'Connor, 2008). An empirical study by Olson et al. (2001) supported that high levels of cooperation between marketing and R&D functions during the early stages of the development process of highly innovative projects can lead to positive project performance. Further, a firm’s capability to connect to informal networks may stimulate recognition of the value of a new product and exploit it to commercial ends (Cohen & Levinthal, 1990). de Brentani and Reid (2012, p.73) stated that “it is the informal processes of networking and information sharing that have been shown to be of particular importance during the FFE of the NPD process for discontinuous innovations”.

### ***Front end individuals***

In the product innovation management literature, particular individuals have roles in supporting and forwarding innovations within networks and firms, especially at the front end of market-driving innovation. These front end individuals are people such as senior management (visionary leaders), boundary spanners, product champions and gatekeepers.

At the management level, senior management has an essential role in setting up the organisational culture and instituting the required routines and processes that foster the exploration of entirely new product ideas and/or technologies (O'Connor & Veryzer, 2001). Although the experiments may lead to unexpected results or failures, individuals and NPD teams are encouraged to “learn by doing” and to treat failures as valuable discoveries for their future development in order to achieve bigger and better outcomes. A survey by PricewaterhouseCoopers (2013) supported that an environment where failure and risk are reasonably tolerated is very important for the development of breakthrough innovations (71%) as well as having senior executives taking part in innovative projects (74%). In fact, senior managers have the role of “visionary leaders” in terms of supporting radically new or really new product ideas through to the development process and into a potential market (Tellis, 2006). Without senior management support and commitment during strategic, structural and resource planning at the front end of innovation, the process of developing breakthrough innovations may come to a near standstill (Burgelman & Sayles, 1986; Khurana & Rosenthal, 1997). The findings by the American Productivity & Quality Center (2003) support this contention that senior management in the top-performing companies are committed to necessary product development and resources.

In addition, senior management should offer rewards and recognitions to individuals and NPD teams to stimulate idea generation at the front end of the development process. According to the PricewaterhouseCoopers survey (2013), 73% of senior executives believe that recognising and rewarding innovation initiatives is critical because “the best breakthrough innovators want to be recognised as somebody who makes a difference – to their profession, to the company, and sometimes to the world” (p.28). In the same vein, Baer, Oldham, and Cummings (2003) found that a monetary reward or special bonus (extrinsic motivation) does not have a significant influence on creativity, especially on those highly innovative ideas that are compulsory for breakthrough innovation. The authors also argued that intrinsic factors, such as personal recognition or an opportunity to lead in high-

profile innovation initiatives, can stimulate individuals to generate ideas for radical innovation (Baer et al., 2003).

At the individual level, “boundary spanners” operate at the boundary interface of a permeable organisation and perform organisationally relevant tasks by connecting the organisation with information and elements outside it. The importance of acquiring external information during the early stages of developing a market-driving innovation has already been mentioned. Boundary spanners have strong external networks to facilitate the flow of innovation-related information between the environment and the firm (de Brentani & Reid, 2012; Reid & de Brentani, 2004, 2010). “Gatekeepers” assess the value of the externally acquired information and decide whether to share it with others in the organisation. They perform at the gatekeeping interface by indirectly championing ideas at the front end of innovation (de Brentani & Reid, 2012). Specifically, there are both technological and marketing gatekeepers. Technological gatekeepers are highly important in connecting an organisation with external sources of technology. Marketing gatekeepers have a similar role in sensing, gathering and routing both market and technical information.

Moreover, NPD studies have drawn the concept of “champions” (“visionaries”) from marketing and management sciences to study their roles in both incremental innovations (Cooper & Kleinschmidt, 1986, 1987a; Gupta & Wilemon, 1990; Kim & Wilemon, 2002a; Markham, 1998; Zirger & Maidique, 1990) and particularly market-driving innovations (de Brentani, 2001; de Brentani & Reid, 2012; Leifer et al., 2000; O'Connor & Veryzer, 2001; Veryzer, 1998a). The role of product champions is closely related to that of gatekeepers. Product champions are individuals who informally emerge in an organisation to make significant contributions to innovations. The key role of product champions is to actively and enthusiastically promote the progress of a project through its critical stages, particularly early in the development process, and sell or justify the “vision” internally to the point where senior management and other critical members of the firm support the idea. They are often entrepreneurs by nature and lead the charge of accessing resources and are willing to do what it takes to make an innovation happen (de Brentani & Reid, 2012; Reid & de Brentani, 2004; Veryzer, 1998a).

The importance of key individuals involved in the front end of innovation is related to the concept of “pattern recognition” in the knowledge development and management literature (Roos, 1996; Veryzer, 1998a). Pattern recognition (distinction tree) is an individual process

of thinking which involves two types of distinction making: “refinement” and “rethinking” (Roos, 1996). First, *refinement* is an incremental process of knowledge development. It is a thinking process of making finer distinctions in a branch of knowledge that already exists (knowledge depth increase), and thus often results in incremental improvements. Second, *rethinking* is a recursive process of gaining new insight into new tradition by breaking traditional views and current practices. It is a thinking process of identifying and examining previous assumptions made by oneself or others to seek out possible new branches of knowledge (knowledge width increase), and thus often results in conceptual breakthroughs or breakthrough advancement (Roos, 1996).

The main role of pattern recognition at the individual level is in directing an information search during the idea generation stage of the development process. An information search in the incremental scenario can be carried out through “refinement” (Roos, 1996), given the existing market and technical information (Fisher, Maltz & Jaworski, 1997; Gatignon & Xuereb, 1997). In contrast, “rethinking” for breakthrough innovation is more difficult, given the unknown market and/or advance technical information (Roos, 1996). Individual competence (knowledge, strength and know-how) are thus critical for successfully performing and processing critical work functions in a breakthrough setting.

## **(2) NPD process**

### ***Front end development process and related aspects***

The new product development process was identified as a critical success factor for both market-driving and market-driven innovations. The development of the two types of innovations requires different approaches to the NPD process. This means that specific front end development processes and related aspects of market-driven and market-driving innovations differ in terms of how new product ideas are generated and evaluated. The traditional stage-gate, sequential process of idea generation/evaluation that might work well for incremental innovation may not be suitable for breakthrough innovation, which requires a more flexible process, especially during the early stages of innovation (O'Connor & Veryzer, 2001). This leads to the second front end success factor, which focuses on the front end development process.

Koen et al. (2002) highlighted the “New Concept Development” or “NCD” model as a non-sequential process that comprises five elements: opportunity identification, opportunity analysis, idea generation, idea selection, and concept and technology development. Their study suggested that these five elements represent the flow, circulation and iteration of ideas, as opposed to processes. The new concept development model allows back-and-forth looping among all the five elements, which can be used in any order or combination and more than once. This is quite different from “the sequential NPD or Stage-Gate process, in which looping back and redirect or redo activities are associated with significant delays, added costs, and poorly managed projects” (Koen et al., 2002, p.9). The loop-backs in the new concept development model at the front end ensure that “redo” or “redirect” activities often result in clearly defined market/technical requirements and a more effective new product development plan. This typically leads to a reduction of overall costs and cycle time for product development and commercialisation. In contrast, in the stage-gate model, any rework downstream can exponentially increase the cycle time and costs of product development (Koen et al., 2002; Koen et al., 2001).

The five elements of the new concept development model work differently for market-driven and market-driving innovations. For market-driven innovation, new concept development begins when a firm recognises the need to develop new products to respond to existing market trends (opportunity identification), and then further analyses the trends and competitive threats in more detail (opportunity analysis) to generate and select new product ideas (idea generation and selection) that can be translated into a concept definition (concept and technology development). In contrast, new concept development of market-driving innovation begins when a firm recognises a breakthrough possibility for capturing something radical or really new to the market, an application for which there is no readily identifiable customer need (opportunity identification). Further analysis is done by finding potential business opportunities for the new application (opportunity analysis). Several product ideas associated with the new application are identified and, once selected, the new product idea leads to a new concept and technology development. Importantly, it must be noted that opportunity identification is mostly practised at highly innovative firms (those that produce a large number of really new innovations) (Koen et al., 2001).

The last element of the new concept development model, concept and technology development, involves building a business case based on analysis of customer needs, market



competitiveness and potential, technology unknowns, investment requirements and overall project risk (Koen et al., 2002). A solid business case should be developed for incremental innovation to encourage the translation of product ideas into new products using the firm's existing capabilities (Koen et al., 2002). The level of formality of a business case can vary depending on the type of innovation and its nature of opportunity (e.g., new market, technology and/or product arena), the level of resources, the organisational culture and the requirements for moving the new product idea into the development process (Koen et al., 2001). The business case for a large-scope, risky, breakthrough type of project is less formal than that for an incremental project since getting the right data and constructing a solid, fact-based business case can often be much more difficult. However, a compelling business case should be built because many firms have a lot of great new product ideas with promising value for the firm's growth but do not feel the urge to invest in such ideas. A compelling business case can convince senior management to make an investment and move forward by developing new organisational and/or technological capabilities for translating highly innovative ideas into radical or really new innovations (Cooper, 2011).

### **(3) Strategic Focus (NPD strategy)**

#### ***Front end product portfolio strategy***

The third front end success factor, the front end product portfolio strategy, is in line with the strategic focus approach (NPD strategy). Front end product portfolio management and formalised decision processes involve the "evaluation, selection, prioritisation and control" of the firm's product innovation portfolio at both program level (portfolio) and project level (specific projects). The strategy supports the main front end objective by facilitating "the selection of best new product concepts for the development and launch for successful products" (Oliveira & Rozenfeld, 2010, p.1339).

A formal portfolio management system and plan is a method commonly applied by top-performing firms to keep their product innovation portfolio current and competitive (Cooper & Kleinschmidt, 2010). The results of the PDMA Best Practices Study (2003) indicated that 55% of firms have a well-defined, structured process for portfolio management. However, formally planned activities are conducted for only one third of the projects to fill identified

gaps in the firm's product portfolio (Barczak et al., 2009). A review of the product innovation and management literature suggests that a firm needs to attain four primary goals when managing a product innovation portfolio and related activities at the front end of the development process (Barczak & Kahn, 2012; Cooper, Edgett & Kleinschmidt, 2002c). These four goals are described below.

- i. **Strategic alignment:** strategic alignment between projects in a portfolio and the general NPD strategy

Most of the firms examined by Cooper and Kleinschmidt (2010) were suffering from having too many NPD projects, resulting in the lack of resources, time and money to commit to further innovations. This state of affairs seemed to be due to a lack of focus, inadequate project evaluation and poor project prioritisation (Cooper & Kleinschmidt, 2010). Studies have shown that the combination of too many projects and inadequate resource commitment creates high new product failure rates (Cooper, 2001; Cooper & Kleinschmidt, 1996) and poorer NPD performance for the business overall (de Brentani & Kleinschmidt, 2004). Firms should therefore seek strategic alignment in their product portfolio and ensure that innovative development and the resources allocated to it reflect the firm's strategic NPD priorities (Cooper, Edgett & Kleinschmidt, 2001).

- ii. **Portfolio balancing:** a balance between incremental and breakthrough projects within a portfolio

The results from a PDMA best practice study by Barczak et al. (2009) indicated that firms have focused less on expanding into new competitive spaces by developing new product lines and new-to-the-world projects in their portfolios, but more on exploiting the firm's existing knowledge, markets and customers by maintaining their current product lines or engaging in product improvement projects. As a result, incremental innovations have constituted the majority of new product projects (approximately 90%) (Cooper, 2001; Cooper, Edgett & Kleinschmidt, 2003).

Accordingly, a critical issue in portfolio management is to foster well planned and properly resourced NPD projects with the right mix and balance in the product portfolio. Cooper and Kleinschmidt (2010) found that while firms typically have too many low-value, non-innovative NPD projects, top-performing firms foster a higher proportion of innovative

NPD projects by specifically articulating a product innovation strategy for breakthrough innovations. This suggests that firms may need to focus more on risky, long-term, breakthrough projects and less on short-term, incremental projects in order to perform better in today's highly competitive business environment.

iii. **Resource allocation:** management of resources (especially R&D budget) for preferred projects

Effective portfolio management helps to ensure that necessary resources (funds, time and people) are dedicated to preferred projects (i.e., incremental versus breakthrough projects) and/or across strategic arenas (Cooper, 2011; Cooper & Kleinschmidt, 2010). The management of portfolio funding for incremental projects typically leans towards traditional corporate R&D spending through a centralised system (Stringer, 2000). In contrast, several large firms have managed to decentralise their R&D and build “fat” and “flexibility” into their budgets over the portfolio for breakthrough projects. Breakthrough projects should be funded separately from a large firm's traditional R&D budget. The purpose is to avoid the “trap of incremental thinking”, which tends to inhibit all aspects of breakthrough innovations (Stringer, 2000, p.74). Avoiding that trap allows for the identification, testing and screening of promising breakthrough ideas through to development and into commercialisation.

An external strategy to manage funding for breakthrough projects is the ability to attract and retain high-quality venture capital. Relying only on ever-larger internal R&D budgets cannot possibly support all of the potential breakthrough ideas from the front end through to the development and into the marketplace (Rice et al., 2000). The venture capital model considers a set of breakthrough projects as a portfolio of corporate entrepreneurship. A pool of money is put aside to open up new investments related to the firm's growth strategy early in the process and this enables ventures to obtain more money for breakthrough projects faster (Rice et al., 2000). Governance of a portfolio entirely composed of high-risk, breakthrough projects also requires an appropriate resource diversification strategy to acquire new competencies and/or new technology and new business platforms (O'Connor, 2008).

- iv. **Maximisation of portfolio value:** maximise the value of projects in the portfolio during idea generation and selection

Idea generation and selection in the product portfolio often appear to be poorly managed at the front end of innovation. Barczak et al. (2009) study on trends and drivers of success in NPD practices indicated that less than half of the ideas for radical or really new projects are initiated through formally planned activities to fill identified gaps in the product portfolio. In contrast, most of the ideas for incremental projects are generated from a wide variety of people through formally planned activities. Further, formal records of ideas have been found for only 60%–65% of the ideas generated, while less than half of those ideas are accessible by people other than the idea originator. Then, only approximately 60% of the ideas emerge into the NPD process using a formal selection process, while most of the remaining ideas cannot be moved forward and have no budget allocation. Thus, new product ideas often fade away as potential opportunities (Barczak et al., 2009).

During the idea selection stage, decisions made by firms within the formal product portfolio rely on formalised decision processes. Making the right investment decisions by selecting the most promising product ideas can lead firms to achieve the greatest business value and is significant to the firm's future health and success. However, to evaluate which new product ideas to pursue over the specific projects within the portfolio (project level go/kill decisions) and over the several projects as a portfolio (program level) can be difficult because of the limited information available during the early stages of the development process (Koen et al., 2002). Firms therefore utilise a variety of evaluation tools and techniques, particularly traditional financial measurements such as discounted cash flow analysis and payback periods (Barczak et al., 2009).

Traditional financial measurements are subject to short-term biases, which inhibit a significant flow of breakthrough ideas into commercialisation (Cooper, 2011; Stringer, 2000). The more novel an idea is, the more uncertain the development process and time to commercialisation are, thus increasing overall project risk. The financial measure does not evaluate the dependency of project value on risk beyond what is captured by the discount rate, net present value or internal rate of return. The return of investment in a breakthrough innovation occurs only after there are purchases by customers over time (Koen et al., 2002; Rice et al., 2000; Stringer, 2000).

For breakthrough innovations, formalised decision processes must be modified to allow “crazy” new ideas that do not offer immediate payoff a fair chance to succeed (Stringer, 2000). Breakthrough ideas can be evaluated by future cash flow/benefits or risk assessment using real-options theory. Assessing risk using options theory supports investment in projects associated with high uncertainty. The approach focuses on keeping investment options open by relying on how new information changes the option value of the opportunity (of the project invested). The aim of this approach is to learn more as the project progresses in order to reduce uncertainty and is in line with the exploratory process previously described. A unique governance board involving market/technology experts in the investment may also be required to overlook the portfolio of breakthrough innovations and related project level issues (O'Connor, 2008).

#### **(4) Research**

##### ***Market learning***

The fourth front end success factor is related to research and specifically the view of market learning at the front end of the development process. Rangan and Bartus (1995) described two views of market learning, which are consistent with the two research perspectives of customer insight and executive foresight previously described . Whereas market-driven innovations call for “market listening” (voice of customer), market-driving innovations call for “market visioning” (technology voice) (O'Connor, 1998).

##### **The View of “*Market Listening*”**

Incorporating market listening through the voice of the customer (VOC) at the front end of the development process has been regarded by the majority of researchers as “a critical success factor for NPD” (Kleef, van Trijp & Luning, 2005, p.181). According to the PDMA, VOC can be defined as “a complete set of customer wants and need; expressed in the customers’ own language; affinitized, that is, organized into a hierarchy; and prioritized, that is, rated for relative importance and performance or satisfaction” (Katz, 2001, p.1). VOC can be obtained through traditional methods of market research such as customer interviews or focus groups (Bell, Holbrook & Solomon, 1991; Davis, 1989; Hassenzahl, 2001). Following traditional market research, customers are a significant source of new product ideas (Callahan & Lasry, 2004; Fang, 2008; Griffin & Hauser, 1993; Urban &

Hauser, 1993). Thus, early involvement with customers can lead to successful product innovation (Kahn, Castellion & Griffin, 2005; Verworn, 2009; von Hippel, 1986).

In a view opposed to the long-standing marketing theory on the value of customer input, several studies have pointed out the limitations of listening to customers on NPD and product innovation (e.g. Leonard-Barton, 1995; Ulwick, 2002). Ulwick (2002) described how firms often wrongly interpret customers' expressed needs for innovation. The study asserted that "customers want to buy groceries on-line; companies then deliver these tangibles, and customers, very often and much to everyone's chagrin, just don't buy" (Ulwick, 2002, p.5-6). This relates to "the limitations of listening" to customers (Leonard-Barton, 1995). For this reason, management may conclude that customers do not know exactly what they want (Ulwick, 2002).

Christensen (1997) had a similar view on "innovator's dilemma" or "the current-customer trap". Leading firms fail to sustain their positions and lose business to entrant firms because they are too "well managed", meaning that they listen closely to their customers and develop new products that correspond to customers' needs and market trends. Christensen claimed that "we cannot expect our customers to lead us toward innovations that they do not now need" (1997, p.258). In other words, customers may not be able to see even current needs, much less the innovations that may serve their needs in the future. By the time customers are aware that they want an innovation, it is too late for the firm to develop that innovation to compete in the market (Luecke & Katz, 2003). Christensen (1997) concluded that "staying close to your customers appears not always to be robust advice" (p. 54).

The growing number of discussions on market listening raises the question of the value of customer input (VOC) in the development of breakthrough innovation (e.g. Christensen & Bower, 1996; Day, 1998; Leonard-Barton & Doyle, 1996). Direct customer input may hamper breakthrough innovation, particularly during the front end of the NPD effort. Customers have difficulty visualising and articulating their future needs because their mindsets are based on what they have experienced or their current use context (Deszca et al., 1999; Mullins & Sutherland, 1998; Reid & de Brentani, 2010). This is a "functional fixedness" (Baron, 1998), a cognitive limitation that may hinder truly creative thinking and can influence the tacit knowledge of customers (Maqsood, Finegan & Walker, 2004). Tacit knowledge by its nature is individualised and difficult to transfer (Narvekar & Jain, 2006). This type of knowledge underlies intuition or "gut-feeling" and hinders well-informed

decisions (Maqsood et al., 2004). When customers rely on their intuitions or articulate their needs based on what they are familiar with, this leads to only small, incremental improvements of existing products or short-sighted product innovation (Kotler & Keller, 2009; Luecke & Katz, 2003; Verhees & Meulenberg, 2004). This may be one explanation for the problems of the dominant stage-gate innovation process when applied to breakthrough innovation given its primary focus on VOC research (Cooper & Edgett, 2006, 2007; Deszca et al., 1999). Henry Ford (1988) supported the contention that:

It is not easy to get away from the tradition. That is why all our new operations are always directed by men who have no previous knowledge of the subject and therefore have not had the chance to get on really familiar terms with the impossible.

Some theorists have further argued for the need to “ignore customers” as a source for completely new product ideas (Martin, 1995). In most cases, customers do not have sufficient knowledge about the technology required to develop a new product that requires different behaviour patterns (O'Connor, 1998). They are often overstrained by the high technological complexities involved in developing breakthrough innovations (Bogers, Afuah & Bastian, 2010; Lettle, Herstatt & Gemuenden, 2006). As a consequence, it is unlikely that most customers are able to envision revolutionary products, concepts and technologies (Kumar et al., 2000). Hamel and Prahalad (1994a, p.67) went so far as to state, “customers are notoriously lacking in foresight”.

### **The View of “*Market Visioning*”**

Let's face it, the customer, in this business, and I suspect in many others, is usually, at best, just a rear-view mirror. He can tell you what he likes about the choices that are already out there. But when it comes to the future, why, I ask, should we expect the customer to be the expert in clairvoyance or creativity? After all, isn't that what he expects us to be?

Robert Lutz, Vice-Chairman of Chrysler (Day, 1998, p.5)

The importance of “vision” or “visioning” has recently been highlighted in much NPD research as a “new” market learning approach for developing successful breakthrough innovation (Baker & Sinkula, 1999; O'Connor, 1998; Reid & de Brentani, 2010). The approach is under the notion of “market-driving” orientation, which goes beyond the

immediate voice of customer issues and attempts to reshape the market structure and the preferences or even behaviour of all players in the market (Jaworski et al., 2000).

Effective visioning is a process of sensing and thinking about future scenarios (O'Connor & Rice, 2001). Several researchers have suggested that the thinking and imagination underlying the success of breakthrough innovation, particularly technological breakthroughs is the “technology voice” or “techno-market insight” (Leifer et al., 2000; Leonard-Barton, 1995). This comes from “marketing flair” (Jolly, 1997) or “visioning the future market” (Hamel & Prahalad, 1994b) or an ability to recognise that a certain new technology has compelling benefits and commercial implications, and to embed those benefits into a product for which a market may not have previously existed. This also involves how a firm developing a new product approaches a problem technically, plays with the technology and deals with interaction with the end users, particularly lead users.

A “lead user” can be a valuable source of highly innovative ideas (Urban & von Hippel, 1988; von Hippel, 1989). Lead users are not standard users, but expert customers who are highly motivated to seek solutions for their unmet needs (Lilien, Morrison, Searls, Sonnack & von Hippel, 2002; von Hippel, 1986). There is, however, only a small number of lead users in the market (Moore, 1991). According to Lynn et al. (1996, p.16), lead user analysis is the process of “probing and learning” about users and the technology to introduce “an early version of the product to a plausible initial market” and its subsequent redesign for customer acceptance. The probe and learn process offers a unique approach of discovering rich information on emerging and future customer needs (Eisenberg, 2011). Notwithstanding this process, O'Connor and Veryzer (2001, p.244) argued that:

Customers or lead users seem to play little if any role in the visioning process in this development context. While it may be that customer input is indirectly funnelled into the process via knowledgeable members of the development teams, the implication is still that “market visioning” for radical new products is not heavily customer driven in the traditional sense.

In many cases, the use of lead-user analysis appears to support the front end of breakthrough innovation because it centres on: “(a) obtaining a deep understanding of the customer’s current and future *usage situation* and (b) accelerating the customer’s level of *interaction* with the product” (O'Connor, 1998, p.153). This may enable a firm to attain a market insight or market vision.



Having a strategic focus (NPD strategy) may provide a firm with a general framework for its innovation efforts, but market vision is more specific, being about “a desired and important product-market for a new advanced technology” (Reid & de Brentani, 2010, p.500). Effective market vision has a clear focus related to employee effort as well as the firm’s activities related to customers, technology and competitors to reduce innovation risk (O’Connor & Veryzer, 2001). A lack of market vision clarity may discourage the initiative of prospective innovators in the firm (Kelley, 2009). Market vision must therefore be grounded in a stimulating, future-looking view and strategically based on proactive use of market learning tools and competence (Reid & de Brentani, 2010). These involve entrepreneurial behaviour and the process of opportunity discovery/identification through exploratory and collaborative learning (Kirzner, 1997; Schindehutte et al., 2008; Venkataraman, 1997). Then, networking can drive the vision through the firm to support individuals and NPD team members to work in a coordinated manner towards the desired vision (Lynn & Akgün, 2001; Reid & de Brentani, 2010). The vision may also redirect the strategic focus of a firm’s innovative efforts to respond to market forces and new technologies that are not evident to competitors (Tellis et al., 2009).

## **(5) Metrics and performance measurement**

### ***Front end performance metrics***

The last front end success factor is the front end performance metrics, which are measureable goals to track idea generation and enrichment. Although the front end performance metrics do not lead to market-driven or market-driving ideas, they capture the front end success that is a predictor of NPD performance. These metrics may include the following:

- Number of ideas retrieved and enhanced from an idea portfolio
- Number of ideas generated/enriched over a certain period
- Percentage of ideas commercialised
- Value of ideas in an idea portfolio (or idea bank)
- Percentage of ideas that entered the NPD process
- Percentage of ideas that resulted in patents
- Percentage of ideas accepted by a business unit for development

(Koen et al., 2002, p.20-21)

## 2.5.5 Section Conclusion

Drawn from the seven multidimensional factors of NPD success, five dimensions that are relevant and critical to the front end success were identified in this section. The five front end success dimensions are: (1) organisational culture/behaviour (organisational learning process and front end individuals), (2) NPD process (front end development process and related aspects), (3) strategic focus (front end product portfolio strategy), (4) research (market learning) and (5) metrics and performance measurement (front end performance metrics). Within each dimension, the front end characteristics and issues associated with the development of market-driving innovation were discussed and, where applicable, compared to those associated with the development of market-driven innovation.

A review of the product innovation and management literature has suggested that the nature of market learning through *market visioning* is now emerging and is of particular importance in ensuring the front end success of market-driving innovation (Reid & de Brentani, 2010). The key issue of the front end of market-driving innovation is how successful the front end is in delivering highly innovative concepts into development and commercialisation phases. However, getting market-driving innovations across the stages between opportunity discovery and product development, whilst retaining their innovativeness, is fraught with difficulties and remains a challenge for many firms. Firms must therefore determine how to prevent the rejection or modification of the highly innovative ideas, which may eventually cannibalise their existing businesses (Koen et al., 2002). Kumar et al. (2000, p.136) stated:

An established firm that wishes to engage in market driving must meet two challenges; it must have the *vision* and *environment* to generate breakthrough ideas and it must have the capital, fortitude, and risk tolerance to persevere and allow the radical idea to have a fair chance to succeed.

The process of market visioning during the front end of market-driving innovation is not well understood. In particular, it is unclear how a vision can be created based on the proactive use of market learning tools or individual competence and then sustained in the face of the short-term pressures of the firm's activities. Further, the organisational learning process – the firm's capability to manage and process external information – appears to be an important proxy for vision creation and market intelligence (Dröge, Jayaram & Vickery, 2000). Information flow and informal/external networking during the front end of market-

driving innovation have not been well understood or managed at the broader organisational level. It is therefore critical to understand what firms can do to create the environment that stimulates market-driving behaviour, in particular exploratory learning and thinking about future market opportunities (O'Connor & Veryzer, 2001; Schindehutte et al., 2008). There must be some organisational structures or learning processes that can be instituted to better manage the front end of market-driving innovation (Davenport, 1993; de Brentani & Reid, 2012; Reid & de Brentani, 2004). This need highlights the significance of a firm's absorptive capacity as an emerging organisational dynamic learning capability to the front end success of market-driving innovation (Zahra & George, 2002).

The next sections review the elements of these emerging front end success factors – market visioning and absorptive capacity – in more detail.

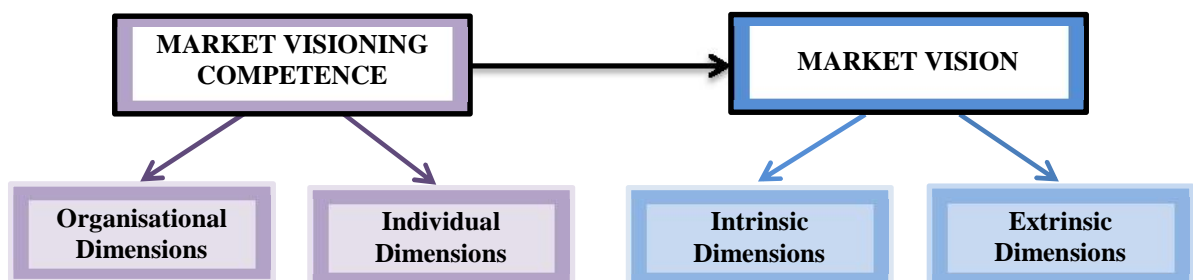
## 2.6 The Emergence of Critical Front End Success Factors

### 2.6.1 Market Vision and Market Visioning Competence

The previous section covered research on the need for market visioning, particularly at the front end of market-driving innovation. This section reviews market visioning, which consists of market visioning competence (MVC) and market vision (MV), and the dimensions underlying these constructs.

Based on the perspective of the resource-based view (RBV) of the firm and dynamic capabilities, research by Reid and de Brentani (2010) suggested that market visioning involves exploratory processes and the dynamic learning capabilities of individuals and their organisations. These capabilities are reflected in MVC, which allows organisational members to create an effective mental image, an MV, of a viable and potentially successful radical innovation. The dimensions comprising effective MV are both intrinsic and extrinsic in nature in that they represent what the vision looks like to the organisational members as well as the external view of thinking toward that vision (Jolly, 1997; Rice, O'Connor, Peters & Morone, 1998; Stokes, 1991). Figure 2.5 illustrates the basic relationship between market visioning competence and market vision.

**Figure 2.5: Key relationships between MVC and MV**



Source: Reid and de Brentani (2010)

The following sections define what market vision is for the purpose of this study and specify the intrinsic and extrinsic dimensions associated with market vision as a construct. This is followed by a definition of market visioning competence and its individual and organisational dimensions.

### **2.6.1.1 Defining Market Vision**

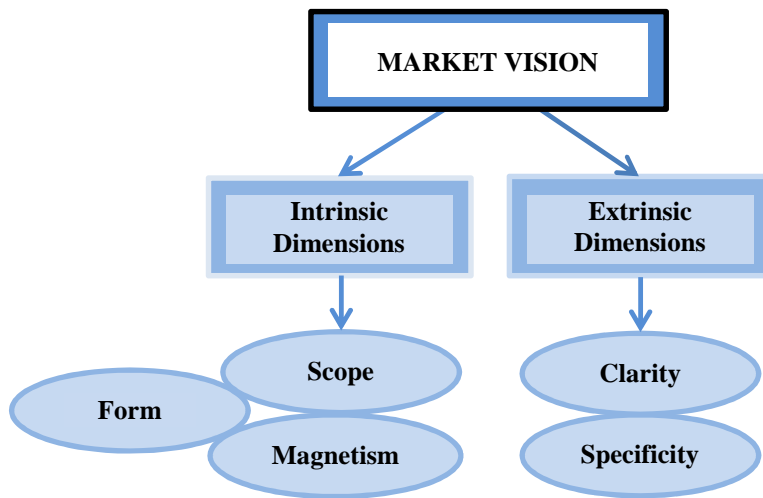
The concept of market vision (MV) has recently emerged to deal with the high degree of ambiguity and uncertainty involved in developing market-driving innovations at the front end of the innovation effort (O'Connor & Veryzer, 2001; Reid & de Brentani, 2010). According to Reid and de Brentani (2010), market vision is defined at the product-market level as “a clear and specific mental model or image that organizational members have of a desired and important product-market for a new advanced technology” (p.500). This definition of MV seems to relate only to radically new, high-tech products. In addition, the analysis of that study was done at the NPD project level.

This study extends the definition of market vision (Reid & de Brentani, 2010) by capturing the MV of both radical and really new innovations and generally defines “market vision” or “vision” as “a clear and specific early-stage mental model or image of a product-market that enables NPD teams to grasp what it is they are developing and for whom”. The definition is extended to broaden the concept of effective MV for the analysis of this study at the NPD program level.

The intrinsic dimensions of effective MV are form, scope and magnetism; the extrinsic dimensions are clarity and specificity (Reid & de Brentani, 2010).

Figure 2.6 presents the intrinsic and extrinsic dimensions of market vision.

**Figure 2.6: Intrinsic and Extrinsic Dimensions of Market Vision**



Source: Reid and de Brentani (2010)

### ***Intrinsic Dimensions of MV***

The intrinsic dimensions of MV are form, scope and magnetism (Reid & de Brentani, 2010). These dimensions are described as follows.

- **Form (FO)**

In general, vision form refers to the tangibility or specific conditions of the image. Collins and Porras (1991) explained tangibility as a clear focus of mission or goal. When such a description is incorporated into the MV, vision form is related to the market goal. The market is “the set of all actual and potential buyers of a product or service” (Kotler & Keller, 2005, p.10). MV form, therefore, refers to the potential or desired market as part of the market focal point/goal (Reid & de Brentani, 2010).

The perspective of MV form captures the design and concept of a product as well as the product in use. This involves the idea for the product components and their integration espoused through a prototype, and a consideration of the anticipated product features in relation to customer benefits and product-user interaction (Reid & de Brentani, 2010; Ulrich & Eppinger, 1995). Understanding the anticipated product fit to customers’ needs and product-user interaction in the use environment has been shown to be critical for new product success (Crawford, 1980; de Brentani, 1989; Tripsas, 2000).

- **Scope (SC)**

MV scope involves the target market and the target magnitude (Reid & de Brentani, 2010). The target market (target business) provides the specific market goal (end-user group and activity) for new product development (Cooper, 1993; Crawford, 1980). The target magnitude is the scope and breadth of the envisioned potential market. Several studies in NPD have supported that the size of the potential market can influence the product outcomes and the success of developing innovative products. Typically, the larger the size and greater the importance of the market, the more successful the outcome (e.g. Cooper, 1984, 2011; Cooper & Kleinschmidt, 1995a; de Brentani, 1989). Some researchers have asserted that large markets do not exist for breakthrough innovations and that it is not appropriate to consider the size of the market at the front end of breakthrough innovation (e.g. Christensen, 1997; O'Connor, 1998). However, Reid and de Brentani (2010) argued that a forecast of long-term market potential in terms of size and importance is essential to fire employees' imaginations.

- **Magnetism (MG)**

MV magnetism reflects "how compelling, important, or desirable the vision is" in the eyes of the organisation members and the way that they are drawn to "an idea pertaining to a product-market" (Reid & de Brentani, 2010, p.505). Collins and Porras (1991) described the notion of a guiding philosophy in terms of how people are attracted to ideas which relate to their core beliefs, values and purpose. Applying this to MV, a vision comprising magnetism dimension can infuse value into the firm by motivating individuals to move in a coordinated direction and attain a given vision of the product-market interface because they believe in the value of the vision (Reid & de Brentani, 2010).

### *Extrinsic Dimensions of MV*

In addition to the intrinsic dimensions, Reid and de Brentani (2010) stated that “an image itself is separate from thinking directed toward that image” (p.503). An image can be seen differently over time but this uncertainty can be separated from the image itself, as it has independent, extrinsic dimensions. The emergent strategic process may direct the intrinsic components of the vision. The strength of the vision, however, evolves over time and clarity and specificity are the extrinsic dimensions of the generic vision. These extrinsic dimensions are described as follows.

- **Clarity (CL) and Specificity (SP)**

According to Lynn and Akgün (2001), “vision clarity” is defined as “a well-articulated, easy-to-understand target – a very specific goal that provides direction to others in the organization” (p.375). At the project level, vision clarity has been found to relate positively to the success of both radical and really new innovations (Lynn & Akgün, 2001). Having a vision at the project level (a project vision) has generally been identified as a significant NPD success factor (e.g. Lynn et al., 1999a; Lynn et al., 1999b). A “project vision”, also known as a “product vision”, has been defined as the consistency between a firm’s strategy and the need of the market to develop an effective product concept (Brown & Eisenhardt, 1995); clear goals and objectives that enable NPD teams to develop a product (Crawford & di Benedetto, 2003); and “a firm’s ability to define clear objectives and a well-recognized strategy for the development process and to share these objectives and strategy with all those involved in the development” (Tessarolo, 2007, p.74). A project vision, however, comes only after a market vision of a particular new product-market scenario has been formalised, elaborated and accepted for further development.

At the product-market level, vision clarity can be separated into “clarity” and “specificity” dimensions (Reid & de Brentani, 2010). On one hand, MV clarity is specifically related to MV form and represents a clear vision of how the product will be used, who the target user is and what the target customers’ needs would be. On the other hand, MV specificity is “more general and at a higher level of abstraction pertaining to specificity of the overall vision” (Reid & de Brentani, 2010, p.511). Thus, specificity refers to a clear, specific and easy to visualise (tangible) market vision that is able to provide direction to individuals and NPD teams even prior to formal project status (Reid & de Brentani, 2010).

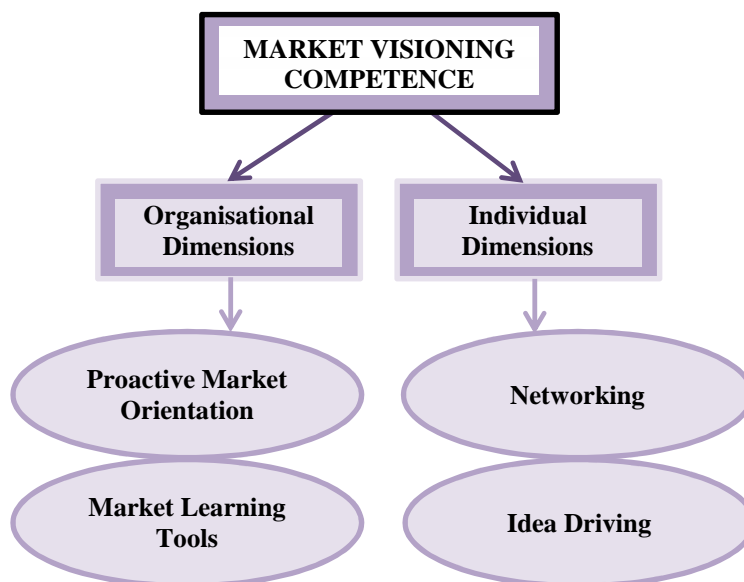


### 2.6.1.2 Defining Market Visioning Competence

Cast in RBV, the development of an effective market vision (MV) requires market visioning competence (MVC) to be successful (Reid & de Brentani, 2010). Reid and de Brentani (2010, p.500) defined MVC as “the ability of individuals in organizations to link advanced technologies to market opportunities of the future”. Similar to their definition of MV, the definition of MVC was limited to radically new, high-tech products. In addition, the analysis of their study was done at the NPD project level.

Based on the study by Reid and de Brentani (2010), this study broadens the concept of effective MVC to capture both radical and really new innovations at NPD program level by defining it as: “the ability of individuals or NPD teams in organisations to link *new ideas or advanced technologies* to future market opportunities”. The organisational and individual dimensions of MVC comprise proactive market orientation, market learning tools, networking and idea driving (Reid & de Brentani, 2010). Figure 2.7 presents the organisational and individual dimensions of market visioning competence.

**Figure 2.7: Organisational and Individual Dimensions of Market Visioning Competence**



Source: Reid and de Brentani (2010)

## ***Organisational Dimensions of MVC***

At the NPD project level, Reid and de Brentani (2010) identified the organisational dimension of MVC, which consists of proactive market orientation and market learning tools. These dimensions are described as follows.

- **Proactive market orientation (MO)**

In line with previous literature review, the proactive market orientation dimension captures the notion of market driving which has been identified as critical to the success of market-driving innovation. “Proactive market orientation” is the first organisational dimension of MVC, which focuses on discovering and incorporating solutions to unarticulated needs or additional needs of customers in new products (Narver & Slater, 1990; Reid & de Brentani, 2010). This is in contrast to “reactive market orientation”, which focuses on listening closely to customers and reactively responding to customers’ expressed needs, which appears to be useful only in the case of market-driven innovation (Christensen, 1997).

- **Market learning tools (ML)**

Market learning was identified as the key success factor/dimension at the front end of market-driving innovation. The market learning approach for market-driving innovation involves the process of sensing and thinking about future scenarios. In a similar vein, Reid and de Brentani (2010) specifically considered “market learning tools” as a second organisational dimension of MVC for probing and learning about future technological scenarios and potential market opportunities (Lynn et al., 1996; Reid & de Brentani, 2010). As noted earlier, deep interaction with customers through VOC or market listening is simply not appropriate during the front end development of market-driving innovation (de Brentani, 2001; Song & Montoya-Weiss, 1998). Other tools and techniques for visioning the future market are needed before making a market selection (Deszca et al., 1999). These tools and techniques include back casting, scenario analysis and planning, technology opportunity analysis, road mapping and learning by using (Kostoff & Schaller, 2000; Noori, Munro, Deszca & McWilliams, 1999; Porter, 1994; Schoemaker, 1995), and have been found to be most effective when used in combination (Meade & Islam, 1998).

### *Individual Dimensions of MVC*

The individual dimensions of MVC are networking and idea networking. Consistent with one of the emerging front end success factors identified to relate to “the front end individuals”, the individual dimensions relate specifically to the boundary spanners and champions who play critical roles at the front end of market-driving innovation (Reid & de Brentani, 2010). These individual dimensions are described as follows.

- **Networking (NW)**

Networking is considered a key individual dimension in creating effective MVC. In the context of MVC, networking involves “boundary spanners” who develop external webs of relationships with people outside the firm (Reid & de Brentani, 2004, 2010). The important aspects of an external network are its structural features (size, variety and centrality) and its potential to capitalise on competitive advantage (Reid & de Brentani, 2010). The development of an external network allows individuals to draw on new and diverse knowledge and product applications, thereby broadening their knowledge base and thinking for breakthrough innovations. The underlying focus of networking is related to the processes of “vision migration” (also called “divergent visioning”), as opposed to focusing on current uses and markets (O'Connor & Veryzer, 2001).

- **Idea driving (ID)**

The literature has supported the notion of “champions” as the individuals responsible for moving ideas (the vision) forward from the individual level to the organisational level for breakthrough innovation (e.g. Burgelman & Sayles, 1986; O'Connor & Veryzer, 2001). Similarly, Reid and de Brentani (2010) proposed champions or idea drivers as one of the individual level capabilities of MVC in market-driving innovation scenarios. At the front end of market-driving innovation, a market-driving idea is often squelched or loses its innovativeness before moving through to development and into launch, given the high risk and uncertainty associated with the idea (Hill & Rothaermel, 2003; McDermott & O'Connor, 2002). It is therefore important to have an idea driver who can obtain and accelerate support and commitment from key decision makers and senior managers to drive the market-driving idea (MV) forward.

## **2.6.2 Absorptive Capacity**

A review of the product innovation and management literature has suggested the notion of “absorptive capacity” (that is, an organisational dynamic learning capability) as another emerging factor that is critical to the front end success of market-driving innovation.

This section first reviews the general concept of absorptive capacity and the definition adopted for the purpose of this research. This is followed by a review of the key studies on absorptive capacity and innovation, particularly in relation to the front end of market-driving innovation.

### **2.6.2.1 Defining Absorptive Capacity**

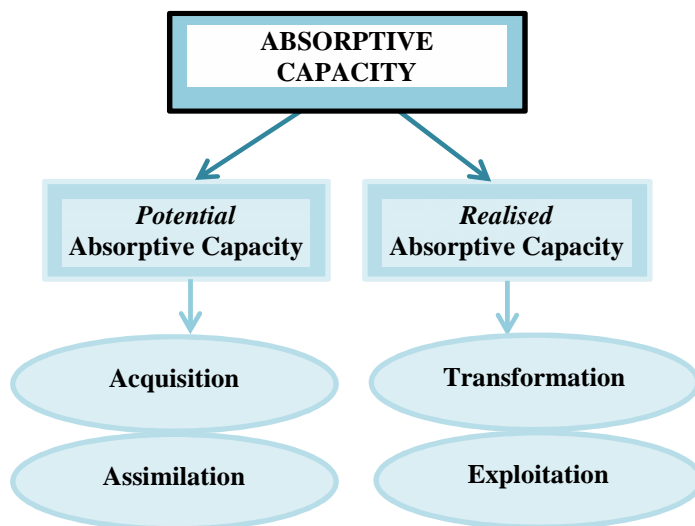
The concept of absorptive capacity first arose from the field of macroeconomics and referred to the ability of an economy to exploit and absorb external information and resources (Adler, 1965). Many different research fields have utilised the concept of absorptive capacity (e.g., strategic management and industrial policy). Following Adler (1965), the original concept of absorptive capacity was adjusted by Cohen and Levinthal (1990) to provide a new perspective on learning and innovation, and since then it has become one of the most important concepts in the field of organisational research (Lane et al., 2006). In general, the concept of absorptive capacity focuses on a firm’s existing base of knowledge and the exploitation of external sources of knowledge as a key to organisational innovation. In that view, absorptive capacity is the capacity of a firm to innovate (innovative capacity) by adopting and implementing new ideas, processes or products successfully (Cohen & Levinthal, 1990).

Most researchers have slightly modified the definition of absorptive capacity proposed by Cohen and Levinthal (1990). Their definition of “absorptive capacity” was “the ability of a firm to recognize the value of new, external information, assimilate it and apply it to commercial ends” (p.128). In a similar vein, Mowery and Oxley (1995) defined absorptive capacity as the range of skills required to deal with the tacit element of transferred knowledge and the ability to transform externally acquired knowledge. According to Kim (1997, 1998) absorptive capacity is defined as the learning system or capacity to learn and solve problems. Importantly, Zahra and George (2002) reconceptualised and further extended the definition of absorptive capacity by Cohen and Levinthal (1990) and their

definition has been adopted by several studies on the contribution of knowledge processes to organisational performance (e.g. Da Silva & Davis, 2011; Lev, Fiegenbaum & Shoham, 2009; Sun & Anderson, 2010).

Following the work by Zahra and George (2002), this study adopts the definition of absorptive capacity (ACAP) as: “a set of organizational routines and process by which firms *acquire, assimilate, transform* and *exploit* knowledge to produce a dynamic organizational capability” (p.186). Their definition is in line with the perspective in the RBV of the firm and dynamic capabilities literature. By definition, ACAP comprises two subsets of potential and realised absorptive capacities, which have acquisition, assimilation, transformation and exploitation dimensions (Zahra & George, 2002). Figure 2.8 presents the potential and realised subsets of absorptive capacity.

**Figure 2.8: Absorptive capacity, its potential and realised subsets and dimensions**



Source: Zahra and George (2002)

### ***Potential Absorptive Capacity (PACAP)***

The dimensions of potential absorptive capacity allow a firm to discover new sources of knowledge by:

- **Acquisition:** a firm's capability to identify and acquire external knowledge that is important to its operations, especially for NPD and innovation (e.g., new technology and market information)
- **Assimilation:** a firm's capability to develop routines and processes that are useful for analysing, interpreting and understanding the information obtained from external sources

### ***Realised Absorptive Capacity (RACAP)***

The dimensions of realised absorptive capacity allow a firm to use transformed knowledge for a commercial purpose by means of:

- **Transformation:** a firm's capability to develop and improve existing routines that promote the future use of existing knowledge with newly acquired and assimilated knowledge
- **Exploitation:** a firm's capability to constantly use the "transformed" knowledge, and explore its existing routines, competencies and technologies for improvement and expansion in order to create something new for commercial purpose

(Zahra & George, 2002; Zahra et al., 2006)

### **2.6.2.2 Absorptive Capacity and Product Innovation**

Recent literature on product innovation has highlighted absorptive capacity as an emerging factor of firm-specific learning, resource and capabilities and as one of the most influential positive determinants of innovation performance (Chen et al., 2009; Kostopoulos et al., 2011; Lichtenthaler & Lichtenthaler, 2009; Zhou & Wu, 2010). Studies have pointed out that firms with high levels of absorptive capacity perform better in new product development and innovation (McMillan, Muari & Halmilton, 2003; Newey & Shulman, 2004; Stock, Greis & Fischer, 2001). Lane et al. (2006, p.849) supported that absorptive capacity helps to increase “the speed, frequency, and magnitude of innovation and that innovation produces knowledge that becomes part of the firm’s absorptive capacity”.

Several studies on increasing a firm’s absorptive capacity have used research and development (R&D) as a determinant of absorptive capacity (Escribano, Fosfuri & Tribo, 2005; Grunfeld, 2004; Kamien & Zang, 2000; Kneller & Stevens, 2002; Knudsen, Dalum & Villumsen, 2001; Mancusi, 2004). Nonetheless, it has been argued that R&D is not sufficient to capture the different kinds of knowledge (Schmidt, 2005). R&D may not be as significant an influence on the absorptive capacity of small firms as it is on that of large firms (Jones & Craven, 2001). Correspondingly, some researchers have begun to shift the focus to the human resources involved in the process (Mangematin & Nesta, 1999; Vinding, 2006) and more commonly to organisational aspects such as the organisational structure, the flow of communication and the firm’s ability to combine existing knowledge with new knowledge (Cohen & Levinthal, 1990; Lane & Lubatkin, 1998; Van den Bosch et al., 1999). Thus, research on absorptive capacity has been conducted at different levels such as the individual and organisational levels (e.g. Cohen & Levinthal, 1990), the business unit level (e.g. Szulanski, 1996; Tsai, 2001), the industrial district level (e.g. Aage, 2003a; Aage, 2003b), the dyad level (e.g. Lane & Lubatkin, 1998) and the cluster level (e.g. Giuliani & Bell, 2005).

Table 2.5 presents a summary of key studies on absorptive capacity and innovation from 1990 to 2013.

**Table 2.5: Summary of Key Studies on Absorptive Capacity and Innovation**

	<b>Author</b>	<b>Year</b>	<b>Journal</b>	<b>Ranking</b>	<b>Findings</b>
1	Cohen and Levinthal	1990	Administrative Science Quarterly	A*	Absorptive capacity is used as predictor of innovative activity; R&D creates a capacity to assimilate and exploit new knowledge.
2	Lui and White	1997	Technovation	B	Absorptive capacity is a predictor of innovative output; the synergy of investments in absorptive capacity (R&D personnel) and new sources of knowledge (foreign technology) drive innovation in developing economies.
3	Kim	1998	Organisation Science	A*	Absorptive capacity is an integral part of a learning system (organisational learning is a function of ACAP), that is, the capacity to create new knowledge (for innovation); the investment in knowledge development and increased efforts in learning come from the creation of crises.
4	Lane and Lubatkin	1998	Strategic Management Journal	A*	“Relative absorptive capacity”: The factors that determine success of firms in the (R&D) alliances are: (1) relevance of the learning firm’s basic knowledge to the teaching firm, (2) similarity in pay and benefits practices, (3) similarity in areas of research, (4) similarity of organisational structures.
5	Van den Bosch, Volberda and De Boer	1999	Organisation Science	A*	In a turbulent knowledge environment, firms are likely to increase their level of absorptive capacity; the focus is on exploration of knowledge that is beyond essence of refining and extending existing competencies, technologies and paradigms.
6	Tsai	2001	Academy of Management Journal	A*	Absorptive capacity acts as a conduit of knowledge transfer among organisational units and hence facilitates the use of new knowledge for a firm’s innovation activities [the significant positive effects of absorptive capacity on innovation and business performance].
7	Zahra and George	2002	Academy of Management Review	A*	The reconceptualisation of absorptive capacity into potential and realised absorptive capacities and their different influences on firm performance through product and process innovation; ultimately firms are more likely to achieve and sustain a competitive advantage.



**Table 2.5: Summary of Key Studies on Absorptive Capacity and Innovation (continued)**

	<b>Author</b>	<b>Year</b>	<b>Journal</b>	<b>Ranking</b>	<b>Findings</b>
8	Lane and Koka	2006	Academy of Management Review	A*	A detailed analysis of 289 papers on absorptive capacity (14 major peer-reviewed management journals) found that the significant positive impact of absorptive capacity and its effect on innovation (i.e., patents or new products) has been highlighted in many studies. The study clearly indicated a lack of research between current absorptive capacity and radical innovation.
9	Abecassis-Moedas and Mahmoud-Jouini	2008	Journal of Product Innovation Management	A*	The source-recipient knowledge complementarity, particularly the role of design knowledge with prior knowledge (marketing or technological) has a positive moderating effect on the absorption process (knowledge transformation and exploration) and NPD performance.
10	Fosfuri and Tribo	2008	The International Journal of Management Science	A	Potential absorptive capacity is a crucial source of competitive advantage in innovation (e.g., in gaining large shares of sales from new or substantially improved products). The external linkages in the process of experiential learning increase heterogeneity in the level of potential absorptive capacity, and hence produce a stronger ability to understand and assimilate internal information flows.
11	Chen, Lin and Chang	2009	Industrial Marketing Management	A	Absorptive capacity positively influences a firm's innovation performances and competitive advantage (e.g., in developing and accelerating the launch of new product innovations and in new technology to improve operation processes).
12	Kostopoulos, Papalexandris, Papachroni and, Ioannou	2010	Journal of Business Research	A	Absorptive capacity is a mechanism of external knowledge inflows and a means of achieving superior innovation and financial performance.
13	Ritala and Hurmelinna-Laukkanen	2013	Journal of Product Innovation Management	A*	Potential absorptive capacity (knowledge acquisition and assimilation) has a significant positive relationship with the creation of radical innovations with high levels of appropriability. To develop radical innovation with rivals, the emphasis should be on protecting existing core knowledge, particularly for the emergence of novel innovations and new market opportunities.

The review of the key studies on absorptive capacity has suggested that it has gained recognition predominantly in organisational and management studies. Despite the considerable number of studies, previous research that has specifically dealt with radical or really new innovation appears to be limited. ACAP, as a dynamic capability, involves “difficult-to-replicate” (knowledge) capabilities and process improvement techniques that constitute a firm’s capability to adapt its operating routines (organisational structure, processes, procedures and decision-making rules) to changing market and technological opportunities (Teece, 2007; Zahra et al., 2006). The focus of ACAP on creating, enhancing and reconfiguring organisational knowledge (intangible assets) reflects an exploratory learning process, which facilitates the development of market-driving innovation. Nevertheless, Lane et al. (2006, p.850) stated that “consistent with the organizational learning theme’s omission of exploratory learning, there has been little attempt at understanding the relationship between current absorptive capacity and radical innovation”, in particular at the front end of the development process.

### **2.6.2.3 Absorptive Capacity and the Front End of Market-Driving Innovation**

The front end of market-driving innovation can be best supported by absorptive capacity. The front end activities of market-driving innovation include novel combinations of existing or new ideas/technologies during the idea generation stage and the evaluation/selection of the “right” new product concept for development and commercialisation (Koen et al., 2002; Kogut & Zander, 1992; Van den Bosch et al., 1999). Broring et al. (2006) argued that the prevailing trigger of the awareness stage for idea generation is the ability to recognise an opportunity and is related to the concept of absorptive capacity. In a similar vein, Verganti (2008) supported that absorptive capacity is one of the most important concepts for design discourse of “design-driven innovation”, that is, radical innovation, in regard to the ability to develop unique vision and recognise possible radical changes in product meanings.

Drawing on cognitive and behavioural sciences, the level of absorptive capacity is linked to prior related knowledge and skills (Harvey et al., 2010). Absorptive capacity is path dependent by means past activities and accumulated experiences (i.e. with the targeted markets and/or technologies), which influence the ability to acquire and absorb external

knowledge and the relevant information required to seize an opportunity for idea generation. The path dependency evolves over time as the cognitive processes are cumulative and idiosyncratic (Broring et al., 2006; Cohen & Levinthal, 1990; Zahra & George, 2002). Thus, absorptive capacity helps to further increase the broad range of loosely related knowledge (breadth) required during the front end of market-driving innovation. The breadth or diversity of knowledge and divergent thinking may give rise to creativity, allowing linkages between what is already known and novel associations (Cohen & Levinthal, 1990).

The level of creativity is a vital factor in the creation of breakthrough ideas (Bertels et al., 2011; Da Silva & Davis, 2011). The nature of market learning at the front end of breakthrough innovation is inherently explorative, which explains the behavioural phenomenon of “insight” (Bertels et al., 2011; Cohen & Levinthal, 1990; March, 1991). Tacit knowledge or an insight is a central stock at the front end of innovation where activities such opportunity recognition, idea generation and concept definition are conceived (e.g. Khurana & Rosenthal, 1998; Koen et al., 2002; Koen et al., 2001; Montoya-Weiss & O'Driscoll, 2000; Reid & de Brentani, 2004). This type of knowledge is essential for dealing with uncertainty and the extraordinary requirements for creativity (Bertels et al., 2011). In this respect, creative capacity and absorptive capacity are relatively similar in the psychology literature (Cohen & Levinthal, 1990).

Previous research has also supported the significance of intuition at the idea and concept screening stages of the NPD process (e.g. Hart, Hultink, Tzokas & Commandeur, 2003). Stevens, Burley, and Divine (1998, 1999), for instance, explained that individuals with high intuition and thinking can evaluate and make decisions about project selections better than individuals with low intuition. This is particularly the case for highly innovative, market-driving ideas when much of the information is not readily available to support rational decision making (evaluation) (O'Connor, 2008). The traditional evaluation tools and techniques such as financial measures have been shown as unsuitable for market-driving innovation. Other techniques such as risk options theory and future cash flow have only recently emerged and there is no consensus in terms of which technique is best to evaluate market-driving innovation (Koen et al., 2002).

In fact, intuition is a non-logical mental process that is known to support creativity, innovation and foresight (Sadler-Smith, Hodgkinson & Sinclair, 2008). It is rapid, non-

conscious and essential in high speed decision making (Cunha, 2007; Dane & Pratt, 2007). Intuitive decision making involves the ability to quickly perceive, reconstruct and classify unstructured or complex problems without imposing rational or logical thinking (Allinson, Chell & Hayes, 2000; Alves, Marques, Saur & Marques, 2007; Ben & Cruz, 2009; Dane & Pratt, 2007; Sadler-Smith & Shefy, 2004). A firm's exposure to external knowledge in its environment also affects the quality of its decision making (Kostopoulos et al., 2011; Zahra & George, 2002). Often NPD team members make intuitive decisions by seeing the solutions with no conscious ability to describe their vision for breakthrough innovation but with a compulsion to pursue it (Goffin & Koners, 2011; Mascitelli, 2000). Polanyi (1966) stated that "we can have a tacit foreknowledge of yet undiscovered things" (p.23).

Further, the development and deployment of absorptive capacity as dynamic capability require enough experience to store tacit organisational knowledge in new patterns of activity in known routines and processes. Such capabilities allow firms to take on the newly acquired information and reconfigure capabilities to transform them into knowledge useful for breakthrough innovation, particularly at the front end of the development process. Lane et al. (2006) stated that the magnitude of innovation could have implications for future absorptive capacity; a revolutionary innovation is likely to create absorptive capacity in valuable new areas" (p.850).

### 2.6.3 Section Conclusion

This section of the literature review has identified a firm's absorptive capacity (ACAP) and its subsets of potential absorptive capacity (PACAP) and realised absorptive capacity (RACAP), and market visioning competence (MVC) and its resultant market vision (MV) as the emerging critical success factors at the front end of market-driving innovation. While much progress has been made in increasing the understanding of the general management processes of developing market-driving innovation, research on the front end of market-driving innovation remains a gap in the literature, especially during the stages where breakthrough ideas are generated and evaluated for potential development and commercialisation.

This research seeks to incorporate ACAP (PACAP and RACAP), MVC and MV factors and their associated dimensions based on the RBV of the firm and dynamic capabilities theory. The process of visioning (MVC/MV) is important for managing the "upstream creative challenge" as the ability of individuals and NPD teams to link new ideas or technologies to future market opportunities (MVC) can lead to the creation of potentially successful future market applications/product-market options (MV), thereby influencing the front end success of market-driving innovation (Koen et al., 2002; Kumar et al., 2000; Reid & de Brentani, 2010). At the organisational level, ACAP, an organisational dynamic learning capability, involves routines and process by which firms *acquire, assimilate, transform* and *exploit* knowledge" (Zahra & George, 2002, p.186), especially for NPD and innovation. It therefore has an implication for idea generation and evaluation at the front end of market-driving innovation (Cantner & Pyka, 1998; Lane et al., 2006). Lindgren and O'Connor (2011, p.789) stated that:

The sources of ideas, the skills of the actors early in the project, the processes utilized in the early stages and the screening criteria for radical innovation projects are markedly different than those utilised for incremental innovations. And yet, studies are equivocal.

The next section further assesses the emerging front end success factors – ACAP, MVC and its resultant MV – and hypothesises potential relationships. As these factors are expected to influence the front end and final success of market-driving innovation, a conceptual model that captures the proposed hypotheses is also developed for this research.

## 2.7 Conceptual Model and Hypotheses Development

The previous section identified market visioning competence (MVC) and its resultant market vision (MV) as the critical front end success factors for market-driving innovation, thus influencing the front end of the NPD effort (Reid & de Brentani, 2010). Furthermore, if both MVC and MV are important, it is similarly important to understand what might be antecedents to these factors. Absorptive capacity (ACAP) has emerged as an organisational dynamic learning capability and is related to the front end and final success of market-driving innovation.

This leads to the main research question of this research as:

*To what extent does a firm's absorptive capacity, market visioning competence and its resultant market vision influence the firm's success at developing market-driving innovations?*

Firstly, this section examines and hypothesises the key relationships between a firm's ACAP and MVC and between MVC and MV at the front end of market-driving innovation. Secondly, the performance consequences of MV, that is, the before-launch stage performance and the post-launch stage performance, are examined, including the relationships among these performance outcomes and their relationships to financial performance. Thirdly, some characteristics that might influence the impact of MV on the before-launch stage and the post-launch stage performance outcomes are considered. These include the external environment, the degree of rigidity inherent in the NPD process and the firm size (number of employees). The section concludes with the development and presentation of the conceptual model and the summary of the research hypotheses of this research.

### **2.7.1 Absorptive Capacity as an Antecedent to Market Visioning Competence**

At the broader organisational level, absorptive capacity (ACAP) and its subsets of potential and realised absorptive capacities (PACAP and RACAP, respectively) have a high likelihood of being significant antecedents to market visioning competence (MVC) at the NPD program level of the front end of market-driving innovation. The definition of MVC in this study, previously extended to capture both radical and really new innovations, is “the ability of individuals or NPD teams in organisations to link *new ideas* or *advanced technologies* to future market opportunities”. By definition, MVC captures the dynamic learning capabilities of individuals and of the organisation in which they participate (Reid & de Brentani, 2010). In view of that, ACAP refers to general organisational routines and learning processes that allow firms to refine, extend and leverage existing competencies, technologies and knowledge for new product development (Kostopoulos et al., 2011; Zahra & George, 2002).

The subsets of ACAP (PACAP and RACAP) are expected to play different roles in terms of influencing MVC at the front end of market-driving innovation. On one hand, PACAP is the main source of market-driving ideas (Chen et al., 2009). PACAP involves *acquisition* and *assimilation* of knowledge – the capabilities of a firm to obtain and process externally acquired knowledge. Acquiring outside sources of knowledge and information about markets, technologies, competitors and resources, and translating that knowledge into a product design and strategy is critical for new product success, especially at the front end of market-driving innovation (de Brentani & Reid, 2012). On the other hand, RACAP is the main source of performance improvements (Zahra & George, 2002). RACAP involves *transformation* and *exploitation* of knowledge – the capabilities of a firm to develop and refine existing routines that facilitate the combination of existing knowledge with newly acquired/assimilated knowledge generated through PACAP (transformed knowledge) and to exploit this transformed knowledge to develop innovative products for commercial purpose (Cantner & Pyka, 1998; Zahra & George, 2002).

Therefore, ACAP and its subsets could potentially help to facilitate the individual and organisational dimensions of MVC. These are described in detail below.

### *The Influence of ACAP on the Organisational Dimensions of MVC*

- **Proactive Market Orientation (MO)**

As previously described, proactive market orientation focuses on providing solutions to the unarticulated and/or latent needs of customers. New market information gained from the external environment through PACAP may translate into the discovery of new needs of customers, rather than following current demands or existing needs of customers. Linking existing knowledge with newly acquired knowledge, as occurs through RACAP, may create new insights that enable individuals or NPD teams to incorporate solutions into new products.

- **Market Learning Tools (ML)**

PACAP may facilitate the use of market learning tools in terms of analysing and planning for future product and technology scenarios. Identifying, analysing and interpreting externally acquired knowledge through PACAP may translate into technology opportunity and visioning for several potential markets, seeing both short-term and long-term opportunities for a given idea or technology. In addition, RACAP involves a firm's capability to work more effectively by regularly reconsidering ideas or new technologies and adapting them according to new knowledge. This could also support the decision-making process in terms of choosing which market to pursue.

### *The Influence of ACAP on the Individual Dimensions of MVC*

- **Networking (NW)**

Boundary spanners are at the centre of "the knowledge network" made up of a variety of people with different backgrounds. As previously described, they are people who deal with organisationally relevant tasks at the border of a firm and stimulate the flow of new innovation-related information and ideas from the external environment to the firm (information search).

The boundary-spanning role is dependent on pattern recognition at the individual level in terms of directing information search, and in identifying and understanding patterns and



new ideas (using intuition) in their environment (Kuhn, 1962; Roos, 1996). An individual's perception or recognition of an idea and/or information pattern is dependent on the sources of the environment, the interaction between internal and external people and the individuals themselves. de Brentani and Reid (2012, p.75) stated that:

The greater the discontinuity of an innovation, the higher the level of complexity, the greater the difficulty to observe, try out, and have a compatible context for understanding its relevance or benefits and, thus, to recognize it as a pattern in the environment.

Individuals have limited capacities and find it difficult to perceive, understand and make decisions with respect to new information in the case of breakthrough innovation. They often need to acquire more information by continuing to interact with external network contacts, which results in "multiple waves of opportunity recognition" during early pattern recognition (O'Connor & Rice, 2001, p.109). Each individual also varies in their ability to discern new patterns in the environment. It is therefore important for firms to manage the individual pattern recognition and resultant decision initiatives associated with breakthrough innovation (de Brentani & Reid, 2012).

With respect to PACAP as an organisational capability is likely to influence the pattern recognition ability of individuals in that the more information patterns and concepts a person has acquired and assimilated as prior related knowledge, the more readily can that person recall and use the information in new and complex settings (Cohen & Levinthal, 1990). The development of knowledge processing and routines through PACAP could potentially benefit boundary spanners in terms of broadening their thinking and allowing them to draw on new and diverse knowledge about product application situations. Thus, PACAP is likely to influence the ability of boundary spanners to recognise new opportunities quickly and to effectively analyse and interpret the information they have obtained before moving the new information across the boundary interface and connecting the firm with external environment aspects (de Brentani & Reid, 2012).

Furthermore, PACAP emphasises the importance of searching for relevant information both within and beyond the industry and communicating ideas and concepts quickly across departments to exchange information on new developments and to solve problems. This is likely to generate broad networks of people from different backgrounds (e.g. different

industries, different functions) both within and outside the firm, thus supporting the role of boundary spanners. In addition, the ability to structure and apply collected new knowledge to practical work as well as to make it available for further purposes, through RACAP, may stimulate boundary spanners to collect additional information and ideas from external sources in order to make the information more useable and meaningful.

- **Idea driving (ID)**

The routines and processes developed to analyse, interpret and understand externally acquired knowledge through PACAP may enable “champions” to actively and enthusiastically drive new ideas, draw attention to opportunities internally and overcome resistance to uncertainty during the early phase of the NPD process. Further, RACAP reflects management support of the development of new products including product prototypes. This enables champions to secure the required support from senior management/key decision makers early and to share information quickly.

In summary, ACAP and its subsets PACAP and RACAP are related to MVC at the front end of the NPD effort for market-driving innovation. The relationships between these constructs occur during idea generation/exploration and evaluation stages of the front end phase. These stages of the front end are also referred to as the boundary and gating decision-making interfaces (prior to project interface) (Reid & de Brentani, 2004) and can also be referred to as pre-phase zero (preliminary opportunity identification) (Khurana & Rosenthal, 1998). The idea generation stage begins with information flowing from the external environment through PACAP to boundary spanners or other individuals (as reflected in the networking dimension of MVC), who investigate the meaning of the information by translating “that something is” to “what something is”. After the idea generation stage, the evaluation process begins through RACAP. This is where the information flows from gatekeepers (as in the idea-driving dimension of MVC), who evaluate the value of externally acquired information by translating “what something is” to “what something means” and then share it with other organisational members (de Brentani & Reid, 2012, p.71). de Brentani and Reid (2012, p.72) stated that “the way in which information flows are managed, or ‘transformed’ into products, during the FFE can profoundly impact their effectiveness and ultimately the success of the firm in developing and marketing new-to-the-world products”.

ACAP and its subsets PACAP and RACAP are expected to facilitate the creation and successful implementation of market-driving ideas into products (Da Silva & Davis, 2011). The higher the level of absorptive capacity, particularly PACAP, the higher the level of business performance in terms of creating new product ideas (Tsai, 2001). Further RACAP could potentially shape the entrepreneurial mindset/action of the individuals or the NPD teams, facilitating new insights and opportunity recognition in MVC. PACAP and RACAP coexist at all times. They are separate entities but have complementary roles that enable firms to capitalise on changing environmental conditions and strategic changes by leveraging organisational resources and capabilities for NPD and innovation (Zahra & George, 2002). New knowledge or a market-driving idea must first be acquired and assimilated before it can be transformed and exploited into an innovative product that recognises the needs of a future market. In the same vein, firms might be efficient in acquiring and assimilating knowledge but lack the capabilities to transform and exploit that knowledge into a future product-market. Hence, firms that focus on developing both subsets of ACAP have a high likelihood of linking new ideas or advanced technologies to future market opportunities (MVC). The significance of ACAP overall and its subsets PACAP and RACAP can be argued to be during the idea generation/exploration and evaluation stages (the front end) of market-driving innovation and its result of MVC.

The discussion in this section leads to the following hypotheses.

*H1a: ACAP has a significant and positive impact on MVC.*

*H1b: PACAP has a significant and positive impact on MVC.*

*H1c: RACAP has a significant and positive impact on MVC.*

## **2.7.2 Market Visioning Competence and Market Vision**

### ***Market Visioning Competence (MVC) - the relationship factor of Market Vision (MV)***

Based on the RBV of the firm and dynamic capabilities, MVC has the ability to influence MV at the front end of the NPD effort for market-driving innovation. The relationship between the two factors occurs during the idea evaluation/selection stage of the front end phase. This stage of the front end of innovation is also referred to as the gating interface or phase zero to phase one in terms of moving a product concept forward to feasibility/project planning (Khurana & Rosenthal, 1998; Reid & de Brentani, 2004). As previously stated, the evaluation process begins after the idea generation phase where externally acquired information is translated in order to move from understanding “what something is” to “what something means” (de Brentani & Reid, 2012, p.71), as reflected in MVC. The meaning and value of the newly created knowledge or the emergent MV is assessed for business and technical feasibility. The outcome of idea evaluation/selection is a decision to approve or reject the MV. If approved, MV moves to the project interface where it becomes a project vision (Broring et al., 2006; de Brentani & Reid, 2012).

Following Reid and de Brentani (2010), MVC comprises “a set of capabilities that enable the linking of advanced technologies to a future market opportunity” (p.500). This results in MV, that is, “a clear and specific mental model or image that organizational members have of a desired and important product-market for a new advanced technology” (p.500). Specifically, the combined impact of the MVC dimensions (MO, ML, ID and NW) results in effective MV which comprises both intrinsic and extrinsic dimensions. The key elements of effective MV, as previously described, are form (product design, product concept and product in use), scope (target market and target magnitude), magnetism (how the inherent value of the vision infuses into the firm), clarity (well-articulated, easy-to-understand target) and MV specificity (specific and tangible to direct organisational members). The literature has suggested that MVC dimensions allow organisational members to learn quickly from the environment and use ideas stemming from early technology development to create a shared mental model of future product-market or effective MV of a radically new product.

This study broadens the perspective of MVC–MV to the NPD program level and proposes the relationship in the context of market-driving innovation. Market-driving innovation, as

defined in this research, captures both radical and really new innovations. The perspective of the MVC and MV factors is not limited to the exploration of new technologies but is extended to include new product ideas that are able to transform existing markets or create new ones. MVC, in this study, is “the ability of individuals or NPD teams in organisations to link *new ideas* or *advanced technologies* to future market opportunities”. It is therefore expected to result in knowledge, insight and foresight of a radically or really new product (MV), that is, “a clear and specific early-stage mental model or image of a product-market that enables NPD teams to grasp what it is they are developing and for whom”. Because exploratory learning is an underlying process of MVC, this factor has a high likelihood of influencing the environment by initiating disruptive variance through effective selection of best markets and moving quickly to shared mental models of future markets, and hence resulting in effective MV of a radically new or really new product.

The discussion in this section leads to the following hypothesis:

*H2: MVC has a significant and positive impact on MV.*

## **2.7.3 Performance Consequences of Market Vision**

### **2.7.3.1 Before-Launch Stage Performance**

Ensuring the “right” selection of MV at the front end of the NPD is critical as it influences the specific focus of the NPD process and ultimately its likelihood of success (Cooper, 1993, 1996; Murphy & Kumar, 1997). MV emerging from the front end of innovation determines the activities in the development phase or NPD execution. Accordingly, MV is the first major strategic decision in product development and can strongly influence the overall process of NPD, innovation performance and a firm’s competitive advantage (Calantone, Chan & Cui, 2006; Langerak, Hultink & Robben, 2004). In particular, MV is expected to have a positive influence on the front end or “early performance” (Reid & de Brentani, 2010), also referred to as before-launch stage performance.

Based on the literature review on the front end outcomes of market-driving innovation, before-launch stage performance (BLSP) in this study captures two dimensions – product-

related and customer-related – as the outcome measures of MV, namely, breakthrough integrity (BI) and early success with customers (ESC), respectively (Reid & de Brentani, 2010, p.507). The review of the literature on NPD success measures has suggested that the traditional measures are based on standard post-launch metrics, which appear to be irrelevant at the front end of the NPD process (O'Connor, 1998; O'Connor et al., 2008). In taking both breakthrough integrity and early success with customers as measures, BLSP in this study refers to the extent to which a clear and highly innovative concept of a potential new product is maintained after it enters the development and commercialisation phases of being satisfied and accepted by early customers (Clark & Fujimoto, 1991; Reid & de Brentani, 2010; Seidel, 2007).

The key challenge of developing market-driving innovation is the ability to maintain the highly innovative product concept from the front end through to launch (“breakthrough integrity”); this is likely to be achievable through effective MV (Reid & de Brentani, 2010). The inherent uncertainty and unforeseen challenges at the front end of market-driving innovation may influence NPD team members to shift or adapt the original product concept. This is often the situation in market-driven firms that listen closely to their customers. Christensen (1997) stated that “we cannot expect our customers to lead us toward innovations that they do not now need” (1997, p.258). The highly innovative concept of a potential new product often becomes “dumbed down” or led astray by the customers (Deszca et al., 1999; Wind & Mahajan, 1997). Concept shifting may also cause a lack in vision clarity and lead to a delay in coordinating decisions and confusion among team members (Lynn & Akgün, 2001; Seidel, 2007). In this respect, MV is a clear and specific image of a radical or really new innovation (vision/goal) that enables NPD teams to grasp what it is they are developing and for whom even in the early stages of the development process. Thus, the emergent MV has a high likelihood of being validated and translated into a highly innovative product concept, moving through to development and into commercialisation (Kim & Wilemon, 2002b; Koen et al., 2001; O'Connor et al., 2008). Seidel (2007) supported that “the maintenance of an original concept as a deferred goal allows the team to maintain momentum and commitment to broad objectives, even in the face of underlying concept shifting” (p.531). The significance of MV can therefore be argued to influence breakthrough integrity, thereby avoiding the customer’s short-term and current experience bias.

This study also captures “early success with customers” (ESC) as an outcome measure of MV. At the NPD project level, Reid and de Brentani (2010p. 507) described effective MV as fulfilling ESC, that is, “satisfaction and acceptance of a new product idea” by early customers, in the case of radical innovation. At the NPD program level analysis, ESC in this study refers to the degree to which “early customers are satisfied and readily accept breakthrough innovations even prior to their formal launch”. Accordingly, an effective MV focuses on reshaping and delivering customer value and benefits. The clarity and specificity dimensions of an effective MV allow a firm to move towards the shared vision of the future quickly. Form facilitates the product concept that offers to meet the ahead-of-the-trend needs and wants of potential customers. Magnetism attracts NPD members and others in the firm towards the same goal of impacting on the most profitable and the most important, largest target market (scope). Thus, the MV of a radical or really new innovation that is magnetic, clear, specific and with the right form and scope can maximise the effect on ESC.

The discussion in this section leads to the following hypothesis:

*H3: MV has a significant and positive impact on before-launch stage performance.*

### **2.7.3.2 Post-Launch Stage Performance**

In recent studies in product development, competitive advantage has been used as the most strategically useful construct for performance-based success, particularly for market-driving innovation or new-to-the-world products (e.g. Bertels et al., 2011). A review of the literature has suggested that competitive advantage can be viewed from both strategic (non-financial) and financial dimensions, which is consistent with the RBV and dynamic capabilities theory. Noting that superior financial returns for market-driving innovation can only be expected in the long term (Chandy & Tellis, 2000), the short-term strategic dimensions are considered to be easily determined post-launch performance measures for market-driving innovation (Kleinschmidt et al., 2007).

This study captures two dimensions of post-launch stage performance (PLSP) as the strategic outcome measures (process- and firm-related) of MV, namely, speed-to-market (STM) and windows of opportunity (WO). In taking both STM and WO as outcome

measures of MV, PLSP in this study refers to “the speed at which breakthrough innovations are moved to market and ultimately open new markets, product or technological arenas” (de Brentani et al., 2010; Lynn et al., 1999b). de Brentani et al. (2010) supported the use of STM and WO as the outcome measures in their finding of a significant positive impact of a global presence strategy entailing vision on NPD program performance in terms of time-to-market and windows of opportunity.

STM is a strategic measure related to efficiency and ultimately competitive advantage (Millson et al., 1992). In general, STM measure relates to the time elapsed between idea generation and formal product launch (Kessler & Chakrabarti, 1999; McNally et al., 2011). STM has been shown to positively result in an edge over competitors, a first mover advantage. In a similar vein, several studies have suggested that STM has an important role in successful NPD, particularly in high-tech industries (de Brentani & Reid, 2012). However, some scholars and practitioners have disregarded the notion of a positive relationship between accelerated product development (speed) and new product success because of the likelihood of increased mistakes and increased development and commercialisation costs (Crawford, 1992). Thus, it is critical to understand what could be an antecedent to STM.

Effective MV has a high likelihood of positively influencing STM. A number of empirical studies have highlighted the importance of product vision in accelerating the development process (e.g. Lynn & Akgün, 2001; Lynn, Akgün & Keskin, 2003; Lynn et al., 1999b). Effective MV, comprising its dimensions of clarity, specificity and magnetism, can attract and clearly signal to NPD members to work efficiently and move quickly towards development goals. An empirical study by Lynn et al. (1999b) found that vision creates a psychologically safe environment for NPD team members to understand the development goals. Song, Montoya-Weiss, and Schmidt (1997) empirically found that sharing common goals, vision and strategy can make teamwork more collaborative and efficient. Lynn and Akgün (2001), in a case-based study comparing and contrasting successful and unsuccessful NPD projects, suggested that unsuccessful new products are those ones without clear visions. An unclear product-market vision may cause uncertainty and conflict about what is to be developed, resulting in time-consuming readjustments and debates, and delaying the new product development (Dyer, Gupta & Wilemon, 1999a, 1999b; Kessler & Chakrabarti, 1996). Therefore, effective MV is needed in the early, pre-project stages of market-driving



innovation so that the new product can be developed and launched on or ahead of the original schedule developed at the initial project go-ahead.

Further, effective MV has a high likelihood of influencing “windows of opportunity” (WO) performance. WO is another strategic dimension of PLSP and in this study refers to the extent to which “market-driving innovations opened a window of opportunity on a new category of products or on a new market for the firm” (Cooper & Kleinschmidt, 1987a, 2000; Knight & Cavusgil, 2004; Salomo et al., 2010). A clearly defined vision provides important mindset for firms to explore unique market and product opportunities. MV, as a result of MVC, creates future business potential, an opportunity window for firms to enter new markets (WO) or new product development activities. Consequently, firms are more likely to take advantage of the pioneering opportunities that enable them to leap forward and achieve a competitive advantage (Cooper & Kleinschmidt, 1986; Zou & Cavusgil, 2002).

The discussion in this section leads to the following hypothesis:

*H4: MV has a significant and positive impact on post-launch stage performance.*

## **2.7.4 Market-Driving Innovation Performance**

Based on the review of commonly used NPD performance measures, the existing measures of new product success are deemed inadequate for capturing the complete performance of market-driving innovation. Researchers have often used performance measures as independent dimensions such as product-related (product performance), customer acceptance (customer based), process-related (speed-to-market), firm-related (new opportunities for new products) and financial related aspects (profitability, return on asset-investment) (Griffin & Page, 1993; Langerak et al., 2004). Further, Kahn (2001) categorised the measures of general product development performance by pre-launch and post-launch activities.

This study examines relevant performance dimensions in NPD studies for the purpose of setting up a more complete performance measure of market-driving innovation. Several dimensions based on the key non-financial and financial outcomes are primarily drawn from

existing studies of market-driving innovation (e.g. Clark & Fujimoto, 1991; Cooper & Kleinschmidt, 2000; Griffin & Page, 1996; Knight & Cavusgil, 2004; Reid, 2005). This results in a set of product innovation performance dimensions, categorised by a different time horizons, to measure the front end success and the final success of market-driving innovation (Cordero, 1990; Utterback & Abernathy, 1975).

Market-driving innovation performance (MDIP), in this study, refers to the extent to which “a clear and highly innovative concept of a potential new product is maintained after it enters the development phase of being satisfied and accepted by early customers, and quickly moves into commercialisation, opening a new market or product/technological arena and ultimately generating financial returns”. By this definition, MDIP captures the success of market-driving innovation in terms of:

- **Before-launch stage performance:** breakthrough integrity and early success with customers
- **Post-launch stage performance:** speed-to-market and windows of opportunity
- **Financial performance**

The following section discusses the relationships between the before-launch stage performance and the post-launch stage performance and their influences on financial performance outcomes.

In line with RBV and with the empirical results in NPD research, there is an implied relationship between before-launch stage performance (BLSP) and post-launch stage performance (PLSP). A highly innovative product concept accepted by customers is likely to speed up the entire process and be translated into a market-driving innovation, thereby opening up a new market or a new product or technological arena (Kim & Wilemon, 2002a; O'Connor et al., 2008). BLSP and PLSP are seen as antecedents to the overall financial performance. Financial performance (FP) is the extent to which “breakthrough innovations meet their sales (value/volume) and profit objectives relative to the resources invested in them” (Kleinschmidt et al., 2007). At BLSP, early acceptance of a breakthrough innovation by customers can stimulate sales and product adoption by other customers. Maintaining breakthrough integrity ensures the delivery of a superior product to the marketplace, and thus is likely to influence the firm’s long-term products advantage (Henard & Szymanski, 2001) and ultimately its financial performance (Calantone et al., 2006; Song & Parry, 1996).

At PLSP, both speed-to-market and windows of opportunity are likely to be antecedents to financial performance. Speed-to-market is important for new product success, particularly for the development of market-driving innovations in high-tech industries (de Brentani & Reid, 2012). Fast paced development and commercialisation may result in firms achieving first-mover advantage (Kerin, Varadarajan & Peterson, 1992), which in turn may have a significant and positive impact on the firm's overall financial performance (Calantone et al., 2006; de Brentani et al., 2010; Langerak & Hultink, 2005). Additionally, firms involved in new product development activities, specifically new market entries, can generate financial returns by creating future exigencies. Empirical studies on global NPD program performance support this contention that speed-to-market and windows of opportunity have strong and positive effects on financial performance (e.g. de Brentani et al., 2010; Kleinschmidt et al., 2007).

The discussion in this section leads to the following hypotheses:

*H5: Before-launch stage-performance has a significant and positive impact on post-launch stage performance.*

*H6: Before-launch stage-performance has a significant and positive impact on financial performance.*

*H7: Post-launch stage-performance has a significant and positive impact on financial performance.*

## **2.7.5 Proposed Moderation Effects**

Both the external and internal structural factors of the firm are considered to have moderating effects on the emergent MV and BLSP/PLSP outcomes. Li and Atuahene-Gima (2001) explained the need to investigate these moderating factors in examining product innovation strategy and the performance of new technology investments. A recent study highlighted the importance of factoring in a firm's competitive environment and its internal environment as moderators on MVC, MV and performance paths (Reid & de Brentani, 2012). Accordingly, this study has determined that the relevant moderating factors in terms of their effects on the relationships between MV and BLSP/PLSP outcomes, which are: a firm's external environment, the degree of rigidity inherent in the NPD process (NPDR) and firm size.

The following sections discuss each of these moderating factors and their influences on MV and BLSP/PLSP outcomes in more detail.

### **2.7.5.1 External Environment**

Many studies have reported the moderating effect of environmental variables on product innovation performance (new product success and failure) (e.g. Li & Atuahene-Gima, 2001; Yap & Souder, 1994). Environmental factors have been considered as moderators on the effectiveness of different strategic choices or orientations in new product development studies (e.g. Jaworski & Kohli, 1993; Lukas & Ferrell, 2000; Zhang & Duan, 2010). The three commonly used external environmental factors in the NPD studies are: (1) competitive intensity, (2) technological turbulence and (3) market turbulence. Competitive intensity (CI), in this study, refers to the environment where competition in an industry is very high, indicated by activities such as promotion wars and price matches. Technological turbulence (TT) refers to the environment where there is a rapid change of technology in an industry that may provide opportunities for firms to develop new product ideas through technological breakthroughs. Market turbulence (MT) refers to the environment where customers' product preferences or demands change frequently and new customers have different product-related needs from existing customers (Jaworski & Kohli, 1993).

The external environment (EE) is particularly related to the very early decisions made by NPD teams at the front end of developing breakthrough innovation. As previously discussed, EE is the main source of new ideas for breakthrough innovation. New ideas are often initiated from outside the firm beyond its existing industry through both individuals and organisational level processes (Reid & de Brentani, 2004). Firms need to engage in the pursuit of information regarding new technology and market adoption patterns to generate new ideas and support decision making (Dröge, Calantone & Harmancioglu, 2008). A firm's competence to obtain, share and use market information (market intelligence) is considered a strategic asset that enables the firm to possibly alter the competitive dynamics (Li & Calantone, 1998).

In an environment of technological turbulence (TT) and market turbulence (MT), acquiring and evaluating very new or radical market information, analysing technology opportunities and determining product-technical specifications and the demand for certain product characteristics can be difficult (Zhang & Doll, 2001). Comprehensive information is often not readily available and the decision making process for breakthrough innovation is likely to be much slower and more difficult than for incremental innovation (O'Connor, 2008). The changing needs of customers and their inability to visualise and articulate needs may also increase the difficulty of developing radically new or really new products that would create early customer acceptance/satisfaction (ESC) (Mullins & Sutherland, 1998). Such products introduced into markets with a high degree of market uncertainty may lead to market failure because the opening of windows of opportunity (WO) often falls short (Zhang & Doll, 2001). Thus, high technological turbulence and market turbulence are likely to increase the overall risk and uncertainties of investing in new product development, particularly for breakthrough innovation (March, 1991).

Further, high levels of competitive activity (CI) may create uncertainties and difficulty for firms in terms of targeting a competitive situation and becoming a leading innovator (Zhang & Doll, 2001). CI implies a large number of players in the industry or a low industry concentration (Robinson, 1988). Many industry players in the marketplace intensify market uncertainties and the likelihood of a firm's losing its competitive position (Jaworski & Kohli, 1993; Kohli & Jaworski, 1990; Slater & Narver, 1994). In fact, firms often focus on protecting the "tyranny of the served market" when facing competitive threat and pressures (Hamel & Prahalad, 1994a). Environmental threats may discourage a firm from taking

further risks and exploring new competencies, and instead facilitate dominant organisational routines and the exploitation of existing resources and competencies. In so doing, they are paying close attention to the needs of existing customers in established markets. This organisational inertia prevents firms from experimenting with technological breakthroughs or exploiting newly acquired knowledge into breakthrough innovation (Christensen, 1997; Gilbert, 2005).

Accordingly, the external environmental factors of CI, TT and MT form turbulent environments that may hinder the ability to translate MV into BLSP and PLSP outcomes. Some authors may have argued that environmental dynamism enhances innovativeness and radical innovation (e.g. Koberg, Detienne & Heppard, 2003; Zhang & Duan, 2010). The dynamic conditions of the environment can create market uncertainties that force firms to engage in radical innovative activities to survive (Brown & Eisenhardt, 1997). But turbulent environments are, indeed, beyond a firm's manipulative and direct managerial control, in the short term, at least (Yap & Souder, 1994). Such conditions can amplify the level of ambiguity and uncertainty associated with the development of breakthrough innovation, particularly at the front end of the NPD process. These conditions may create difficulties in speeding up the NPD process (STM), and may render obsolete a formal assessment system for maintaining the breakthrough integrity (BI) of potential new products that are being developed (Calantone, Garcia & Droge, 2003; Calantone, Schmidt & di Benedetto, 1997; Iansiti, 1995; Wheelwright & Clark, 1992).

The discussion in this section leads to the following hypotheses:

*H8a: The relationship between MV and before-launch stage performance is negatively influenced by CI, TT and MT.*

*H8b: The relationship between MV and post-launch stage performance is negatively influenced by CI, TT and MT.*

### **2.7.5.2 NPD Process Rigidity**

Several process models have been developed in attempts to structure the front end of innovation (FEI) in spite of its inherent ambiguity and uncertainty (e.g. Cooper, 1988; Khurana & Rosenthal, 1998; Murphy & Kumar, 1997). The key deliverable of the front end stage is a clear product concept/definition that, once approved, translates into NPD implementation (Verworn & Herstatt, 1999). A review of the product innovation literature has suggested that Cooper's stage-gate process is one of the most recognised models used to structure the front end activities to reduce their fuzziness. The stage-gate process for FEI involves four formalised sub-phases from idea generation to concept evaluation, and highly structured gates which act as quality control or go/kill decision check points before moving into the next stage (Cooper, 2008). Thus, there was some evidence that a formal NPD process is positively linked to NPD outcome success (Bonner, Ruekert & Walker, 2002; Schmidt & Calantone, 2002).

The relevance of a formal NPD process to breakthrough development is, however, the subject of some debate in the literature on the front end of new product development. A sequential, highly formalised approach has often been criticised as being inflexible or too rigid and possibly harmful to creativity and breakthrough ideas (de Brentani, 2001). Although different versions of stage-gate exist and it acknowledges the need for iteration and within-stage feedback, the process primarily relies on market-driven NPD and predetermined sets of routines and evaluation criteria (gates) that may not facilitate highly innovative, breakthrough projects with their multitude of inherent risks and uncertainties (Garcia, Calantone & Levine, 2003; Lynn & Akgün, 1998; Lynn & Green, 1998; McDermott & O'Connor, 2002; Rice et al., 1998). The high market and/or technical uncertainty involved at each gate creates no confidence for top managers in making an informed go/no-go decision and resource commitments (Mullins & Sutherland, 1998). In fact, some evidence has been found that too inflexible a process can result in a negative performance effect (Kleinschmidt et al., 2007). And yet, there is no direct evidence that a modified stage-gate NPD process can lead firms to increase new product launch of breakthrough type products (Ettlie & Elsenbach, 2007).

Accordingly, this study conceptualises a highly formalised or inflexible stage-gate process and clearly defined go/no-go decision points (gates) as "NPD process rigidity" (NPDR).

This type of NPD process model offers little scope to do things differently and rather reinforces the *status quo* by solving customers' existing problems or stated preferences in current markets (Sethi & Iqbal, 2008). As such, the traditional short-term, cost-oriented evaluation at sequential gates or NPDR is likely to hinder breakthrough developments (Verworn & Herstatt, 2001). This negative influence can be argued to undermine the effectiveness of MV's impact on BLSP by reducing breakthrough integrity and early success customers and the effectiveness of MV's impact on PLSP outcomes by slowing down the product-to-launch and shortening windows of opportunity.

The discussion in this section leads to the following hypotheses:

*H9a: The degree of NPD process rigidity negatively influences the relationship between MV and before-launch stage performance.*

*H9b: The degree of NPD process rigidity negatively influences the relationship between MV and post-launch stage performance.*



### **2.7.5.3 Firm Size (number of employees)**

Firm size has been a subject of extensive and continuing research in terms of its effects on innovation (Audretsch & Acs, 1991; Cohen, 1995; Scherer, 1991; Schumpeter, 1942). The research outcomes, however, have been decidedly varied. On one hand, several researchers have argued that large firms are at a disadvantage because they often respond to changes more slowly, and are more bureaucratic and conservative in risk taking than small firms (e.g. Ettl, Bridges & O'Keefe, 1984; Gellman Research Associates, 1982; Globberman, 1975; Rothwell, 1978; Rothwell & Zegveld, 1982). Therefore, smaller firms are more likely to develop breakthrough innovations. On the other hand, other researchers have suggested that small firms are less innovative than large firms. This is because large firms have the ability to research and develop breakthrough innovations in economies of scale. Through economies of scale, the risks associated in developing breakthrough innovations can be spread broadly, while greater financial support can be gained (Cohen, 1995; Scherer, 1992).

Breakthrough innovation involves high complexity, high cost and considerable risk in business strategy (Treacy, 2004). This type of innovation requires an exploration in new technologies and new markets, a large investment in new processes (production and R&D), a long-term focus and long-time spans (Freeman, 1994). Thus, the costs of developing and bringing a breakthrough innovation to market can be extremely high (Lynn et al., 1996). In responding to all these requirements, large incumbent firms are often the ones who develop breakthrough innovations rather than small start-ups (Ahuja & Morris Lampert, 2001; Hill & Rothaermel, 2003). A large firm size implies that more functional areas and people are involved in an innovative project. This could be beneficial in reviewing and monitoring the progress of developing a breakthrough innovation given its high uncertainties and ambiguities in design, production and marketing approaches (Green, Gavin & Aiman-Smith, 1995). Further, Mowery, Oxley, and Silverman (1996) argued that larger firms have more accumulated knowledge, which can be assimilated into innovation through developed routines and processes.

Accordingly, large firm size, through its “slack resources” (finance, people, and accumulated knowledge) (Bower, 1970), is expected to positively influence MV to be translated into BLSP and PLSP outcomes. The commitment of the resources required to develop breakthrough innovations, particularly when the cost increases over the NPD

stages, is likely to increase the likelihood of maintaining breakthrough integrity, achieving success with early customers, and speeding up the development process, thereby opening up new markets or new product/technological arenas. Recent research by Reid and de Brentani (2012, p.136) supported this contention that “large firms appear to be getting better at radical innovation, and therefore, their size does not have as negative an impact on the ability to move forward in the early stages of the radical process as was the case historically”.

The discussion in this section leads to the following hypotheses:

*H10a: Large firm size (number of employees) positively influences the relationship between MV and before-launch stage performance.*

*H10b: Large firm size (number of employees) positively influences the relationship between MV and post-launch stage performance.*

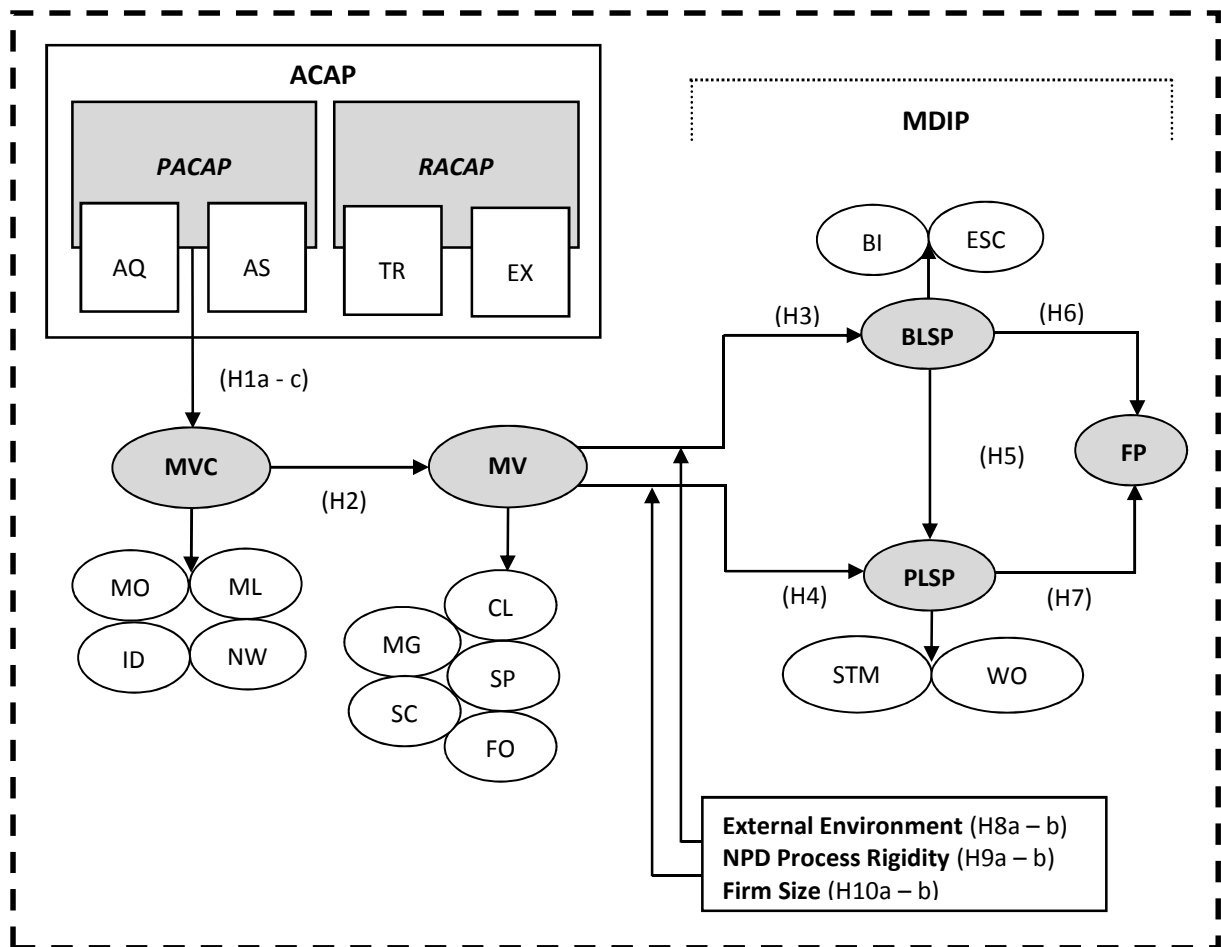
## **2.7.6 Conceptual Model and Summary of Research Hypotheses**

The conceptual model presented in Figure 2.9 sets out an interpretation of the literature review and presents the proposed relationships, which will be tested in this research.

The resource-based view (RBV) of the firm as proposed in the dynamic capabilities literature is the basic premise of this study. Accordingly, the assumption is that a firm's resources incorporating capabilities and competencies play a central role in achieving a competitive advantage and successful innovation performance (Acur, Kandemir, de Weerd-Nederhof & Song, 2010; Narvekar & Jain, 2006; Salomo et al., 2010). In line with the literature, this study seeks to improve the understanding of the market-driving phenomenon and visioning by extending the concept of Reid and de Brentani (2010) on market visioning competence and market vision.

At the broader organisational level, the addition of absorptive capacity and its potential and realised subsets is proposed as a dynamic learning capability, which influences the market visioning competence (of individuals and NPD teams). Market vision results from market visioning competence, and mediates the effects on before-launch stage performance and post-launch stage performance. Before-launch stage performance, post-launch stage performance and financial performance are conceptualised as market-driving innovation performance. Further, the effects of market vision on before-launch stage performance and post-launch stage performance outcomes are moderated by the external environment, NPD process rigidity and firm size.

**Figure 2.9: Conceptual Model**



**Legend:**

<b>ACAP = Absorptive Capacity</b>	<b>MV = Market Vision</b>
<b>PACAP = Potential Absorptive Capacity</b>	CL = Clarity (of market vision)
AQ = Acquisition (of knowledge)	SC = Scope (of market vision)
AS = Assimilation (of knowledge)	MG = Magnetism (of market vision)
<b>RACAP = Realised Absorptive Capacity</b>	SP = Specificity (of market vision)
TR = Transformation (of knowledge)	FO = Form (of market vision)
EX = Exploitation (of knowledge)	<b>MDIP = Market-Driving Innovation Performance</b>
<b>MVC = Market Visioning Competence</b>	<b>BLSP = Before-Launch Stage Performance</b>
MO = Proactive Market Orientation	BI = Breakthrough Integrity
ML = Market Learning Tools	ESC = Early Success with Customers
ID = Idea Driving	<b>PLSP = Post-Launch Stage Performance</b>
NW = Networking	STM = Speed-to-Market
	WO = Window of Opportunity
	<b>FP = Financial Performance</b>

→ Hypothesised significant relationship

### ***Summary of Research Hypotheses***

The review of the literature results in the identification of the following research hypotheses:

#### **Absorptive Capacity as an Antecedent to Market Visioning Competence**

*H1a: ACAP has a significant and positive impact on MVC.*

*H1b: PACAP has a significant and positive impact on MVC.*

*H1c: RACAP has a significant and positive impact on MVC.*

#### **Market Visioning Competence and Market Vision**

*H2: MVC has a significant and positive impact on MV.*

#### **Performance Consequences of Market Vision**

*H3: MV has a significant and positive impact on before-launch stage performance.*

*H4: MV has a significant and positive impact on post-launch stage performance.*

#### **Market-Driving Innovation Performance**

*H5: Before-launch stage performance has a significant and positive impact on post-launch stage performance.*

*H6: Before-launch stage performance has a significant and positive impact on financial performance.*

*H7: Post-launch stage performance has a significant and positive impact on financial performance.*

## **Proposed Moderation Effects**

*H8a: The relationship between MV and before-launch stage performance is negatively influenced by CI, TT and MT.*

*H8b: The relationship between MV and post-launch stage performance is negatively influenced by CI, TT and MT.*

*H9a: The degree of NPD process rigidity negatively influences the relationship between MV and before-launch stage performance.*

*H9b: The degree of NPD process rigidity negatively influences the relationship between MV and post-launch stage performance.*

*H10a: Large firm size (number of employees) positively influences the relationship between MV and before-launch stage performance.*

*H10b: Large firm size (number of employees) positively influences the relationship between MV and post-launch stage performance.*

## 2.8 Chapter Summary

This chapter has reviewed the relevant literature in product innovation and management domains, particularly for market-driving innovation. The term “market-driving innovation” was defined to capture both radically new and really new products. The review of the common success factors of market-driving innovation suggested the front end of the development process as the key area of focus. Noting the high uncertainty and ambiguity found at the front end of market-driving innovation, market visioning (market visioning competence/market vision) emerged as instrumental to maintain breakthrough integrity from the front end of innovation through to commercialisation. Accordingly, the study has reviewed the relevant literature to provide a coherent picture of what the emerging market visioning entails, what its antecedents might be and what associations exist with market-driving innovation performance. The assumption is based on the resource-based view of the firm and dynamic capabilities literature.

The proposed key antecedents of market visioning competence and its resultant market vision – absorptive capacity and its subsets potential and realised – were identified on the strength of the literature review to conceptually and potentially operationally draw linkages between the constructs. While previous studies have highlighted the importance of market visioning and absorptive capacity, the understanding regarding their roles and the relationships between these factors is limited, particularly at the front end of market-driving innovation. It is expected that these factors have some influence on before-launch stage performance and post-launch stage performance and ultimately on financial performance. The relationships between these performance outcomes have also been identified. Further, it is proposed that the external environment, NPD process rigidity and firm size are moderators in the relationships between market vision and both before-launch stage and post-launch stage performance outcomes.

This chapter concludes with a conceptual model illustrating the relationships among the constructs based on the literature reviewed. A series of hypothesised relationships is presented to form the foundation of a response to the research problem. The next chapter provides a comprehensive discussion and justification of the research methodology and data collection.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1 Introduction**

The conceptual framework and the 15 hypotheses of this study were presented in Chapter 2. From the review of the relevant literature, the key constructs and their relationships were identified as the focus of investigation, the premise being that absorptive capacity, market visioning competence and its resultant market vision influence market-driving innovation performance.

This chapter discusses and justifies the research paradigm, design, methodology and data analysis chosen to test the hypotheses and to develop and administer a measurement instrument. The methodology adopted is quantitative research based on the theoretical paradigm of positivism. The research design was conducted in two phases. Phase One is the literature review and conceptual model development, as described in Chapter 2. Phase Two consists of conclusive research using a cross-sectional descriptive study. The development and administration of the questionnaire instrument for a web-based survey is described. The chapter concludes with preliminary data examination and a description of the analysis procedure, including sample characteristics of the survey respondents.

### **3.2 Research Paradigm**

The philosophical approach or research paradigm provides a framework for academic research (Proctor, 2005). The paradigm is “the basic belief system or world view that guides the investigator, not only in choices of method but in ontologically and epistemologically fundamental way” (Guba & Lincoln, 1994, p.105). There are two prevailing yet opposing approaches of research paradigms in the social sciences: the phenomenological or naturalistic (interpretivist) paradigm and the positivist paradigm (Evered & Louis, 1991; Guba & Lincoln, 1994; Hussey & Hussey, 1997; Saunders, Jenkin, Derwent & Pilling, 2003; Weber, 2004). In addition to these paradigms, “realism”, also known as “critical



realism” (Hunt, 1991) and “post-positivism” (Denzin & Lincoln, 1994; Guba & Lincoln, 1994), is also suggested by contemporary researchers to bridge the views of the interpretivist and the positivist approaches (Manicas & Secord, 1983; May, 1993; Stiles, 2003). Each of these research paradigms has various methodological implications and traditions associated with its positions, assumptions and practices.

The philosophical paradigms are lenses for researchers to use different types of research methodology. The two main types of research methods are quantitative and qualitative. The qualitative method is fundamental to the interpretivist paradigm, whereas quantitative research is aligned with the positivist paradigm (Connole, Smith & Wiseman, 1995; Denzin & Lincoln, 1994). Positivism is formal and objective and is deductive in problem solving. It advocates the standpoint of objective truth requiring empirical, tangible evidence, observable and measurable facts or scientific investigation. Positivism therefore disregards intangible, unobservable or unmeasurable evidence such as imagination, emotion, thoughts, awareness and perceptions (Van Fraassen, 1980; Weber, 2004). In the view of positivism, an investigation uses a quantitative approach, a common approach being survey questionnaires for data collection and quantitative analysis (Evered & Louis, 1991). The aim of the positivist approach is “to construct a set of theoretical statements that are generalizable and service the development of universal knowledge” (Stiles, 2003, p.264).

In contrast, interpretivism or the qualitative approach is more informal and subjective and is inductive in problem solving. This approach gains insights through the observation of phenomena and subjective interpretation to obtain a comprehensive description and explanation of a problem. It advocates that objective truth is less important because reality can be analysed by exploring the richness, depth and complexity of phenomena. Interpretivism presents subjective truth based on the study of the natural environment and the effects on phenomena in the natural environment. Unlike the view of positivism, the interpretivist approach thus “produces findings not arrived at by means of statistical procedures or other means of quantification” (Strauss & Corbin, 1990, p. 17). By its nature, the interpretivist approach promotes the value of qualitative data in the pursuit of knowledge, to discover how things occur in reality and how people react to occurrences rather than to make generalisations based on standard laws (Kaplan & Maxwell, 1994).

The realist approach uses mixed methods that include both qualitative and quantitative methods (Healy & Perry, 2000). Qualitative approaches such as case studies and unstructured or semi-structured in-depth interviews and group observation to gather subjective information are acceptable in the paradigm of realism. The qualitative approaches can be followed and reinforced with surveys, the results of extant research and statistical analysis such as structural equation modelling, partial least squares or other techniques (Bisman, 2002; Morgan, 2007; Perry, Alizadeh & Riege, 1997; Tashakkori & Creswell, 2008). This process of analysis, called “triangulation”, incorporates both subjective and objective standpoints, reflecting inductive and deductive reasoning, respectively (Bhaskar, 1989; May, 1993; Morse, 2003).

The theoretical paradigm for this research is the positivist approach. The research aims to understand the critical success factors influencing market-driving innovations at the front end of the new product development process. Drawing from the literature review in Chapter 2, the research objective of the present study is:

*to investigate the degree to which market visioning competence and market vision influence the ability of a firm to develop and commercialise market-driving innovations and, further, to examine the way in which absorptive capacity acts as an antecedent to these factors.*

The research objective captures the key constructs that emerged from the literature review. These constructs have been defined and can be quantified as briefly described above. As the hypotheses were presented in propositional form, as shown in the conceptual framework, they are subjected to empirical tests to verify them.

### **3.3 Research Design**

Developing an appropriate research design is fundamental for any research as it serves as the blueprint that determines the choice of methodology and the actions necessary to address the research problem (Sekaran, 2003). This involves a series of choices in relation to the type of sample and data collection methods to be employed, and how the variables in the questionnaire are to be measured, including scaling procedures and data analysis techniques.

The research design also identifies the time frame, the setting of the study and the unit of analysis (Aaker, Kumar & Day, 2001; Churchill, 1995; Zikmund, 2000). The initial goal of the research is to identify a strategy that will enable the project to achieve its established objectives and answer questions by means of providing the logic that links the collected data to the initial research questions (Churchill & Iacobucci, 2005; Malhotra, 2007).

The theoretical paradigm and the assumptions underlying qualitative or quantitative methodologies provide guidance for the research design (Creswell, 1994). The research design can be classified mainly as exploratory or conclusive research (Burns & Bush, 2008; Malhotra, 2007). Accordingly, the research design of the present study comprises two sequential approaches:

### ***Phase One: Literature review***

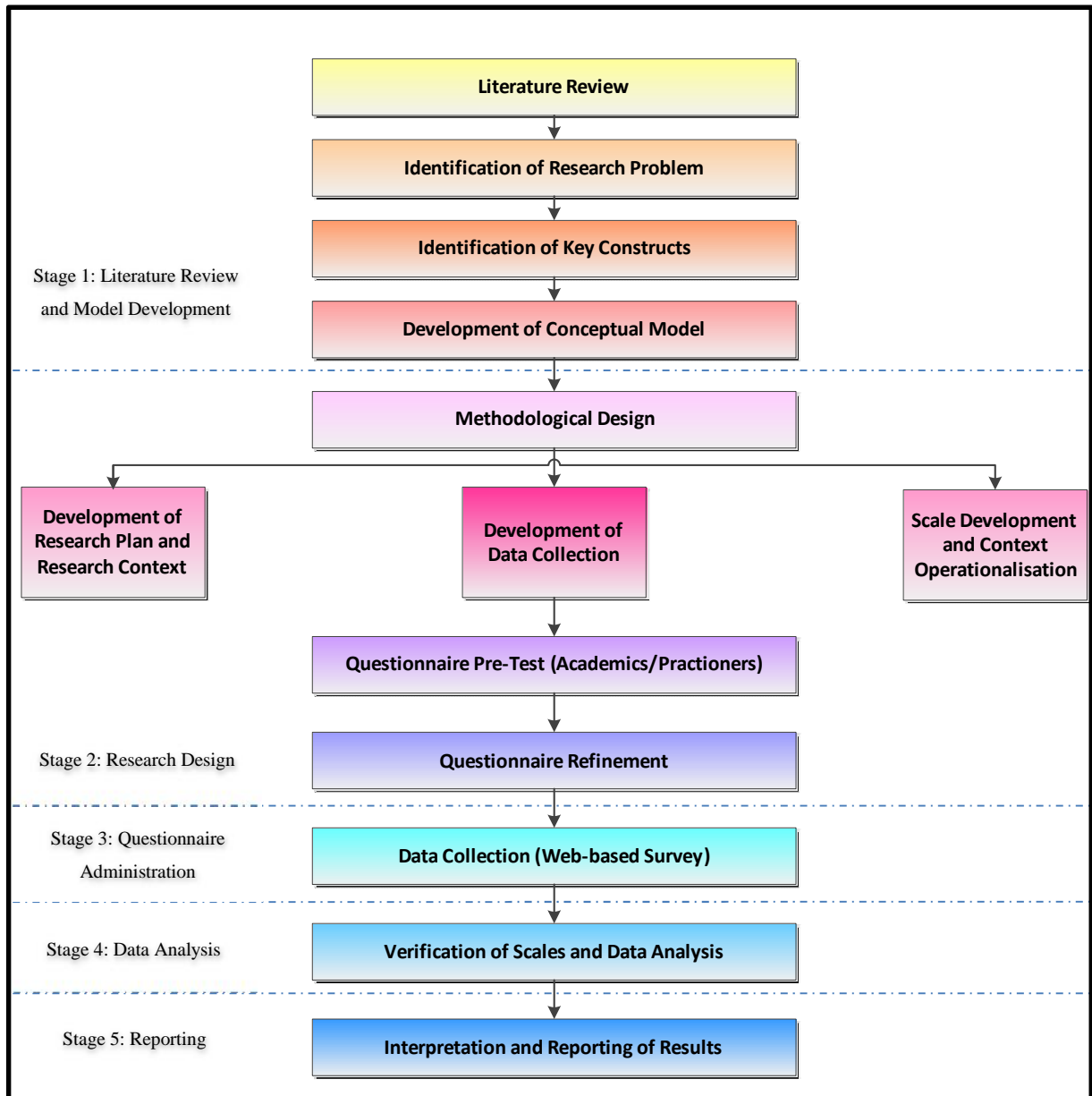
A literature review is required to gain information about the nature of the research problem (Burns & Bush, 2009). This initial stage provides a strategic direction for research by generating a hypothetical idea and a theoretical problem. At this phase, specific research objectives are also formulated to address the research problem (Malhotra et al., 2004).

### ***Phase Two: Conclusive research using a cross-sectional descriptive study***

The nature of the research question and the target population determined that cross-sectional descriptive research would be the most appropriate technique in this study to obtain and represent the required information. Descriptive research is applied to test the theory and propositions by obtaining precise answers to questions about “how many?” or “what proportion?” (Emory & Cooper, 1991). As previously stated, the main research question of this study is: *To what extent does a firm’s absorptive capacity, its market visioning competence and market vision influence the firm’s success at developing market-driving innovation?* The descriptive research design supports the investigation of meaningful relationships, testing their validity and verifying whether true differences exist (Hair et al., 2012a).

Figure 3.1 illustrates the overview of the research activities designed to achieve the research objectives of this study.

**Figure 3.1: Overview of the Research Activities**



**Stage 1:** The process began with an exploratory review of the literature in the field of marketing, management and product innovation. The purpose of reviewing the literature was to define terms and concepts and to articulate the key dimensions of each construct. The key constructs identified in the literature, as presented in Chapter 2, were absorptive capacity, market visioning competence and market vision. A number of potential relationships between these constructs were proposed, which appear not to have been explored in other research. The identified constructs were hypothesised to speculate on the relationships among the variables and how those relationships might contribute to market-driving innovation performance. Additional moderating constructs were also proposed to

examine their influence on the relationship between market vision and market-driving innovation performance. This resulted in the development of a conceptual model underpinning the research propositions and hypotheses. At this stage the researcher also assessed whether the key constructs had existing measures and whether they had been operationalised and tested in previous research.

**Stage 2:** This stage involved the preliminary development of the questionnaire that was to be the primary research tool. Constructs with existing measures were adapted and operationalised. In particular, a scale to measure the concept of breakthrough integrity was developed, as this concept had not been fully operationalised in previous studies. This stage also involved a sampling process of defining the population of concern and determining the sample size for the study. The web-based questionnaire was tested with academic and industry experts in the field to check for content validity, wording and ease of understanding. The final version of the questionnaire was available in both English and Thai, the questions in each language having been pre-tested. As a result of the pre-testing, the questionnaire was slightly refined and modified prior to data collection in Stage 3.

**Stage 3:** At this stage, the study employed cross-sectional descriptive research by means of a web-based survey for data collection. Managers responsible for developing and commercialising product innovations across several industries in Thailand were contacted and invited to complete the web-based survey. The study measures units from the snapshots of these specific populations at one point in time.

**Stage 4:** The data obtained from the web-based survey were subjected to a preliminary examination and were prepared for data analysis. The data were then assessed for the reliability and validity of the constructs (see Chapter 4). This stage also involved testing the proposed hypotheses and relationships through quantitative data analysis (see Chapter 5). The aim is to produce a final empirical model that best captures the interrelationships the proposed constructs.

**Stage 5:** This last stage involved the interpretation, reporting and discussion of the results, presented in Chapters 5 and 6.

### **3.4 Quantitative Research**

This thesis employed quantitative research methodology through the use of a cross-sectional survey. According to Guo (2008) analysis of 22 years of research in product innovation literature, the survey was found to be the most widely used method (45.2%) of all research methods, including case studies, interviews and experiments. The survey questionnaire provides uniformity as questions and their response options (scales) are pre-set identically in the same format and in a particular order. The standardisation of this approach results in a high quality of information. Participants can be challenged with structured, direct questions related to the research objectives of the study, while the questions also provide participants with clarification and a point of reference. Thus, the survey approach lends support to the reliability of the study (Malhotra, 2009a).

Traditional survey methods that can be used for data collection includes face-to-face, mail, fax and telephone (Malhotra, 2009a). However, new efficient techniques for survey data collection have emerged from substantial advances in computer and telecommunications technology, and alternative modes of survey data collection have begun to replace the traditional methods. These new modes are computer-assisted personal interviews (CAPI), computer-assisted telephone interviews (CATI) and web-based surveys. These methods allow researchers to use statistical analysis and quick tallies, especially with web-based questionnaire design software (Burns & Bush, 2008).

#### **3.4.1 Development of Web-based Survey Tool**

The web-based survey has become the industry standard for respondents to answer questions in an online questionnaire. The online questionnaire enables a wide geographical coverage and is employed in many countries, particularly those with high internet access and usage (Burns & Bush, 2008; Ilieva, Baron & Healey, 2002). With the rapid growth in the use of the internet and its increased availability to the general public, recent researchers have begun to adopt web-based surveys as the research method of choice (Cobanoglu, Warde & Moreo, 2001; Dillman, 2000a; Dixon & Turner, 2007), particularly researchers in the area of product innovation and management (e.g. Bartl, Füller, Mühlbacher & Ernst, 2012; Hofstetter, Miller, Krohmer & Zhang, 2013; Holahan, Sullivan & Markham, 2014;

Lamore, Berkowitz & Farrington, 2013; Stanko, Molina Castillo & Munuera Aleman, 2012).

For the reasons outlined above, the web-based survey was deemed the most appropriate method of research for this study. Accordingly, the study utilised the web-based questionnaire design software Qualtrics to host the questionnaire through a specific URL (Uniform Resource Locator; a global address of the document on the World Wide Web) (Qualtrics, 2013). The Qualtrics software offers a more complete control of the research process and facilitates the creation, distribution, storage and analysis of a web-based survey. This study adopted the use of a web-based survey (Simsek, Veiga & Lubatkin, 2005) using Qualtrics questionnaire design software for the five reasons explained below.

#### **i. Thailand's Internet Penetration**

The country of focus for this research is Thailand. According to the International Telecommunication Union (ITU), there are several information and communications technology (ICT) indicators to measure internet penetration in a country. ICT indicators include the ICT development and infrastructure, domain names or website registration and internet access (ITU, 2005). These indicators are important to consider when deciding to conduct a research through a web-based survey due to limited sampling (sample frame) in the online environment (Andrews, Nonnecke & Preece, 2003; Dillman, 2000b; Wright, 2005). This is the most commonly cited disadvantage of web-based survey because certain demographics are less likely to have internet access. As a result, it may be harder to draw probability samples based on e-mail addresses and to encourage respond to the online questionnaire (Fleming & Bowden, 2009). This study therefore considered some of the ICT indicators to determine the level of internet penetration in Thailand.

First, recent government activities in Thailand have provided support for expanding ICT infrastructure leading to a broader internet penetration. This has been enhanced by legislation on internet usage in 2007 and the ICT plan of enhancing the online environment for trading and transactions among businesses and consumers from 2000 to 2010. The aim was to support and promote the usage of ICT to strengthen businesses and e-commerce technology (Department of Commerce, 2013). Second, the survey by NECTEC (2008) indicated an increased number of domain names registered under .TH (indicating Thailand)

from 2005, resulting in a total of 37,850 registered domain names by 2008 (Charnsripinyo, 2008). Last, Thailand's overall internet population was estimated at approximately 37% of the population (about 26 million people) according to the ICT Ministry's survey in 2011 by Thailand's Electronic Transaction Development Agency (ETDA). The number of internet users in Thailand was also expected to increase to 52 million by the end of 2013 (Williams, 2013). In general, the internet population in Thailand can be classified into corporate and home access services or business and individual use, respectively (Charnsripinyo, 2008). According to an ICT Business Survey by Thailand's National Statistical Office in 2009, the number of businesses in Thailand employing 16 people or more indicated a high proportion of computer (81.1%), internet (68.5%) and e-mail usage (57.1%) (Santipaporn, 2010). Overall, evidence of ICT indicators suggests an acceptable level of internet penetration in Thailand, thus supporting the method of a web-based survey.

## **ii. Ease of Access and User-Friendliness**

The online questionnaire is available virtually for ease of access and offers respondents the flexibility of answering the questions at a personally convenient time. This facility can be considered to increase the accuracy of the data collected (Churchill, 1999; Sekaran, 2003).

User-friendliness is an important element in the design of a web-based questionnaire. Accordingly, the graphical user interface (GUI) enables ease of use for the survey respondents. The use of the Qualtrics questionnaire design software enabled the web-based questionnaire to be easily set up to accommodate the standard question format with simple navigation on the website. Qualtrics allows the respondents to change their responses by clicking on the Back button. A Save and Continue function also allows the respondents to interrupt their completion of the survey. This function is enabled through a cookie on the respondent's browser which tracks the progress of the survey. Once the questionnaire is completed, the respondents can simply click the Submit button (Qualtrics, 2013).

Some other user-friendly design features are the use of space to enhance clarity, grouping related questions in a section, limiting the number of questions per page to prevent clutter, the use of a progress bar to display the percentage of the questionnaire completed and minimal design to enable straightforward navigation. This can reduce the time and effort required for the respondents to complete the questionnaire. Overall, a user-friendly GUI can



facilitate respondents' participative interest and reduces operational fatigue (Roman, 2002). The web-based instrument helps to reduce possible common-method variance problems that may lead to inflated reliability measures (Stanton, 1998).

### **iii. Efficiency in Data Collection**

The main benefits of a web-based survey for data collection are speed of distribution and fast turnaround time. This is particularly useful for a research project that has time constraints (Zikmund & Babin, 2007). Given that the survey in this research had a three-month span, a web-based survey appeared to be suitable. Web-based surveys are self-administered, meaning that respondents can complete the questionnaire unattended. This has a significant administrative advantage compared to methods such as telephone surveys (Burns & Bush, 2008). Furthermore, some studies of web-based survey methods have found that response rates in email surveys are also equal to or better than those for traditional mailed surveys (Mehta & Suvadas, 1995; Stanton, 1998; Thompson, Surface, Martin & Sanders, 2003).

### **iv. Efficiency in Database Management**

The web-based survey minimises and eliminates errors that may be made by the respondents, the database system or the researchers.

To reduce data entry errors by respondents, the following control mechanisms were used: (Roman, 2002):

- **Prevent ballot box stuffing:** This setting prevents a respondent from submitting the questionnaire more than once (dual entry), by placing a cookie on the individual's browser.
- **Multiple entries:** The design allows only one answer (option) to be chosen for each question.
- **Incomplete questions/questionnaire:** The option "force response" was used via *Qualtrics* web-based questionnaire design software for data collection. This means that respondents will not be able to proceed with the survey unless they provide an answer.

Each question has to be completed before the respondent can move to the next page of the questionnaire. In addition, the questionnaire cannot be submitted until all questions have been answered.

The forced response option is a solution to item non-response for any web-based surveys. This prevents the problem of missing data throughout the collection process. Despite this advantage, some researchers have argued that it can be offset by the decreased quality of responses (i.e. potential for incorrect forced data) or increased respondent drop-off rate (e.g. Couper, 2008; Dillman, 1998). However, a recent study conducted by the Graduate Management Admission Council (GMAC) investigates the impact of forced response items on respondent drop-off and differences in items answers and indicates that no differences in terms of response drop-off, attitudinal nature of the response items and content of responses were found between the forced response and requested response item conditions. The only impact on the content of responses by forced item condition is to reveal sensitive information, which is a common survey respondent issue (Leach, 2013). This was not the case for this research as no sensitive personal questions were asked in the survey and that all data is analysed at the aggregate level, thus, individual participant cannot be personally identified (see Appendix 1 for project information statement). The force response option was therefore considered appropriate and utilised in this research.

- **Backward navigation:** This feature prevents data loss from accidental clicking on the Back or Refresh buttons.

Further, the web-based survey offers error control mechanisms that enable the researchers to efficiently manage the collected data with the following features:

- **Data storage and security:** The collected data are stored securely on the Qualtric servers, which are protected by a high-end firewall system. Vulnerability scans are performed regularly and complete backups are done daily to prevent data loss and ensure that the data collection process can be conducted successfully within the scheduled time (Qualtrics, 2013).
- **Real-time data access and monitoring:** The web-based survey allows real-time 24/7 access to the research data. Program security codes prevent unauthorised alteration of the survey and access to the survey is protected with passwords. Only researchers can

access the web-based survey to make necessary modifications or obtain the data that have been collected.

Researchers can continuously monitor the progress of the web-based survey throughout the data collection process, which makes it possible to identify any problems with the survey quickly. A web-based survey is therefore believed to create responses equal in quality to responses to telephone or mail surveys (Burns & Bush, 2008).

- **Data conversion and compatibility across linked programs:** The data from the web-based survey is stored in a consolidated database, which can be downloaded and tabulated into computer data files (data conversion). This feature of data conversion eliminates the handling of paper questionnaires, with manual and multiple data entry that may lead to data errors (Ilieva et al., 2002). The exported data files are compatible with MS Office programs and some statistical analysis programs including the Statistical Package for Social Sciences (SPSS). This compatibility provides an efficient data management tool that enables further data analysis.

#### **v. Use of Qualtrics at RMIT University**

The Qualtrics questionnaire design software (Qualtrics, 2013) is freely available to RMIT's researchers to support the use of web-based survey research for university-related work. This enabled the setup of the web-based survey tool at no cost.

### **3.4.2 Sampling and Data Collection**

Sampling is “the selection of a small number of elements from a larger defined target group of elements and expecting that the information gathered from the small group will allow judgments to be made about the large group” (Hair et al., 2012a, p.260). With surveys, the sampling process involves statistical analysis to predetermine a set and proportion of unit to be taken from a larger population. The key consideration of sampling is the selection of a small number of units that truly represent the general population being surveyed (Hill & Alexander, 2006).

#### **3.4.2.1 Unit of Analysis**

The unit of analysis indicates the level of aggregation on which the study focuses, particularly what or who to be investigated. The unit can be any element such as individuals (e.g., employees or owners) or organisations (e.g., business units) in the target population being studied (Hair et al., 2012a). The unit of analysis must be specified during the problem-definition stage of the research because it influences the conceptual framework, including the sampling frame and variables and the approach for data collection (Zikmund & Babin, 2007). To address the research propositions, the data collection must capture the appropriate respondents (Sekaran, 2003).

The unit of analysis of focus for this study is the product innovation (new product development [NPD]) program rather than any one product (project). A significant number of product innovation and management studies have adopted program level of analysis for their research (e.g. Acur et al., 2010; Kleinschmidt et al., 2007; Salomo et al., 2010). In other related literature, Cooper and Kleinschmidt (1995a) argue that there is a difference in terms of result scope between studies conducted at project level and program level. Although studies at a project level analysis are important for increasing knowledge on NPD processes, the authors highlight that “there may be company practices that are not apparent at the project level and yet are important ... These practices may be missed—simply not observed or measured—when the unit of analysis is the project” (p.376). A study at a program level analysis allows “standard NPD review practices of organizations to be examined instead of practices that may be idiosyncratic to a particular project” (Schmidt, Sarangee & Montoya, 2009, p.526). More specifically, a program level analysis seems to be

more effective than a project level analysis for studies involving the effects of some higher-level specific practices such as a clear and well-defined product innovation strategy or defined product vision (Crawford & di Benedetto, 2003)—this is consistent to the focus of this research.

The focus on program level analysis is also something that has been called for in the product innovation and management literature (e.g. Cooper & Kleinschmidt, 1995a; Schmidt et al., 2009; Stock & Zacharias, 2013). A recent study by Stock and Zacharias (2013, p.517) state that “innovativeness at the program level remains underresearched”, and thus innovation research “must move from the micro [or product level] of analysis to the company or macro level” (Cooper & Kleinschmidt, 1995a, p.375). The present study therefore adopted a program level unit of analysis, which on the basis of the aforementioned considerations appeared to be most appropriate to achieving the research objective.

Accordingly, this study investigates the company level or strategic business unit (SBU) level of an organisation where research, development and commercialisation of breakthrough innovations were undertaken. It must be noted that this study uses “firm” as an overall term to capture the specific types of respondents and entities (i.e. company or SBU). The result is the collection of information about each variable at the program level of NPD in order to examine the hypothesised relationships.

#### **3.4.2.2 Sample Selection**

The sample was drawn from the top innovative firms in Thailand. The top innovative firms were considered as they are actively involved in NPD and product innovation. Initial information was gained through an on-site visit and member registration at the National Innovation Agency (NIA), Thailand. The NIA is one of the specialised agencies which operate under the umbrella of the Ministry of Science and Technology. The main aim of NIA is to transform Thailand into an innovation-driven economy by fostering innovation-related activities, culture and developments.

Recent innovative activities supported by NIA include National Innovation Day, Innovation Development and Research and Technology Fund, international conferences such as ASEAN Economic Community (AEC) Biomedical Innovation, and innovation showcases

such as InnoBioPlast, InnovAsia and TechnoMart InnoMart. Other NIA innovative activities are awards and other recognition given to selected Thai innovative firms and entrepreneurs for their achievements in product development and innovation. Examples are awards for the Top Ten Innovative Businesses, National Innovation Awards, Rice Innovation Awards and the Design Innovation Contest. Moreover, NIA plays a central role in coordinating, networking and partnering with innovative firms across different industrial clusters, at both the policy and operational levels (National Innovation Agency, 2010b).

Accordingly, the initial list of the sample was drawn from the database of NIA Thailand Top Innovative Companies in the year 2011–2012 (National Innovation Agency, 2011, 2012). The top innovative companies were listed as award winners across various industries and product categories. The key selection criteria for the winners were related to: (1) the degree of novelty of the product at the international, national or corporate level, (2) the management process and effectiveness of operation in terms of knowledge and exploitation of locally available materials and resources, and (3) the overall benefit of the innovation in terms of adding value to related business, local community and the grass-roots economy (National Innovation Agency, 2006). Thus, the NIA database narrowed down the search for highly innovative Thai firms involved in new product development.

Drawn from the NIA database, the initial list comprised 249 innovative Thai firms with details of company profile and key contact persons (mainly managing directors) including phone numbers and e-mail addresses. In order to distribute the survey to a wider audience, 75 additional contacts of Thai innovative firms were obtained through a network-based approach at NIA innovation showcases. TechnoMart InnoMart, for instance, was the year's 2012 biggest technology and innovation event in Thailand. The event gathered more than 300 innovative products from Thai and large international firms to showcase their research and development, primarily Thai technology and innovation, industrial machinery, Thai SME (small-to-medium enterprises) products and innovative projects initiated by the King of Thailand (BITEC, 2012). In addition, another list of 46 innovative firms (both Thai and multinational) was compiled, originating from 28 known industry contacts. Care was taken to ensure that the list consisted of firms considered top innovators by commentators in the market. The final sampling frame comprised 370 innovative firms in Thailand operating across various sectors, thereby offering a practical means of capturing a sample sufficiently large and representative of the total population being studied.

### **3.4.2.3 Sample Size**

For any statistical technique, it is important to determine the minimum sample size required to facilitate the generalisability and validity of the result in a given model before data collection occurs. The sample size suggests how accurate a sample is (Tabachnick & Fidell, 2007). The required sample size is based on the proposed data analysis technique and its requirements. This study involves data analysis through simple/multiple regression and partial-least square structural equation modelling (PLS-SEM).

To meet the assumption of multiple regression analysis, Tabachnick and Fidell (2007) recommend a formula to determine the required sample size:  $N > 50 + 8m$ , where  $N$  is the required sample size (number of participants) and  $M$  is the number of independent variables. In this regard, the maximum number of predictors used in any one model totalled 10, which yielded a required sample size of 130 participants for this study.

For PLS-SEM, the minimum sample size needs to be equal to or larger than: (1) “ten times the largest number of formative indicators used to measure on construct” or (2) “ten times the largest number of structural paths directed at a particular latent construct in the structural model” (Hair, Ringle & Sarstedt, 2011, p.144). As the given model of the present study represents reflective constructs and the largest structural path was equivalent to 10, this suggests a minimum of 110 cases required to generate valid model fit measures for PLS-SEM.

To incorporate both requirements of the proposed data analysis techniques, the study thus required a minimum sample size of 130 respondents.

### **3.4.2.4 Key Informants**

The approach of using key informants is often adopted and more favoured than multiple informants in empirical research (Kortmann, 2014) and has been used in prior studies in product innovation and management literature (e.g. Calantone et al., 2003; Stanko et al., 2012). Accordingly, the key informant technique was adopted for this research. Importantly, the most appropriate key informant must be chosen to ensure that the respondents are exceptionally knowledgeable and competent to specifically answer the questions related to the subject being examined (Kumar, Stern & Anderson, 1993).

As mentioned in Section 3.4.2.2, the target sample was top innovative firms because firms developing breakthrough innovations are a subset of firms which undertake product innovation. Correspondingly, the key informants of the present study were identified as managers with responsibility for the development and commercialisation of market-driving innovations (as defined in this study). In line with the unit of analysis, the informants were asked to refer to their SBU, or, when the firm had only a single SBU, to their firm. An SBU is an autonomous division or organisational unit with its own approach for NPD, defined business strategy and formulation, including a manager with sales and profit responsibility (Aaker, 1988).

A qualifying criterion was applied to filter that the informants would be able to shed light on the activities associated with the front end and final success of market-driving innovation. This involved two qualifying questions to screen pool of participants. To be eligible, participants had to: (1) be significantly involved in the development and commercialisation of market-driving innovation and (2) have a strong understanding of organisational routines in general, and NPD processes, resources and capabilities. The target respondents included people with various positions working at different levels of a firm or SBU such as managing director, chief executive officer (CEO), vice president of marketing, product and sales manager and R&D engineer.

#### **3.4.2.5 Survey Design and Process**

Data were collected via a web-based questionnaire over a three month period. Before the first e-mail round, all potential respondents were contacted by phone to verify their status as knowledgeable informants and their appropriateness for the survey based on their understanding of organisational routines, processes, resources and capabilities related to NPD and innovation. If they did not meet the qualifying criterion, they were asked for contact information of appropriate people in their company or strategic business unit (SBU). The phone calls also served as an opportunity to explain the purpose of the study and encourage participation.

For the first e-mail round, the purposive sampling strategy was to invite participants into the study with a short motivational introduction to encourage their commitment to undertake the web-based survey. Drawing from the final sampling frame of 370, managers across a



diverse range of innovative companies in Thailand received an e-mail stating the intention and relevance of the study and including a unique hyperlink directed to the web-based survey (specific URL). The introductory e-mail message stated that the purpose of the survey was to gain an understanding of organisational knowledge and information processing, particularly visioning capabilities, for breakthrough innovations as they related to innovation strategies and business unit level (NPD program) success.

In addition, a project information statement approved by the RMIT University Ethics Committee was attached to the e-mail, including the following information:

- Introduction of the researcher and main supervisor
- An overview of the project (objective and significance)
- Detailed instructions for survey completion
- The rights of the participant, associated risks or disadvantages and benefits
- Requested date of return
- Contact details for the researcher and main supervisor (in the event that additional information or further clarification is required by respondents)
- Contact details of the Chair of the RMIT Business College Human Ethics Advisory Network (in the event of any complaints about the conduct of the research project)

The overall design of the survey was checked for compliance with the RMIT University protocol. The design of the web-based survey was reviewed by web designers to ensure a professional look and feel. Importantly, participants were assured of confidentiality and anonymity for any information provided at every stage of the investigation (see Appendix 1 for the project information statement). Section 3.6 will discuss the project's ethical considerations in greater detail.

### ***Strategies to encourage participation***

To further encourage participation in the web-based survey, the participants were offered a free summary report on findings at the completion of the study. Moreover, a donation of AUD\$2 was offered to the Starlight Children's Foundation Australia for every completed survey – a common type of incentive used by researchers to increase the response rate to mail questionnaires (Gendall & Healey, 2008). Respondents also had the option of completing a paper-based survey. Any participants who viewed the internet as an insecure

network could request a hard copy of the questionnaire to be posted to a given address, for it to be completed in a paper format and return their responses by regular mail at no cost.

To increase the response rate, particularly in the case of the unavailability of a person who was sent the initial e-mail, the recipients were asked to forward the hyperlink of the web-based survey to other appropriate managers. This approach can be referred to as referral sampling, which can help to identify additional potential respondents with similar characteristics (Hair et al., 2012a). The approach is typically suitable for small, hard-to-reach, unique target populations. Since breakthrough innovations are much rarer than incremental innovation, finding a sufficient number of prospective respondents could have been difficult. This referral approach also allows researchers to yield better results in less time and at a relatively low cost (Hair et al., 2012a). This notwithstanding, there was a limit of five participants per unit of analysis (company or SBU) to prevent research bias (Seidler, 1974).

After the administration of the web-based survey, up to three follow-up e-mails were sent to remind the potential informants of the importance of their involvement in the study. The e-mail messages included an acknowledgment of the reasons for not participating, the time required for survey completion, an emphasis on the incentives, the date for survey return and an advance thank-you statement for willingness to participate (Dillman, 2000a).

#### **3.4.2.6 Survey Response**

A total of 179 questionnaires were considered usable for analysis, yielding a 48.38% response rate. This was considered satisfactory when compared to other empirical studies that had employed a web-based survey in the product and innovation management literature. In the studies of Bartl et al. (2012) and Stanko et al. (2012), for instance, the response rates for web-based questionnaires were 12.7% and 14.01%, respectively. Sheehan (2001) study on online users found an average response rate to e-mail surveys of 24% in the year 2000, a significant decrease since 1986 (61.5%).

To detect nonresponse bias, a simple paired-sample *t*-test (equal variances) was computed to compare if there were differences between early and late respondents in terms of main variables relevant to the research hypothesis (Armstrong & Overton, 1977). The data was

organised into two groups. The first group contained the average values found by the survey of the first 10% of respondents for the main variables of absorptive capacity, market visioning competence, market vision and performance variables. The second group contained the same variables of the last 10% of respondents. The results of the *t*-test comparison revealed no statistical significant difference ( $p < 0.05$ ) between the two groups in terms of the means of the variables tested. This finding indicates that the data are free from substantial nonresponse bias.

The 179 respondents were primarily in top management positions and responsible for both marketing and R&D activities (40.2%). The company size varied from small to large, where 42.5% were small-to-medium sized firms and 57.5% were large sized firms. The majority of the firms (company/SBU) were Thai owned and were in the consumer packaged goods market (33%), and spent about 10.5% to 20% of their annual turnover on R&D for product development.

On average, respondents indicated they had introduced 1.54 radical breakthroughs, 1.26 technological breakthroughs, 2.04 market breakthroughs and 4.66 incremental innovations over a three-year period. This suggests that their main type of market-driving innovation activity is based on market breakthroughs and radical breakthroughs followed by technological breakthroughs. In terms of how innovative firms are overall, a total of 1665 innovations were found to be introduced by firms over the three-year period, based on the total sample of 179. Accordingly, the innovation portfolio can be broken down into 270 radical innovations (14.8%), 226 technological breakthrough (13.6%), 303 market breakthrough (21.80%), 829 incremental innovation (49.8%). As part of a balanced innovation portfolio, 50.2% of innovations were thus considered as “market-driving” innovations (see Section 3.5.3 for characteristics of the sample).

### **3.4.3 Survey Questionnaire Development**

A questionnaire, also referred to as a survey instrument, is the “critical key for unlocking understanding and truth about predetermined elements of a defined problem situation” (Hair et al., 2012a, p. 350). The questionnaire is a tool to generate primary data through a set of structured, closed-ended questions and a prearranged set of scale points. The design of the questionnaire was based on the literature review of relevant concepts and previously validated measurement scales in product and innovation management studies. The scale items were developed and slightly modified as clearly, concisely and specifically as possible, to be program-related rather than product-related. Preliminary information was gathered and the overall survey instrument was checked to enhance the accuracy of the data collected for further statistical analysis.

In this study, the survey questionnaire development involved five key components:

- i. Measurement scale;
- ii. Survey instructions;
- iii. Survey structure and layout;
- iv. Survey pre-testing and translation;
- v. Considerations for common method bias.

The following five sections discuss the development of the survey questionnaire in more detail.

#### **3.4.3.1 Measurement Scale**

All constructs were measured using multiple items and seven-point Likert-type scales. As first purposed by Likert (1932), the Likert scale was a technique for the measurement of attitudes in psychology. It can also be referred to as a summated rating scale or itemised rating scale (Hair, Black, Babin & Anderson, 2010; Malhotra, 2009b). A Likert scale is “an ordinal scale format that asks respondents to indicate the extent to which they agree or disagree with a series of mental belief or behavioural belief statements about a given object” (Hair et al., 2012a, p. 314). The Likert scale is one of the most commonly used attitude-scaling techniques in the social sciences and marketing research (Albaum, 1997; Dawes, 2008). This also applies to product innovation research, is as evident in a number of recent

studies using Likert scales, particularly seven-point scales (e.g. Chiva & Alegre, 2009; Hyung-Jin Park, Lim & Birnbaum-More, 2009; Patzelt, Lechner & Klaukien, 2011). The main advantages of the Likert scale are the simplicity of directions to respondents and the ease of scale construction (Malhotra, 2009b).

The use of a Likert-scale was particularly helpful for the present study in terms of measuring items such as absorptive capacity, market visioning and breakthrough integrity, as it allows respondents to express their perceptions about how well their firms were able to manage and achieve these.

More specifically, there are three options to consider involving the format of a Likert scale:

**i. Number of response options**

The number of response options for Likert scale measurement can vary from three to eleven in odd numbers or in even numbers of four, six or ten (Dawes, 2008; Lorken, Pirie, Virnig, Hinkle & Salmon, 1987). It has been suggested that researchers should allow respondents to reveal their true feelings about a given object with a choice of a neutral response (Malhotra, 2009b). The present study therefore utilised an odd number of response options.

**ii. Number of scale options**

A scale point reflects “designated of intensity assigned to the response in a given questioning or observation method” (Hair et al., 2012a, p. 308). The use of scale points can be different for each researcher as there is no set rule in social science studies. Nonetheless, several researchers have claimed that seven-point scales are best for capturing respondents’ opinions (Aaker et al., 2001; Malhotra, 2009a). As previously noted, the seven-point scale has been widely used in recent product innovation research. It has been regarded as a more sensitive scaling than a five-point scale and is suitable for data analysis involving sophisticated statistical techniques such as SEM. Moreover, the seven-point scale deals with cognitive limitations and reliability issues as well as avoiding the confusion that a nine-point scale may pose (Diefenbach, Weinstein & O’Reilly, 1993; Hair et al., 2010; Malhotra, 2009b).

Accordingly, this study adopted the seven-point Likert-scale for measuring survey items with the following anchors:

- (a) 1 = Strongly disagree to 7 = Strongly agree
- (b) 1 = Not at all to 7 = To a very great extent
- (c) 1 = Not at all successful to 7 = Extremely successful

### **iii. Choice of response options**

The choice of response options involves either a forced-choice scale or a non-forced scale. The adoption of an odd number of response categories, as in this study, typically indicates that a neutral or middle ground is allowed, that is, a non-forced scale. A non-forced scale gives respondents the opportunity to express their true feelings in order to receive a true response. Therefore, the respondents may feel more comfortable about answering the questions than if they were forced to give a positive or negative opinion about a given object or statements (forced-choice scale) (Malhotra, 2009b; Parasuraman, Grewal & Krishnan, 2004).

#### **3.4.3.2 Survey Instructions**

It is vital to provide clear instructions to participants before they respond to the questionnaire. The survey instructions emphasised that only knowledgeable key informants were encouraged to participate in the survey.

Once the respondents had clicked on the hyperlink to the web-based survey, the survey instructions advised them to think about the breakthrough innovations which their companies or SBUs had developed and commercialised at program level in the last three years (regardless of whether they were successful), and in which they actively participated. In line with Song and Montoya-Weiss (1998) and Leifer et al. (2000), the definition of “breakthrough innovation” was adopted and clearly stated in the survey instructions. By surveying managers who had participated in the developments of breakthrough innovations at the NPD program level and limiting the recall time frame to three years, bias on retrospective data was minimised.

In terms of making judgements, the respondents were asked to answer the questions as honestly and forthrightly as possible while they were reassured of confidentiality and anonymity. Following the survey instructions, the respondents were requested to reflect on how things actually were rather than their opinion of how things ought to be (see Appendix 2 for survey instructions).

### **3.4.3.3 Survey Structure and Layout**

The layout and format of the questionnaire sections, item sequence, wording and survey instructions were checked by the researchers for logical coherence and smooth transition, professional appearance and visual appeal (Brace, 2004; Oppenheim, 1992). The questionnaire had five sections. For improved clarity and accuracy, each section had explanations and instructions for individual questions that were placed as close to the questions as possible. An overview of the five sections is presented as follows.

#### ***Section 1: General Characteristics of Your Job, Company Product Development Activities***

The first section of the questionnaire captured the demographic profiles of the respondent, the company or SBU and the product development within the company/SBU. For instance, this included job emphasis, organisational structure, number of employees and new product effort structure. Importantly, the respondents were asked to reflect on the NPD activity and to indicate the number of different types of product innovation introduced over the last three years. The types of product innovation defined in this study were explained, with examples given of each type of product. These were radical breakthrough, technological breakthrough, market breakthrough and incremental innovation. The number of new products and their degree of novelty represented how innovative the company or SBU was.

#### ***Section 2: Aspects of Breakthrough Innovation Performance***

The second section of the questionnaire measured the aspects of breakthrough innovation performance, defined as market-driving innovation performance construct in the study. Accordingly, the sub-section captured the instructions and scale items of breakthrough integrity, early success with customers, speed-to-market, windows of opportunity and

ultimately financial performance measures. Respondents were asked to think about the performance of the breakthrough innovations developed by their company/SBU over the last three years, from the early phase of the NPD process through to launch. The aim was to determine specific program level performance outcomes related to breakthrough innovation at before-launch stage and post-launch stage as well as financial success. The responses may suggest how well the studied firms have dealt with the development of breakthrough innovations.

### ***Section 3: Information Processing and Knowledge Management (Absorptive Capacity) of your Company/SBU***

The third section of the questionnaire focused on the antecedents of market visioning competence and its resultant market vision. This section was designed to capture an understanding of the general organisational routines and processes of the company/SBU apart from the innovation-related activities. Respondents were asked to think about all of their company's departments such as R&D, production, marketing and accounting. The respondents were to answer questions about how well they communicated with each other, their connections both within and outside their industry, and how they applied new knowledge in their practical work. These questions reflected information processing and knowledge management at the broad organisational level and the absorptive capacity construct. The sub-section was clearly divided into the four dimensions of absorptive capacity: acquisition of knowledge, assimilation of knowledge, transformation of knowledge and exploitation of knowledge.

### ***Section 4: Organisational Visioning Capabilities***

The fourth section of the questionnaire measured market visioning competence and market vision constructs. The section required respondents to think about breakthrough innovations again, but at the strategic business unit level (NPD program). The questions were designed to elicit information related specifically to all of the dimensions of market visioning competence and market vision. The purpose of capturing the information in this section was to understand how people undertake product-innovation-related tasks and thinking in their company/SBU, particularly the nature of market visioning for breakthrough innovations in the very early stages of the development process.



### ***Section 5: External Business Environment and NPD Process***

The final section of the questionnaire sought to capture data on the external and internal business environment associated with the development of breakthrough innovations. The first sub-section measured the external environment factors of technological turbulence, market turbulence and competitive intensity. The second sub-section measured the new product development process and stages, factoring in the degree of NPD process rigidity (formality). The aim was to elicit information about the circumstances and the types of processes that may negatively or positively influence the front end development of breakthrough innovations.

#### **3.4.3.4 Survey Pre-Testing and Translation**

Pre-testing of the survey was conducted to identify and eliminate any ambiguous wording or other errors in the items and any questionnaire design shortcomings before the actual launch of the survey. Generally, the process involves testing the original questionnaire with a small number of respondents to generate an improved version of the questionnaire (Malhotra, 2010; Zikmund, 2000). Oppenheim (1992) described survey pre-testing as “the process of conceptualizing and re-conceptualizing the key aims for the study and marking preparations for the fieldwork and analysis so that not too much will go wrong and nothing will have been left out” (p. 64).

The pre-testing process involved two stages with panels of experts, consisting of academics and industry informants. The academics and industry informants were invited to review and provide feedback on the structure, questions and language, and the general appearance and design of the survey instrument.

The English version of the questionnaire was first reviewed by five academics in Australia who were familiar with the research area. They were asked to check the questionnaire for content validity and to comment on the appropriateness and comprehensiveness for testing the proposed hypotheses. “Content validity” is “the type of validity, sometimes called face validity, that consists of a subjective but systematic evaluation of the representativeness of the content of a scale for the measuring task at hand” (Malhotra, 2010, p.288). The experts’

suggestions regarding the design structure and some of the questions were subsequently incorporated, which enhanced content validity.

In the second stage, three industry experts from the Product Development Management Association of Australia (PDMAA) were involved in the pre-test of the English questionnaire. These experts were asked to assess the relevance and applicability of the questions and to verify the salience of the listed items, particularly to avoid ambiguous terms and complex syntax. The industry informants were also requested to note the length of time (minutes) it would take to complete the survey. Based on their responses, some modifications were made to the survey instrument in terms of sentence structure and wording.

In addition to English questionnaire, potential respondents in Thailand commented that an alternative version of the questionnaire in Thai language should be offered to overcome the language barrier. Using bi-lingual communication is likely to have a positive influence on the acculturation segment (Holland & Gentry, 1999; Koslow, Shamdasani & Touchstone, 1994; Palumbo & Teich, 2004). This necessitated translating the English questionnaire into Thai language. The key objective of the translation procedure is to ensure translation equivalence (Douglas & Craig, 2007). A direct translation approach was adopted first (Sechrest, Fay & Zaidi, 1972). Afterwards, the Thai questionnaire was back-translated into English by a translator (bilingual expert) who had not seen the original English version. The back-translation method is used primarily in marketing research to reduce possible translation errors to ensure the development of comparable versions of a questionnaire (Douglas & Craig, 2007). Some discrepancies in meaning between the original and retranslated questionnaires were detected and reconciled.

Following the two stages of pre-testing, the Thai survey instrument then went through the process of improving the clarity of the questions and the overall validity of the content. The Thai questionnaire was pre-tested with four academics and six industry experts in Thailand. Based on the feedback and suggestion received, a number of items were reworded.

The final version of the survey questionnaire employed a bilingual instrument that included both English and Thai languages. On the strength of feedback from both academics and

industry experts, the questionnaire was slightly refined and readied for launching in the field (see Appendix 2 for survey instrument in English and Thai languages).

#### **3.4.3.5 Considerations for Common Method Bias**

The issues of common method bias is well acknowledged in several literature (e.g. Bagozzi, 1980; Bagozzi, 1984; Campbell & Fiske, 1959; Fiske, 1982; Greenleaf, 1992). The term “method” involves various aspects of the measurement process, which are:

the content of the items, the response format, the general instructions and other features of the test-task as a whole, the characteristics of the examiner, other features of the total setting, and the reason why the subject is taking the test.

(Fiske, 1982, p. 82)

In this regard, there are two possible effects of method bias found on item reliability and validity as well as on the covariation between constructs i.e. effects of response styles, proximity and item wording (Podsakoff, MacKenzie & Podsakoff, 2012). These biases may lead to incorrect conclusions about a scale’s reliability, convergent and/or discriminant validity and bias hypothesis testing. This study considered a number of factors indicated to increase method bias (MacKenzie & Podsakoff, 2012) and adopted the appropriate remedies to reduce bias, as shown in Table 3.1.

**Table 3.1: Common Cause of Method Bias and Adopted Remedies**

Common cause of method bias	Remedies adopted for the study
<ul style="list-style-type: none"> <li>▪ <b>Lack of verbal ability, education, or cognitive sophistication</b></li> </ul>	<p>Pre-testing procedure ensured questions and item characteristics were easily comprehended by respondents who were those typical of the same population.</p>
<ul style="list-style-type: none"> <li>▪ <b>Lack of experience in thinking about the topic</b></li> </ul>	<p>Key informants with significant knowledge and experiences about product innovation were recruited to participate in the survey.</p>
<ul style="list-style-type: none"> <li>▪ <b>Complex or abstract questions</b></li> </ul>	<p>Clear definitions provided with examples of the concepts (e.g., examples of radical and really new innovations).</p>
<ul style="list-style-type: none"> <li>▪ <b>Low personal relevance of the issue</b></li> </ul>	<p>Offered free summary of reports useful to the respondents and the firms to increase accuracy of the responses (i.e., the critical success factors for the development of breakthrough innovations).</p>
<ul style="list-style-type: none"> <li>▪ <b>Written presentation of item, presence of interviewers</b></li> </ul>	<p>The use of a web-based survey helped to simplify questions and response options; a self-administered method of data collection that may avoid social desirability bias.</p>
<ul style="list-style-type: none"> <li>▪ <b>Low self-efficacy or self-expression to provide a correct answer</b></li> <li>▪ <b>Common scales (e.g., same scale types and anchor labels)</b></li> </ul>	<p>Survey instruction emphasised that respondents answer questions as “how things actually are”, not “how they ought to be” – The most important thing is only their personal experience and knowledge about NPD and breakthrough innovation.</p> <p>Explained to respondents that although some questions may seem very similar, each is unique and requires careful considerations before answering.</p>
<ul style="list-style-type: none"> <li>▪ <b>Low need for self-expression, self-disclosure</b></li> </ul>	<p>Enhanced the motivation for self-expression by stating in the instructions that “Thank you in advance for taking part in this study. Your contribution and insights will help make this a successful and useful study”.</p>
<ul style="list-style-type: none"> <li>▪ <b>Low feelings of altruism</b></li> </ul>	<p>Clearly explained to the respondents in the project information sheet that they have been approached to participate because of the value of their experiences in shedding light on the front end of innovation activities.</p>
<ul style="list-style-type: none"> <li>▪ <b>Impulsiveness</b></li> </ul>	<p>Asked the respondents to read the instructions for each question and consciously think about the issue i.e. the use of preambles.</p>
<ul style="list-style-type: none"> <li>▪ <b>Lengthy scales</b></li> </ul>	<p>Feedback from the pre-tests suggested a survey completion time of approximately 20 minutes; a reasonable request for managers’ time.</p>
<ul style="list-style-type: none"> <li>▪ <b>Contexts that arouse suspicions</b></li> </ul>	<p>Project approved by the RMIT University Human Research Ethics Committee. Information about how the data would be used and kept secure, ensuring anonymity and confidentiality, was provided in the project information sheet.</p>
<ul style="list-style-type: none"> <li>▪ <b>Grouping of related items</b></li> </ul>	<p>Arranging similar items and subjects in the same section, and in a logical order from general to specific; the NPD survey of this research comprised of five sections and begun by asking about general characteristics of job, company, and product development activities before moving onto the aspects of breakthrough performance.</p>

Source: MacKenzie & Podsakoff, 2012

## 3.5 Data Preparation and Analysis Procedure

### 3.5.1 Preliminary Data Examination

Once enough data for the study measures have been collected, the researcher must prepare the data for analysis (that is, a data preparation process) by preliminarily examining the collected data and transforming them into a form suitable for data analysis. This is the mechanical stage of a research project that enables the data to ultimately be translated into useful knowledge (Malhotra, 2009b).

The four steps undertaken to prepare the data for analysis are:

- i. **Questionnaire checking:** Checking the completed questionnaires for overall completeness, accuracy and general usability e.g., eliminating incomplete or unqualified questionnaires
- ii. **Editing:** Correcting, where applicable, illegible or ambiguous answers
- iii. **Coding:** Assigning questions into numeric codes in the design phase (e.g., demographic information) (Luck & Rubin, 1987)
- iv. **Cleaning:** Reviewing data for inconsistencies that may arise from faulty logic (e.g., out-of-range or extreme values) (Malhotra, 2009b)

As indicated in Section 3.4.1, the use of a web-based survey using Qualtrics questionnaire design software can simplify or eliminate some of the stages of the data preparation process, thereby accelerating the overall research process. For example, the programming logic and features prevent participants from skipping questions, and exclude incomplete questionnaires and out-of-range values from the data set. As such, the data set contained no missing values or erroneous values.

### 3.5.2 Data Analysis Procedure

Multiple statistical procedures were involved in the quantitative data analysis. The primary aim was to address the main research questions, the proposed research hypotheses and the conceptual model of the study. Two main stages were conducted for the data analysis:

**Stage One:** Testing reliability and validity of the constructs using SPSS (version 21.0) and AMOS (version 21.0):

- Cronbach's alpha (split-half technique) and correlation analysis: reliability test of multi-item scales
- Confirmatory factor analysis (CFA): validity and unidimensionality test

More details of the data analysis techniques are provided in Chapter 4, including the operationalisation of constructs.

**Stage Two:** Testing the interrelationships among a set of constructs (variables) and the overall conceptual model

- Standard regression through Simple and Multiple Regression analysis:
  - Assumptions of multiple regression: sample size, multicollinearity, outliers, normality, linearity and homoscedasticity, and independence of error
  - Including moderation analysis using the SPSS macro MODPROBE (Hayes & Matthes, 2009)
- Partial-least square structural equation modelling (PLS-SEM) using SmartPLS (version 21.0) (Ringle et al., 2005)

Details of the data analysis techniques are discussed in Chapter 5, including the report and interpretation of findings.

### 3.5.3 Sample Characteristics

<i>Respondent Job Area</i>		<i>Respondent Job Emphasis</i>	
General/Top Management	40.20%	Totally marketing focused	7.30%
Sales and Marketing	28.50%	More marketing focused than R&D	31.80%
R&D/Engineering	20.70%	Balanced marketing and R&D	40.20%
Others	10.60%	More R&D focused than marketing	13.40%
		Totally R&D focused	3.90%
		Other	3.40%

<i>Number of years-</i>	<i>Respondents in current position</i>	<i>Respondents with organisation</i>
1 - 3 years	50.30%	29.60%
4 - 6 years	26.80%	25.10%
7 - 10 years	14.00%	16.20%
More than 10 years	8.90%	29.10%

<i>Industry Type</i>	<i>Number of Employees (Company/SBU)</i>		
Consumer Packaged Goods	33.00%	1 – 20	26.30%
Consumer Durable Goods	15.10%	21 – 40	12.30%
Business to Business Industrial Goods	21.20%	41 – 60	3.90%
Consumer Services	9.50%	61 – 100	12.30%
Other	21.20%	101 – 200	14.50%
		201 – 500	8.40%
		500+	22.30%

<i>Organisational Structure</i>	
Single structure and only one NPD program for all products	55.90%
A division/strategic business unit (SBU) with its own approach to NPD and strategy formulation	44.10%

<i>NPD Structure</i>	
New product development with permanent staff members	25.70%
Distinct division or venture group	5.00%
A new product committee oversees all development efforts	7.30%
Each business unit's general manager directs their own NPD efforts	20.10%
A single function is responsible for NPD	22.30%
A product development process owner helps deploy our process across the firm	15.10%
Other	4.50%

<i>Annual Turnover (Sales)</i>		<i>Annual Turnover Spent on R&amp;D</i>	
Under A\$1 million	25.70%	0.5% - 3%	17.32%
Between A\$1 million - A\$2 million	11.70%	3.5% - 6%	14.53%
Between A\$2.01 million - A\$3 million	2.20%	6.5% - 9%	4.47%
Between A\$3.01 million - A\$4 million	5.00%	9.5% - 10%	13.41%
Between A\$4.01 million - A\$5 million	4.50%	10.5% - 20%	18.99%
Between A\$5.01 million - A\$15 million	10.10%	20.5% - 30%	15.08%
Between A\$15.01 million - A\$25 million	6.10%	30.5% - 100%	13.97%
Between A\$25.01 million - A\$50 million	8.90%	Unknown	2.23%
Between A\$50.01 million - A\$100 million	4.50%		
Over A\$100 million	21.20%		

---

### 3.5.3 Sample Characteristics (*Continue*)

---

**Types of Product Innovation introduced by company/SBU over a three-year period**

	<i>No. of product innovation (Average)</i>	<b>Innovation Portfolio</b> <i>No. of product innovation (%)</i>
Radical breakthroughs	1.54	270 (14.80%)
Technological breakthroughs	1.26	226 (13.60%)
Market breakthroughs	2.04	303 (21.80%)
Incremental innovations	4.66	829 (49.80%)
		<b>Total</b> 1665 (100.00%)

---



### 3.6 Ethical Considerations and Confidentiality

This research project was reviewed and approved by the RMIT University Human Research Ethics Committee (project number 1000360), and strictly followed the ethical guidelines of RMIT University. It is the responsibility of the researcher in research involving human subjects to protect the interests of the participants (Neuman, 2000). The primary concerns of ethical surveying are anonymity, confidentiality and avoiding the exploitation of the subject (Zikmund, 2000). Addressing these concerns may also increase the response rate and accuracy of the data; participants are more willing to respond to a survey and answer the questions truthfully when their identity is undisclosed (Oppenheim, 1992).

Adhering to the ethical guidelines of RMIT University, the following statement was included in the project information statement attached to the questionnaire:

If you have any complaints about the conduct of this research project, please contact the Chair, RMIT Business College Human Ethics Advisory Network, GPO Box 2476V, Melbourne, 3001, telephone +61 3 9925 5596, email [bchean@rmit.edu.au](mailto:bchean@rmit.edu.au) Details of the complaints procedures are available at <http://www.rmit.edu.au/browse;ID=2jqrn7hnpyo>

Participants were assured of anonymity in that they would not be personally identified in any subsequent reports, publications or presentations arising from the study. All data would be analysed at the aggregate level. All the information that the participants provided was strictly and securely controlled and would be accessible only to the identified researchers.

If the participants wished to receive a summary of the relevant findings of the study, they could provide an e-mail address for the report to be sent to. A note attached to the online questionnaire addressed the issues of confidentiality and exploitation of the subject:

*IMPORTANT: Your information will be held strictly confidential and kept securely on a host server, supported by RMIT University. The e-mail address will be used solely by us for sending you the promised report and will never be used for any other purposes.*

### **3.7 Chapter Summary**

The previous chapters explained the conceptual model of the research and the theoretical foundations of the proposed hypotheses related to the research questions of this thesis. This chapter has described the research method adopted for the study. A philosophical approach of positivism was applied to the research through quantitative study using a cross-sectional web-based survey. The web-based survey was designed using Qualtrics questionnaire design software (Qualtrics, 2013). The design of the web-based survey was reviewed by web designers to ensure a professional look and feel.

Details of the sampling, survey design and data collection process have been provided in this chapter, including the response rate (179 usable questionnaires or 48.38% response rate). The sampling frame of 370 highly innovative firms in Thailand was obtained primarily from the database of the National Innovation Agency, Thailand (National Innovation Agency, 2011, 2012). The survey questionnaire was developed after taking into consideration an appropriate measurement scale, layout, accurate translation and use of languages suitable for participants. Pre-testing of the questionnaire was conducted with key academic and industry informants to ensure the readability and appropriateness of the questions and alternative answers, and an appropriate survey completion time. Slight refinements were made prior to the survey administration. The final version of the survey questionnaire employed a bilingual instrument with English and Thai languages. Ethical considerations were implemented throughout the data collection process according to the guidelines provided by RMIT University.

The data collected were subjected to a preliminary examination and then edited, coded and cleaned in preparation for the data analysis. The process of quantitative analysis, using multiple statistical procedures, programs and analytical techniques, was explained in this chapter.

The following chapter discusses the operationalisation, reliability and validity of the measures used to capture the key constructs of the study. Chapter 5 reports on the testing of the hypothesised relationships and the examination of the interrelationships in the path model.

## CHAPTER 4: CONSTRUCT MEASUREMENT

### 4.1 Introduction to Measurement Scale Development

Chapter 4 first explains the operationalisation of the constructs that were introduced in the theoretical model presented in Chapter 2. In order to analyse the casual linkages and relationships between constructs, these constructs must be measured. Accordingly, the constructs must be clearly conceptualised to gain a solid understanding of their true meaning and nature. Each construct was operationalised through indicators (items), representing the essential aspects and facets of the construct. The operationalisation was based on findings from the literature review and previously tested scales considered to be the most appropriate for the context of this study. Then, the indicators were pre-tested with industry experts and academics for their relevance and suitability and were modified if necessary prior to the administration of the survey.

On the basis of the empirical data, the tested indicators were formed into the measurement models. The tested indicators were assessed in terms of their reliability and validity as part of the structural model analysis (see Chapter 5). In accordance with several criteria, among them those of Bagozzi (1979), Churchill (1979) and Peter (1979), the constructs were evaluated and validated. These authors have criticised the field of marketing for not paying enough attention to construct validity associated with measurement until the later 1970s. Peter (1979), for instance, presented a comprehensive review of the traditional psychometric approach to reliability and stated that “construct validity is a necessary condition for theory development and testing. Thus, it is enigmatic that marketing researchers have given little explicit attention to construct validation as is well documented in the marketing literature” (Peter, 1981, p.133). Bagozzi (1981, p.376) argued that “convergence in measurement should be considered a criterion to apply before performing the casual analysis because it represents a condition that must be satisfied as a matter of logical necessity”.

This chapter reports on the analysis undertaken via coefficient alpha to examine construct reliability. In terms of construct measurement, only reflective indicators are used to form the measurement models as they better capture the variables described in Chapter 2. Construct

validity is of central concern to the scientific process (Churchill, 1999). It is primarily used to assess the accuracy of the measurement scales to determine whether the intended construct is the underlying cause of item co-variation. In this regard, confirmatory factor analysis (CFA) is a special case of structural equation modelling that enables an assessment of construct validity (Malhotra, Kim & Patil, 2006; Narver & Slater, 1990). CFA was therefore conducted in AMOS v21 to assess the constructs in terms of convergent, discriminant and monological validity. The measurement model, which can also be formulated as a system of structural equations, was adjusted, where appropriate, to establish measurement fit to the empirical data (Nunnally, 1978).

#### **4.1.1 Operationalisation of Constructs**

The operationalisation of the constructs involves how the measures are configured in order for the constructs to be quantified (Rossiter, 2002). The literature review revealed that more than one measure was pertinent to each construct. To develop the measurement instrument, the most appropriate measurement scales were, therefore, selected for this study. Considerations for the scale selection were based on relevance to the concepts and adoption by other researchers in the domains of product innovation and management.

The scales were slightly modified to capture the NPD program level rather than the individual project, and a few new items were added specifically for the purpose of this study. Despite the minor modifications, the original meaning of each measurement item was maintained. The new items were derived from the conceptual definitions of the constructs and the literature in the relevant domains. The focus on the program level is a holistic approach for understanding what factors account for the repeated success of a firm in developing breakthrough innovations (Johns & Snelson, 1988).

Following the existing scales, all constructs were conceptualised as being of a reflective nature. In general, formative and reflective indicators can be used for construct measurement (Bagozzi, 1979). The decision whether a construct should be operationalised as formative and/or reflective indicators was based on theoretical considerations of the causal relationships between the latent variable and its respective indicators

(Diamantopoulos, Riefler & Roth, 2008; Diamantopoulos & Siguaw, 2006; Fornell & Bookstein, 1982). A formative indicator is a function of its indicators, while reflective indicators are caused by the construct. Thus, the reflective indicators presented in this study are interchangeable, strongly correlated and have the same antecedents and consequences (Jarvis, MacKenzie & Podsakoff, 2003).

#### **4.1.1.1 Multiple-item Scales**

The development of multi-item scales in marketing was adopted from the psychometric literature and was influenced by the early work of Churchill (1979) and Peter (1979). Accordingly, this study applied multi-item scales of constructs, as an approach preferred to single item scales (Churchill, 1979). Using multi-item scales provides an opportunity to measure multifaceted and complex constructs through aggregation. It allows averaging out the degree of specificity where an item may present a low correlation with the construct measured or correlate with other constructs. The determination of a multi-item scales is necessary and each construct in the model should be measured by at least two items (indicators) (Baumgartner & Homburg, 1996; Nunnally & Bernstein, 1994; Peter, 1979). This is to demonstrate theoretical utility and to allow an assessment of both measurement reliability and construct validity (Dillon, Madden & Firtle, 1990; Edwards, 2001; Ping, 2004).

#### **4.1.1.2 Content Validity**

“Content validity” (face validity) can be defined as “the degree to which elements of an assessment instrument are relevant to and representative of the targeted construct for a particular purpose” (Haynes, Richard & Kubany, 1995, p.238). This means that the indicators must capture the domain of the construct being measured (Bohrstedt, 1970; Churchill, 1991). By specifying the domain of the construct and the items that exhaust the domain, the resulting scale must be purified by experts in the field to obtain a content valid instrument (Churchill, 1979).

As reported in Chapter 3, the measurement scales were assessed and validated in the pre-test with a number of industry experts and academics in both Australia and Thailand, who were knowledgeable in the areas of product innovation, marketing and management. This expertise was also evident in the support obtained from the Product Development and

Management Association of Australia (PDMAA). These experts were also asked to evaluate whether the assigned items measured the constructs prior to the survey being administered. Valuable feedback on the instrument was received and minor modifications were made accordingly. For instance, the language used in the questionnaire as adapted to be practitioner (manager) focused rather than academic focused to improve comprehension of the questions. Following the standard procedure for pre-testing, the final version of the instrument was also informed by these experts.

Subsequently, the measurement instruments of the study were considered to have content validity. The use of previously tested scales and the pre-testing procedure ensured that each item was expressed with clarity and that the scales captured the domain of the constructs. After administering the final version of the questionnaire and collecting the resultant data, further evaluation was undertaken to assess construct reliability and validity. This is discussed in the following section.

#### **4.1.2 Reliability and Validity of Constructs**

To assess the quality of the measurement instruments, reliability and validity have to be evaluated. “Reliability” can be defined as the “degree to which measures are free from random error” (Peter & Churchill, 1986, p.4). Assessing reliability determines whether the scale or measurement of a phenomenon is precisely consistent and replicable (Carmines & Zeller, 1979; Rossiter, 2002). Rossiter (2002, p.328) claimed that:

A score from a scale can be assessed for reliability (precision) but not the scale itself. To be useful, both theoretical and practically, the score has to come from a valid scale. Highly precise, reliable scores can be obtained from non valid scales, and high reliability, *per se*, says nothing about validity.

“Construct validity” describes the relationship between the construct and its indicators or measurement tool. It confirms that the constructs are measured by a network of related hypotheses generated from a theory. Thus, high construct validity means that the measurement is conceptually correct (Kline, 2005). Churchill (1979, p.65) stated that “a measure is valid when the differences in observed scores reflect true differences on the characteristic one is attempting to measure and nothing else”.

#### 4.1.2.1 Construct Reliability

In empirical research, reliability assessment can be separated into test-retest, parallel-test and internal consistency (Hildebrandt, 1998; Peter, 1979). The first two reliability checks require comparability measurement through correlation, using the same measurement tool at a later point in time or an equivalent measurement tool at the same point in time (Hildebrandt, 1998). This requires a very high complexity and stability of the results over time. Researchers have advocated that internal consistency is the most suitable measure to perform reliability checks in marketing research (e.g. Churchill, 1995; De Vellis, 1991; Dillon et al., 1990; Hildebrandt, 1998; Peterson, 1994).

In academic publications, the most commonly used reliability coefficient for internal consistency is Cronbach's alpha (Cronbach, 1951), a generalised measure of a uni-dimensional, multi-item scale. Churchill (1979, p.68) described it as "the recommended measure of the internal consistency of a set of items is provided by coefficient alpha which results directly from the assumptions of the domain sampling model". The criterion of Cronbach's alpha can be defined as:

$$\text{Cronbach's alpha : } \alpha = \left( \frac{N}{N-1} \right) * \left( 1 - \frac{\sum_{i=1}^N \sigma_i^2}{\sigma_t^2} \right)$$

(Cronbach, 1951; Peterson, 1994)

Green, Tull, and Albaum (1988, p.254) defined "internal consistency" as "the reliability within single testing occasions". Internal consistency reliability is an important verification measure to assess whether the correlations among scale items or indicators of the same construct reveal a strong mutual association (Heeler & Ray, 1972). Through the assessment of split-halves, internal consistency determines how well the construct is measured by its assigned items (Zikmund, 2000).

Accordingly, this study used Cronbach's alpha and item-total correlations to determine internal consistency (Cronbach & Meehl, 1955). In terms of assessing the Cronbach's alpha, the correlations among items and scale length influence alpha. The primary assumption is that there is a positive average covariance among items. The value of Cronbach's alpha

varies between 0 and 1, where a value closer to 1 indicates stronger reliability. A low alpha score implies that there is either an insufficient number of items or that the combination of items does not adequately capture the construct or attribute (Churchill & Iacobucci, 2005).

Some researchers have recommended a common threshold for sufficient values of Cronbach's alpha or internal consistency and item-total correlations between 0.5 and 0.6 (Hair, Black, Babin, Anderson & Tatham, 2006; Nunnally, 1967; Nunnally & Bernstein, 1994; Venkatraman & Ramanujam, 1986). However, other social sciences and marketing scholars have advocated an alpha score of 0.70 or greater as adequate (e.g. Cortina, 1993; de Vaus, 1985, 1995; De Vellis, 1991; Hulland, Chow & Lam, 1996; Kline, 2005; Nunnally, 1978; Pallant, 2005; Peterson, 1994). Following this more recent research, this study used an alpha score of 0.7 or greater to assess construct reliability.

#### **4.1.2.2 Convergent Validity**

“Convergent validity” can be defined as “the degree to which two or more attempts to measure the same concept through maximally dissimilar methods are in agreement” (Bagozzi & Phillips, 1982, p.468) or “the extent to which it correlates highly with other methods designed to measure the same construct” (Churchill, 1979, p.70). In other words, convergent validity refers to the extent to which the indicators or items of a specific construct share a considerably high proportion of relatedness (correlation) among each other (Churchill, 1979; Hair et al., 2006). A construct is valid only if it measures what it is supposed to measure (Zikmund, 2000). In this respect, the measurement models were operationalised reflectively where confirmatory factor analysis was undertaken to assess convergent validity (Podsakoff, Todor, Grover & Huber, 1984). Section 4.1.2.4 explains the measurement model assessment for convergent validity.

#### **4.1.2.3 Discriminant Validity**

“Discriminant validity” can be defined as “the degree to which measures of distinct concepts differ” (Bagozzi & Phillips, 1982, p.469) or “the extent to which the measure is indeed novel and not simply a reflection of some other variable” (Churchill, 1979, p.70). In other words, discriminant validity refers to “the dissimilarity in a measurement tool's measurement of different constructs” (Götz, Liehr-Gobbers & Krafft, 2010, p.696).



While convergent validity suggests that a high degree of relatedness for indicators of the same factor, discriminant validity indicates that the indicators of different latent variables should exhibit a low degree of relatedness or correlation between each other (Bagozzi, Yi & Singh, 1991). Discriminant validity was tested in this study through the confirmatory factor analysis model, which is explained in the following section.

#### **4.1.2.4 Measurement Models**

A measurement model is used to describe a series of relationships that advocate how measured variables signify a construct that is not measured directly (Hair et al., 2006). Confirmatory factor analysis (CFA) is a measurement model that specifies relationships among the measured or observed variables underlying the latent variables. CFA models are commonly used to assess the convergent validity and discriminant validity (Anderson & Gerbing, 1988; Steenkamp & van Trijp, 1991). CFA examines a measurement model for testing the hypothesised relationships and addressing the adequacy of the observed items as measures for the construct in order to establish validity and uni-dimensionality. “Unidimensionality” is “the existence of one latent trait or construct underlying a set of measures”(Anderson, Gerbing & Hunter, 1987, p.432).

This study employed CFA for measurement model assessment (Anderson & Gerbing, 1988). Respectively, the examination and assessment of the proposed measurement is presented in this Chapter using CFA models. The next Chapter reports on the examination and assessment of the relationships between the model constructs using partial least square structural equation modelling (PLS-SEM) (Ringle, Sarstedt & Mooi, 2010; Ringle et al., 2005).

Following the standard CFA process, the development of the measurement models for each construct was based on theoretical principles where covariance structure analysis were conducted in Analysis of Moment Structures (AMOS) v21. Covariance structure analysis is a multivariate technique that tests the theoretical structure of the measurement model, as presented in Figures 4.1 to 4.8 (Schumacker & Lomax, 2010).

The covariance structure analysis combines confirmatory factor analysis with structural equation models. Squares or rectangles represent observed variables and circles or ellipses represent latent variables to provide a diagram of the combined measurement and structural models. Arrows indicate the theoretical linkage of items/indicators (observed variables) as attributes to the construct (latent variables). As the indicators for this study are of a reflective nature, the measurement items are associated with measurement or response errors (e.g. 'e12') and must be included in the measurement model to represent the extent to which the variable does not measure the hypothesised variable. Further, factor loadings and loadings coefficients can range from 0 to 1, which represents the correlation of the latent variables with the construct and its cohesion with other variables (Arbuckle & Wothke, 1999; Byrne, 2010). The relationships among the latent variables reflected in the measurement model are subjected to substantive theory such as model validity (Schumacker & Lomax, 2004).

### ***Convergent validity***

To assess the convergent validity, a common measure is the average variance extracted (AVE) (Fornell & Larcker, 1981). Convergent validity is based on the correlation/relatedness between responses obtained by maximally different methods of measuring the same construct (Peter, 1981). AVE is the degree of variance of its indicators captured by the construct in relation to the total amount of variance while calculating the variance due to measurement error. An AVE value of less than 0.5 can be considered insufficient for the overall fit of the model, as more variance is due to error variance than to indicator variance (Homburg & Giering, 1996). AVE is formally defined as follows:

$$AVE = \frac{\sum_i \lambda_i^2}{\sum_i \lambda_i^2 + \sum_i \text{var}(\varepsilon_i)}$$

(Fornell & Larcker, 1981, p.45)

To further assess the convergent validity, internal consistency can be determined by computing composite reliabilities (Fornell & Larcker, 1981). Composite reliability (CR) requires that all the assigned indicators jointly measure the same construct adequately,

thereby revealing a strong mutual association (Bagozzi & Baumgartner, 1994). Thus, CR can be used to check the adequacy of the reliabilities of the constructs (Fornell & Larcker, 1981, p.45). In reflective measurement models, CR is defined as follows:

$$\text{Composite reliability}(\rho) = \frac{(\sum_i \lambda_{ij})^2}{(\sum_i \lambda_{ij})^2 + \sum_i \text{var}(\varepsilon_{ij})}$$

The value of CR can range from 0 to 1, where values greater than 0.6 or 0.7 are commonly considered acceptable (Bagozzi & Yi, 1988; Sarkar, Echambadi & Harrison, 2001b). CR is often regarded as similar to Cronbach's alpha. CR, however, uses the actual factor loading rather than equal weighting as in alphas. A weak correlation between the indicator and the measurement model's remaining indicators suggests that it should be eliminated (Fornell & Larcker, 1981).

### ***Discriminant validity***

A thorough validation procedure requires the assessment of a measurement model's discriminant validity, which can be assessed by examining the correlation coefficient relative to each pair of variables (Fornell & Larcker, 1981). According to Fornell and Larcker (1981), a necessary condition for discriminant validity to be proven is that a latent variable's AVE is greater than the common variances (squared correlations) of this latent variable with any other of the model's constructs. In other words, the correlation of the indicators within individual constructs must be significant and greater than the correlation of the indicators between different constructs (Fornell & Larcker, 1981). If the indicators measuring a construct exhibit a high correlation with any of the other constructs, further analysis will need to be undertaken to avoid shared method variance (Peter, 1981). This is because such an occurrence indicates that the latent construct may have less in common with its own measures than it does with other constructs. Kline (2005) recommended that a value of the correlation coefficient greater than 0.85 is likely to imply that the variables of interest represent the same concept, and thus should be combined as single variable. After having checked for discriminant validity, further validation of the overall reflective measurement model can be done by assessing goodness-of-fit measures.

#### 4.1.2.5 Goodness-of-Fit Measures

For the evaluation of an overall measurement model, there are several fit criteria and inference statistical measures. The measurement models were developed in AMOS v21 and analysed using the CFA model fit assessments (Goodness-of-fit measures). The use of the CFA model fit assessments provides criteria to determine how well the specified factor model or hypothesised model fits the data (Kline, 2005). This involves two commonly accepted types of model fit indices: absolute fit and incremental fit (Hoyle & Panter, 1995).

Absolute fit can be used to observe model fit as it concerns the degree to which the hypothesised model reproduces the covariance matrix (Shah & Goldstein, 2006). This includes the basic indices, which are chi-square ( $\chi^2$ ) statistics, degree of freedom (df) and significance level ( $p$  value). According to Hoyle and Panter (1995) and Kline (2005), some ambiguities associated with interpreting chi-square might occur when the study involves a large sample size. Alternative fit indices to quantify the degree of model fit include relative chi-square ( $\chi^2/df$ ) and root mean square error of approximation (RMSEA).

Incremental fit indicates the degree to which the model is superior to the alternative models; the null model in which no covariances among the variables are specified and the model that perfectly fits the data (Hoyle & Panter, 1995; Shah & Goldstein, 2006). Common incremental fit indices are Normed Fit Index (NFI), Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) (Shah & Goldstein, 2006). Generally, the fit indices need to be good for the model to be accepted. If the model represents unsatisfactory fit indices, it will typically be re-specified to improve the model fit rather than be rejected. Further model fit can be evaluated from model parsimony by comparing an over-identified model with a restricted model in order to see the number of estimated coefficients required to achieve a specific level of fit (Kline, 2005).

In this study, a combination of model fit indicators and model comparison criteria using maximum likelihood estimation (MLE) is presented in Table 4.1, as the most widely used model fit assessment (Garson, 2009; Hair et al., 2006; Kline, 2005; Shah & Goldstein, 2006). The application of the MLE method was conducted under the assumption of multivariate normality distribution (Hair, Anderson, Tatham & Black, 1998; Schumacker & Lomax, 1996).

**Table 4.1: Criterion of Model Fit**

<b>GOODNESS-OF-FIT-CRITERION</b>			
Name	Abbreviation	Type of goodness-of-fit	Acceptable level in this study
<b><i>Model Fit</i></b>			
Chi-square (with associated degrees of freedom and probability of significant difference)	$\chi^2$ (df, p)	Model fit	$p > 0.05$ (at equals to 0.05 level)
Relative Chi-square	Cmin/df or $\chi^2/df$	Absolute fit and model parsimony	$1.00 < \chi^2/df < 3.00$
Root Mean Square of Error of Estimation	RMSEA	Absolute fit	RMSEA < 0.05 is good. RMSEA < 0.10 is reasonable.
<b><i>Model Comparison</i></b>			
Tucker-Lewis Index	TLI	Incremental fit	TLI closes to 0.90 is good.
Normed Fit index	NFI	Incremental fit	NFI closes to 0.90 is good.
Comparative Fit index	CFI	Incremental fit	CFI closes to 0.90 is good.

Note:  $TLI = (\chi^2_{null}/df_{null} - \chi^2_{model}/df_{model}) / (\chi^2_{null}/df_{null} - 1)$ .  $\chi^2_{model}$  and  $\chi^2_{null}$  are model chi-square for the given and null models, and  $df_{model}$  and  $df_{null}$  are the corresponding degrees of freedom.

$NFI = (\chi^2_{null} - \chi^2_{model}) / \chi^2_{null}$

$CFI = (1 - \max(\chi^2_{model} - df_{model}, 0) / (\max(\chi^2_{null} - df_{null}, 0) + \max(\chi^2_{model} - df_{model}, 0)))$

Sources: Garson, 2009; Hair et al., 2006; Kline, 2005; Schumacker & Lomax, 2004; Shah & Goldstein, 2006

## **4.2 Operationalisation, Reliability and Validity of Main Independent Measures**

### **4.2.1 Absorptive Capacity (ACAP)**

#### **4.2.1.1 Operationalisation of ACAP**

Building on the work of Cohen and Levinthal (1990), the concept of absorptive capacity has received considerable interest from academics for the last two decades. In the literature, absorptive capacity has been shown to influence organisational learning (Lane & Lubatkin, 1998; Lane, Salk & Lyles, 2001), firm performance, knowledge sharing (Gupta & Govindarajan, 2000; Szulanski, 1996), capability building and innovation (Tsai, 2001).

Although Cohen and Levinthal (1990) highlighted the importance of absorptive capacity and its multidimensionality, most researchers have typically measured it as a uni-dimensional construct through simple R&D proxies (Lane et al., 2006). Previous studies have often used a firm's R&D spending intensity to capture absorptive capacity (e.g. Belderbos, Carree, Diederer, Lokshin & Veugelers, 2004; Oltra & Flor, 2003; Stock et al., 2001; Tsai, 2001). As mentioned in Chapter 2, it has been argued that R&D is not sufficient to capture absorptive capacity, particularly for all kinds of knowledge. Absorptive capacity involves a variety of dimensions and a degree of complexity that have implications for different organisational outcomes. The sources of absorptive capacity build on prior organisational knowledge and experience which contribute to a firm's overall absorptive capacity in due course (Schmidt, 2005). Thus, the use of single dimensional measure such as an R&D proxy is unable to fully gauge the concept of absorptive capacity and may result in misleading findings about its nature and contributions.

Zahra and George (2002) described absorptive capacity (ACAP) and its potential of being a multidimensional construct. Lane et al. (2006) stated that "absorptive capacity should be empirically explored in non-R&D contexts using metrics that capture each dimension of the absorptive capacity process in a manner appropriate for that context" (p.858). The use of R&D measures typically treat "absorptive capacity as a static resource and not as a process or capability" (Lane et al., 2006, p.838). Despite a considerable number of studies that have operationalised ACAP, the measures seem to limit the generalis ability of the results due to

their small sample sizes (Jansen, Van Den Bosch & Volberda, 2005; Szulanski, 1996). An appropriate measure of ACAP and its various dimensions is not clearly evident in the literature (Wang & Ahmed, 2007).

The study by Flatten et al. (2011) developed and validated a multidimensional measure of ACAP. It built on the relevant prior literature and extended the simple proxies commonly used in the literature through a series of pre-tests and two large surveys of German companies. Accordingly, Flatten et al. (2011) scale has been adopted in this study to operationalise the ACAP construct. The ACAP scale by Flatten et al. (2011) captured the four dimensions proposed by Zahra and George (2002), which are also used in this study. The original measure consisted of 14 items representing reflective measures.

Building on the work of Flatten et al. (2011), the scale of absorptive capacity for this study is comprised of 15 items best representing evaluation of the general organisational routines and processes related to information processing and knowledge management. The ACAP construct was operationalised by its subsets of potential and realised absorptive capacities (PACAP/RACAP), which consist of acquisition, assimilation, transformation and exploitation of knowledge dimensions. Slight modifications were made to the items to capture the company and SBU level (NPD program). An additional item was added to the knowledge exploitation dimension to capture the extent to which the company or SBU has the ability to work more effectively by adopting new ideas. In line with the definition of breakthrough innovation, this study explores both new ideas and new technologies for a new product line; therefore, the existing item for the adoption of new technologies was extended. Further, the existing preambles for each of the dimensions were slightly adapted.

Table 4.2 presents the ACAP measure and a total of 15 items.

**Table 4.2: Measure for ACAP Construct (adapted measure)**

Construct	Item	Statement/Question	Source
<b>Absorptive Capacity (ACAP):</b> a set of organisational routines and process by which firms <i>acquire, assimilate, transform</i> and <i>exploit</i> knowledge to produce a dynamic organisational capability			Zahra and George (2002)
<b>Potential Absorptive Capacity (PACAP)</b>			
<b>Acquisition of Knowledge (AQ)</b>	<b>In terms of how your company/SBU acquires knowledge from external sources, please tell us to what extent you agree or disagree with each of the following statements:</b>		Flatten et al. (2011)
	AQ1	The search for relevant information concerning our industry is an everyday business in our company/SBU.	„
	AQ2	Our management motivates employees to use information sources within our industry.	„
	AQ3	Our management expects that employees deal with information beyond our industry.	„
<b>Assimilation of Knowledge (AS)</b>	<b>In terms of how your company/SBU processes the externally acquired knowledge, please tell us to what extent you agree or disagree with each of the following statements:</b>		„
	AS1	In our company/SBU, ideas and concepts are effectively communicated across departments.	„
	AS2	Our management emphasizes cross-departmental support to solve problems.	„
	AS3	In our company/SBU, there is a quick information flow, e.g., if a business unit obtains important information it communicates this information promptly to all other business units or departments.	„
	AS4	Our management demands cross-departmental meetings to exchange information on new developments, problems and achievements.	„



**Table 4.2: Measure for ACAP Construct (continued)**

Construct	Item	Statement/Question	Source
<b>Absorptive Capacity (ACAP)</b>			
<b>Realised Absorptive Capacity (RACAP)</b>			
<b>Transformation of Knowledge (TR)</b>	<b>In terms of how employees within your company/SBU combine their existing knowledge with new knowledge, please tell us to what extent you agree or disagree with each of the following statements:</b>		Flatten et al. (2011)
	TR1	Our employees have an exceptional ability to structure and to use collected knowledge.	„
	TR2	Our employees are used to absorbing new knowledge as well as preparing it for further purposes and to make it available.	„
	TR3	Our employees successfully link existing knowledge with new insights.	„
	TR4	Our employees are able to apply new knowledge in their practical work.	„
<b>Exploitation of Knowledge (EX)</b>	<b>In terms of how your company/SBU exploits new knowledge to develop new products, please tell us to what extent you agree or disagree with each of the following statements:</b>		„
	EX1	Our management supports the development of product prototypes to test a concept or process and make sure things work before starting actual development.	„
	EX2	Our company/SBU regularly reconsiders technologies and ideas and adapts them according to new knowledge.	„
	EX3	Our company/SBU has the ability to work more effectively by adopting new technologies.	„
	EX4	Our company/SBU has the ability to work more effectively by adopting new ideas.	<i>New item</i>

#### 4.2.1.2 Reliability and Validity of ACAP

The reliability of ACAP measure is shown in the following Table 4.3. ACAP exhibits good reliability, with coefficient alphas of acquisition of knowledge 0.868, assimilation of knowledge 0.899, transformation of knowledge 0.942 and exploitation of knowledge 0.917. The coefficient alphas of ACAP ranged from 0.868 to 0.917, showing that they were well above the acceptable level of 0.5 to 0.6 (Nunnally & Bernstein, 1994; Venkatraman & Ramanujam, 1986) and were greater than the range of 0.7 that has been recently advocated (Cortina, 1993; de Vaus, 1995). The results indicate that the particular set of items share the common core of ACAP and capture it well as a construct.

**Table 4.3: Reliability for ACAP measure**

Construct			Number of Items	Cronbach's Alpha
				N = 179
Absorptive Capacity (ACAP)	Potential Absorptive Capacity (PACAP)	Acquisition of Knowledge (AQ)	3	0.868
		Assimilation of Knowledge (AS)	4	0.899
	Realised Absorptive Capacity (RACAP)	Transformation of Knowledge (TR)	4	0.942
		Exploitation of Knowledge (EX)	4	0.917

To assess the validity of the ACAP measure, internal consistency, average variance extracted (AVE) and correlation matrix were examined and are shown in Table 4.4.

**Table 4.4: Internal consistency, square roots of average variance extracted and correlation matrix and model fit of – ACAP**

Construct	Internal Consistency	AVE			
		1	2	3	4
AQ	0.88	<b>0.84</b>			
AS	0.90	0.59	<b>0.83</b>		
TR	0.94	0.58	0.64	<b>0.90</b>	
EX	0.92	0.65	0.71	0.70	<b>0.85</b>

The AVE accounted for by acquisition of knowledge (0.84) was greater than the correlation between acquisition of knowledge and assimilation of knowledge (0.59) and greater than both the correlation between acquisition of knowledge and transformation of knowledge (0.58) and the correlation between acquisition of knowledge and exploitation of knowledge (0.65).

The AVE accounted for by assimilation of knowledge (0.83) was greater than the correlation between assimilation of knowledge and transformation of knowledge (0.64) and greater than the correlation between assimilation of knowledge and exploitation of knowledge (0.71). The AVE accounted for by transformation of knowledge (0.90) was greater the correlation between transformation of knowledge and exploitation of knowledge (0.70).

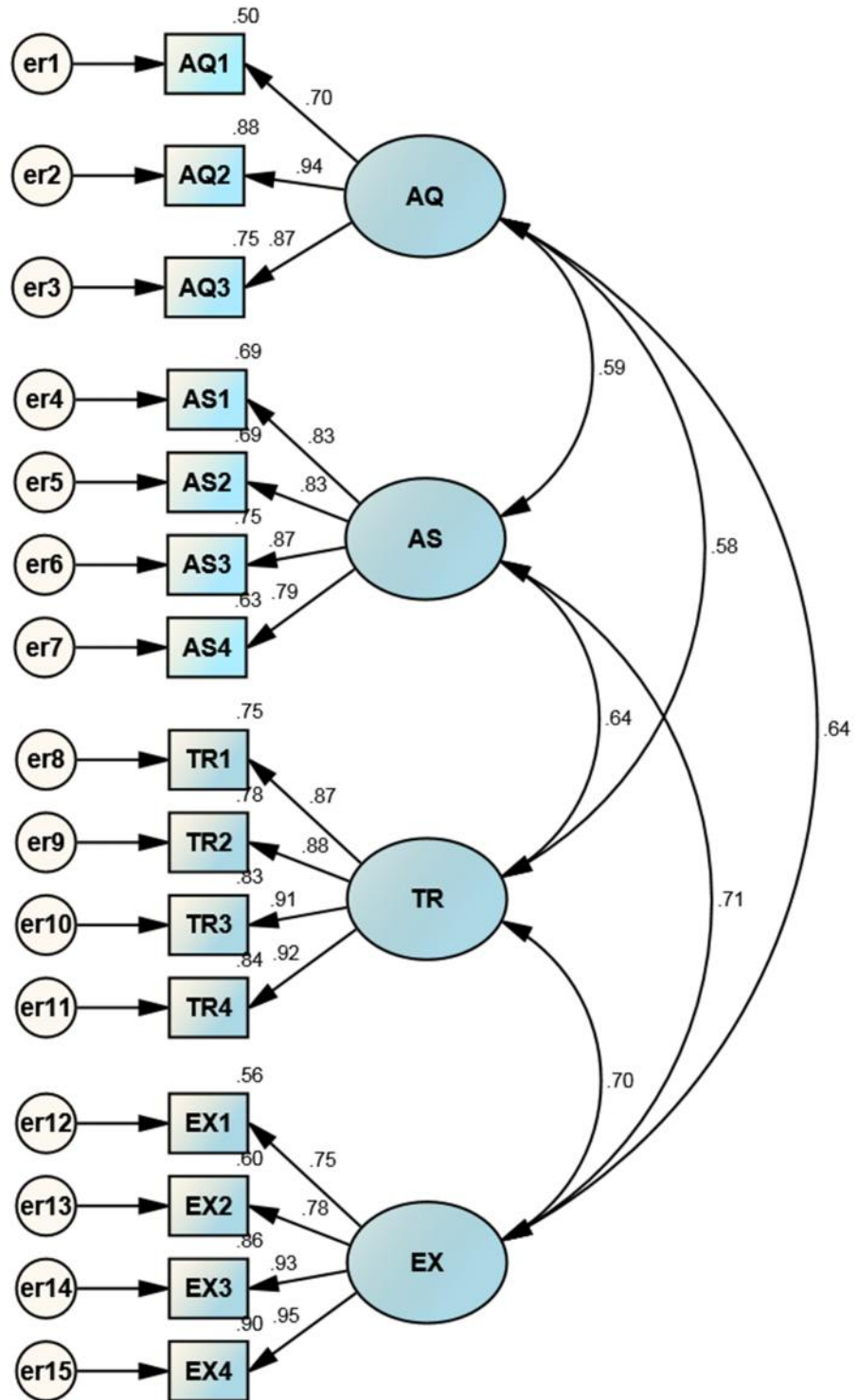
The AVE accounted for by exploitation of knowledge (0.85) was greater than the correlation between exploitation of knowledge and acquisition of knowledge (0.65), between exploitation of knowledge and assimilation of knowledge (0.71) and between exploitation of knowledge and transformation of knowledge (0.70).

Overall, the average variance extracted for each of the four dimensions was well above 0.5, which indicates good convergent validity. Further, the internal consistency measures support the presence of convergent validity of the constructs with internal consistency scores above 0.8 (Sarkar et al., 2001b). The results suggest that acquisition, assimilation, transformation and exploitation of knowledge are distinct measures of absorptive capacity; the 15 items were therefore retained in the study. Furthermore, the goodness-of-fit analysis for ACAP is shown in Table 4.5 below and indicates a good model fit.

**Table 4.5: Goodness-of-fit analysis – ACAP**

<b>GOODNESS-OF-FIT MEASURE</b>	<b>RESULT</b>	<b>GOODNESS-OF-FIT MEASURE</b>	<b>RESULT</b>
<b><u>Model Fit</u></b>		<b><u>Model Comparison</u></b>	
Chi-squared	213.861	Tucker-Lewis Index (TLI)	0.931
Degree of Freedom	83	Normed Fit Index (NFI)	0.915
p-value	0.000	Comparative Fit Index (CFI)	0.946
Cmin/df	2.577		
RMSEA	0.094		

Figure 4.1: Measurement Model – ACAP



## **4.2.2 Market Visioning Competence (MVC)**

### **4.2.2.1 Operationalisation of MVC**

According to Reid and de Brentani (2010), market visioning competence (MVC) is a multidimensional, second-order construct made up of four first-order constructs: market learning tools, proactive market orientation, idea driving and networking dimensions. In terms of the MVC scale, these dimensions consist of 13 items. Some adaptation and modifications were made to these original items, including a preamble to reflect product-innovation-related tasks and thinking related to the front end of breakthrough innovation in a company/SBU. In particular, these original items were modified to capture the NPD program level rather than an individual project.

The preamble to idea driving and networking dimensions was slightly adapted to fit the context of breakthrough innovation. In this study, the definition of breakthrough innovation captures both radical and really new innovations. Accordingly, the unit of analysis, as identified in Chapter 3, is the company/business unit level (NPD program), where research, development and commercialisation of radical innovation, market breakthrough and/or technological breakthrough were undertaken. The existing preamble to idea driving and networking stated that “the person who first championed this technology in our firm...” (Reid & de Brentani, 2010, p.517). It thus appeared to limit the measure to radically new, high-tech products.

A new preamble was developed for the market learning tools and proactive market orientation dimensions. No existing preamble was found that supported both of the dimensions. The purpose of developing the preamble was to improve the accuracy of the responses by providing a clear explanation and instruction leading the participants into the questions. The developed preamble states: “please think about the nature of market visioning for breakthrough innovations within your company/SBU and indicate the degree to which you agree or disagree with these statements”.

Further analysis of the MVC construct suggested dropping an item in the original market learning tool dimension. The item was: “we use forecasting and market estimation techniques before making a market selection” (Reid & de Brentani, 2010, p.518). The item

appeared to have a low eigenvalue (0.651) and is closely related to another item of MVC (ML3): “we use several forecasting and market estimation techniques before making a final market selection” (Reid & de Brentani, 2010, p.518). As discussed in Chapter 3, a number of industry experts and academics familiar with this area of study were asked to assess whether the assigned items measured the constructs. In this regard, there were suggestions from the experts to remove the described item from the original MVC construct because the item might confound the clarity of the MVC measure and result in poor content validity. The removal of such item would also add to instrument parsimony. The modification to the MVC construct was therefore made.

In addition, one of the items of the market learning tool dimension was adapted to fit the context of breakthrough innovation. The original item was: “we tried to keep our market opportunity options open as long as possible for the new technology” (Reid & de Brentani, 2010, p.518). The adapted item now measures: “we try to keep our market opportunity options open as long as possible for potential breakthrough products” (ML1). In a similar vein, one of the items of networking was extended to capture the current state of product-related networking, rather than being limited to new technology. The original item “was at the centre of the network growing up around the technology” (Reid & de Brentani, 2010, p. 517). The adapted item now measures: “are at the centre of the network growing around the products and their technologies” (NW3).

Slight modifications were made to one of the items of idea driving (ID2) and one of the items of networking (NW1) to capture both the company and SBU levels. The original items referred only to the company level. In addition, an item (ID2) was clarified to reflect the early activities of the NPD process. The original item was: “...got key decision makers in our firm involved” (Reid & de Brentani, 2010, p. 517). The adapted item now measures: “...get key decision makers in our company/SBU involved early”. This modification also applied to the item (ID4) of the idea driving dimension.

A new item was also added specifically to the idea driving dimension to capture the unique context of front end decision making in the case of breakthrough innovations. This item captures the extent to which individuals who first champion breakthrough innovations in the company/SBU often make important decisions based on their intuition rather than on data.

As noted in Chapter 2, the importance of intuition has been highlighted particularly at the front end of breakthrough innovation. This is because intuition, at its core of pattern recognition, may lead to the discovery of an unaddressed market need or a new technology path (de Brentani & Reid, 2012; Reid & de Brentani, 2004). The item was adopted from existing measures on intuition proposed by Khatri and Ng (2000) and Dayan and Elbanna (2011).

The MVC construct is comprised of a total of 13 items after the adjustments were made. The industry experts and academics were involved in finalising these items and making sure that they captured the domain of MVC construct.

Table 4.6 presents the MVC measure and the 13 items prior to exposure to MVC measurement model.

**Table 4.6: Measure for MVC Construct (adapted measure)**

Construct	Item	Statement/Question	Source
<b>Market Visioning Competence (MVC):</b> the ability of individuals or NPD teams in organisations to link new ideas or advanced technologies to future market opportunities.			Reid and de Brentani (2010)
<b>Market Learning Tools (ML)</b>	<b>Please think about the nature of market visioning for breakthrough innovations within your company/SBU and indicate the degree to which you agree or disagree with these statements:</b>		<i>New preamble</i>
	ML1	We try to keep our market opportunity options open as long as possible for potential breakthrough products.	Reid and de Brentani (2010)
	ML2	We try to develop several potential product and technological scenarios before choosing market(s) to pursue.	„
	ML3	We use several forecasting and market estimation techniques before making a final market selection.	„
<b>Proactive Market Orientation (MO)</b>	MO1	We continuously try to discover additional needs of our customers of which they are unaware.	„
	MO2	We incorporate solutions to unarticulated customer needs in our new products and services.	„
	MO3	We brainstorm on how customers use our products and services.	„
<b>Idea Driving (ID)</b>	<b>Preamble: “Individuals who first champion breakthrough innovations in our company/SBU...”</b>		„
	ID1	Share information and quickly obtain senior management support.	„
	ID2	Get key decision makers in our company/SBU involved early.	„
	ID3	Often make important decisions based on their intuition more so than data.	<i>New item derived from Dayan and Elbanna (2011) and Khatri and Ng (2000)</i>
	ID4	Secure the required senior management support early.	Reid and de Brentani (2010)
<b>Networking (NW)</b>	NW1	Have a broad network of relationships outside of our company/SBU.	„
	NW2	Have a network made up of people with a variety of different backgrounds (e.g. different industries, different disciplines, and different functions).	„
	NW3	Are at the centre of the network growing up around the products and their technologies.	„



#### 4.2.2.2 Reliability and Validity of MVC

The reliability of the MVC measure is shown in Table 4.7. The MVC measure exhibits good reliability, with coefficient alphas of market learning tools 0.741, proactive market orientation 0.780, idea networking 0.706 and networking 0.874. The coefficient alphas of MVC ranged from 0.706 to 0.874, showing that they are higher than the acceptable level of 0.7 (Nunnally, 1967). This indicates that the particular set of items adequately captures MVC as a construct.

**Table 4.7: Reliability for MVC measure**

Construct	Number of Items	Cronbach's Alpha	
		N = 179	
Market Visioning Competence (MVC)	Market Learning Tools (ML)	3	0.741
	Proactive Market Orientation (MO)	3	0.780
	Idea Driving (ID)	4	0.706
	Networking (NW)	3	0.874

To assess the validity of the MVC measure, internal consistency, average variance extracted (AVE) and correlation matrix were examined and are shown in Table 4.8.

**Table 4.8: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – MVC**

Construct	Internal Consistency	AVE			
		1	2	3	4
ML	0.74	<b>0.69</b>			
MO	0.78	0.98	<b>0.73</b>		
ID	0.80	0.77	0.82	<b>0.68</b>	
NW	0.88	0.76	0.79	0.83	<b>0.84</b>

The average variance extracted for each of the four dimensions was well above 0.5, which suggests good convergent validity. Unexpectedly, the indicators of MVC correlated highly with each other. The AVE accounted for by market learning tool (0.69) was comparatively lower than the correlation between market learning tool and proactive market orientation

(0.98), lower than the correlation between market learning tool and idea driving (0.77) and lower than that between market learning tool and networking (0.76).

As with proactive market orientation, the accounted AVE (0.73) was also lower than the correlation between proactive market orientation and idea driving (0.82) and proactive market orientation and networking (0.79). For idea driving, the accounted AVE (0.68) was relatively lower than the correlation between idea driving and networking (0.83).

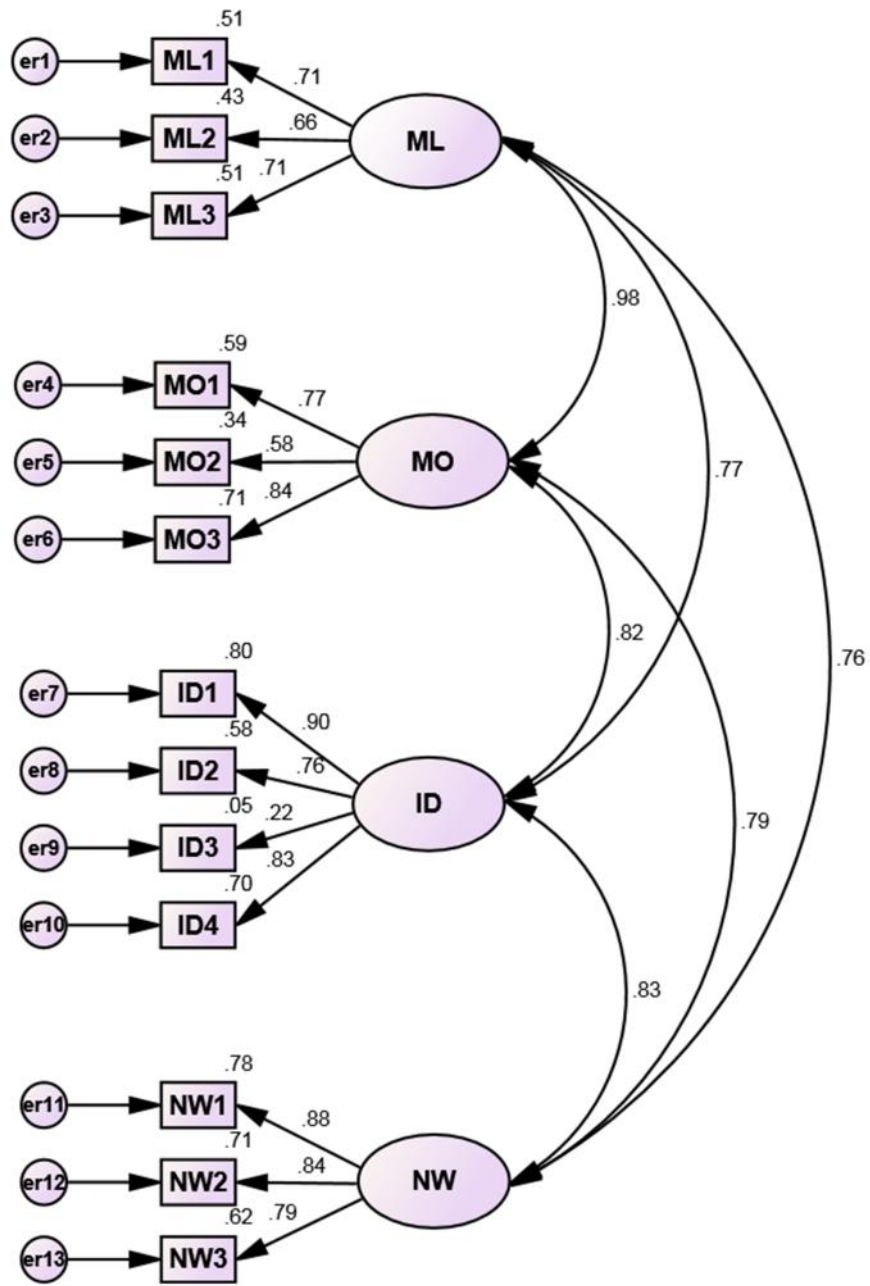
The AVE accounted for by networking (0.84) was marginally higher (0.08, 0.05 and 0.01 respectively) than the correlation between networking and market learning tool (0.76), networking and proactive market orientation (0.79) and networking and idea driving (0.83).

The high correlations among the indicators of MVC indicate an unexpected issue, which might confound the clarity in the relationship with other constructs. Further, some of the internal consistency measures of MVC do not support the presence of convergent validity, with some scores lower than 0.8 (0.6 and 0.2) (Sarkar et al., 2001b). The results appear to show that market learning tools, proactive market orientation, idea driving and networking were somewhat lacking in distinction as market visioning competence measures. The goodness-of-fit analysis for MVC is also shown in Table 4.9, which indicates a lack of model fit.

**Table 4.9: Goodness-of-fit analysis – MVC**

<b>GOODNESS-OF-FIT MEASURE</b>	<b>RESULT</b>	<b>GOODNESS-OF-FIT MEASURE</b>	<b>RESULT</b>
<b><u>Model Fit</u></b>		<b><u>Model Comparison</u></b>	
Chi-squared	154.871	Tucker-Lewis Index (TLI)	0.905
Degree of Freedom	59	Normed Fit Index (NFI)	0.891
p-value	0.000	Comparative Fit Index (CFI)	0.928
Cmin/df	2.625		
RMSEA	0.096		

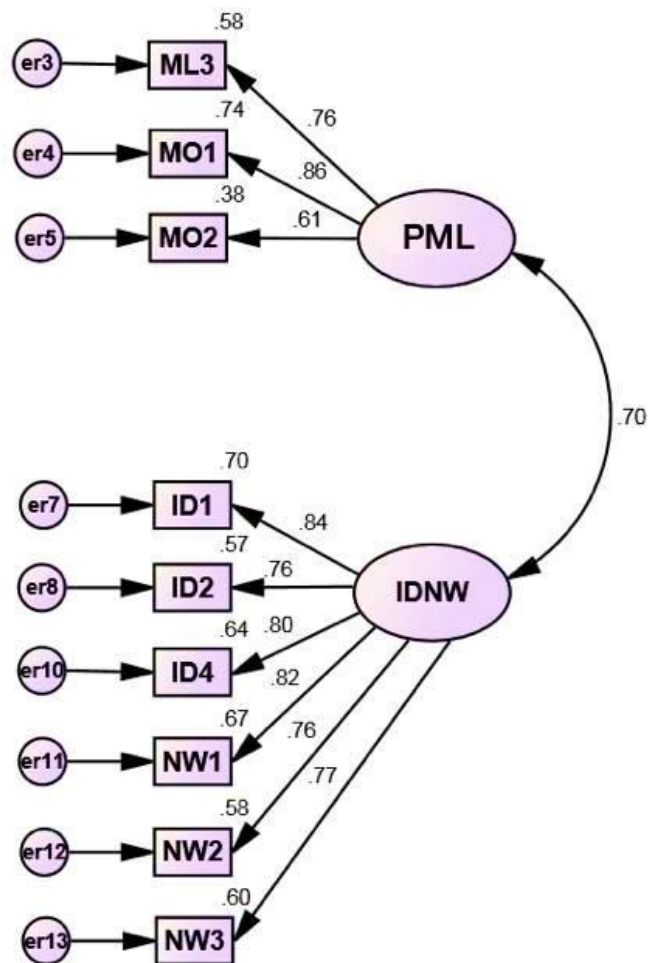
Figure 4.2: Measurement Model – Original MVC (adapted measure)



Accordingly, further factor analysis was undertaken to modify the original MVC construct. Subsequent re-analysis suggested that the market learning tool (ML) and proactive market orientation (MO) indicator be combined into a single dimension, and the same for idea driving (ID) indicator and networking (NW) (see Figure 4.3).

For the purpose of further regression analysis and the development of a structural model, the combination of market learning tool and proactive market orientation dimension is now referred to as “proactive market learning” (PML). The combination of idea driving and networking dimensions is now referred to as “idea networking” (IDNW). The final dimensions of the MVC construct now comprise PML and IDNW, resulting in fewer items in total.

**Figure 4.3: Measurement Model – Final MVC**



The reliability of the final MVC measure is shown in Table 4.10. The final MVC measure exhibits good reliability, with coefficient alphas of proactive market learning 0.794 and idea networking 0.910. The coefficient alphas of MVC were higher than the acceptable level of 0.5 to 0.6 (Nunnally & Bernstein, 1994; Venkatraman & Ramanujam, 1986) and were greater than the range of 0.7 that has recently been advocated (Cortina, 1993; de Vaus, 1995). The results indicate that the particular set of items share the common core of MVC and adequately capture it better than the previous results as a construct.

**Table 4.10: Reliability for Final MVC measure**

Construct		Number of Items	Cronbach's Alpha
			N = 179
Market Visioning Competence (MVC)	Market Learning Tools- Proactive Market Orientation (Proactive Market Learning: PML)	3	0.794
	Idea Driving-Networking (Idea Networking: IDNW)	6	0.910

The validity of the final MVC measure was assessed by internal consistency, average variance extracted (AVE) and correlation matrix as shown in Table 4.11.

**Table 4.11: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – Final MVC**

Construct	Internal Consistency	AVE	
		1	2
PML	0.79	<b>0.74</b>	
IDNW	0.91	0.70	<b>0.79</b>

The average variance extracted for the proactive market learning and idea networking dimensions was well above 0.5, which demonstrated good convergent validity. The AVE accounted for by proactive market learning (0.74) was greater than the correlation between proactive market learning and idea networking (0.70). The AVE accounted for by idea networking (0.79) was also greater than the correlation between idea networking and proactive market learning (0.70).

The internal consistency measures further support the presence of convergent validity of the constructs with internal consistency scores around 0.80 (0.79) and 0.91 (Sarkar et al., 2001b). Overall, the results suggest that both proactive market learning and idea driving are distinct measures of market visioning competence.

The goodness-of-fit analysis is presented in Table 4.12. The analysis indicates a good model fit and a better fit than the results of the previous model [Cmin/df: reduced from 2.625 to 1.997, RMSEA: reduced from 0.096 to 0.075, and TLI, NFI and CFI: increased from 0.905 to 0.962, 0.891 and 0.947, and 0.928 to 0.972, which indicate a close to perfect fit].

**Table 4.12: Goodness of fit analysis – Final MVC**

<b>GOODNESS-OF-FIT MEASURE</b>	<b>RESULT</b>	<b>GOODNESS-OF-FIT MEASURE</b>	<b>RESULT</b>
<b><u>Model Fit</u></b>		<b><u>Model Comparison</u></b>	
Chi-squared	51.915	Tucker-Lewis Index (TLI)	0.962
Degree of Freedom	26	Normed Fit Index (NFI)	0.947
p-value	0.002	Comparative Fit Index (CFI)	0.972
Cmin/df	1.997		
RMSEA	0.075		

## **4.2.3 Market Vision (MV)**

### **4.2.3.1 Operationalisation of MV**

Based on the market vision (MV) measure developed by Reid and de Brentani (2010), MV is a multidimensional, second-order construct reflected by five dimensions: specificity, magnetism, form, scope and clarity, and comprises 17 items. Some adaptation and modifications were made to these original items and their preambles to reflect product-innovation-related tasks and thinking at the front end of breakthrough innovation. Importantly, the original items were also modified to capture the NPD program level rather than an individual project.

The preambles of the MV dimensions were slightly adapted to fit the context of breakthrough innovation. As previously noted, the unit of analysis for this study is radical innovation, market breakthrough and technological breakthrough at business unit level (NPD program). The preamble to clarity, magnetism and specificity, however, stated “in the very early stages of this technology’s development...” (Reid & de Brentani, 2010, p.517). In a similar vein, the preamble to form and scope mentioned that “when we first started thinking about what specific markets would benefit from the technology, we spent most of our time thinking and talking about...” (Reid & de Brentani, 2010, p.517). This appeared to insufficiently capture the broader definition of breakthrough innovation for the present study. The adapted preambles of MV dimensions are presented in Table 4.13.

Specifically, the preamble to clarity was modified to capture the front end of breakthrough innovation scenario. Extensive literature review suggested that clarity is likely to appear as a result of appropriate time spent by the NPD team in thinking and talking about breakthrough innovations. A preamble to clarity now read: “after spending time discussing the specific markets for the breakthrough innovations within your NPD team...” The purpose of this preamble was to improve the accuracy of the responses by providing a clear instruction leading the participants into the questions (measure).

Additionally, one of the items in specificity and one in magnetism were removed from the MV scale. These items were: “the market vision was clear” (MV specificity) and “the market vision was important” (MV magnetism) (Reid & de Brentani, 2010, p.517). The MV

items were reviewed by experts who commented that the two items contained ambiguous statements. Thus, removal of these items would aid instrument parsimony. The MV construct now consists of 15 items, the original scale having comprised 17 items.

Further examination on the remaining 15 items was also done by the experts. Feedback was received and it suggested that some adaptations and clarifications were required to be made on the remaining items. For instance, the original item of specificity was: "...the market vision was able to provide direction to others in the organisation". The item was modified to: "our market vision provides clear direction to others in the company/SBU regarding what is being developed and for whom" (SP2). The original item of magnetism was: "...the market vision was attractive" (Reid & de Brentani, 2010, p.517). This was modified to: "our market vision clearly highlights the attractiveness of the market opportunity" (MG1). The original item of clarity was: "...it was clear who the target market (user) would be" (Reid & de Brentani, 2010, p.517). The adapted item now measures: "...it is generally clear who the target customers would be *for the breakthrough innovations*" (CL1). This rationale was applied to each of the MV items. The purpose of these adaptations was to clarify the meaning of the items and ensure their content validity, particularly in term of capturing the context of breakthrough innovation.

Table 4.13 presents the MV measure and a total of 15 items prior to exposure to the MV measurement model.



**Table 4.13: Measure for MV Construct (adapted measure)**

Construct	Item	Statement/Question	Source
<b>Market Vision (MV):</b>		a clear and specific early-stage mental model or image of a product-market that enables NPD teams to grasp what it is they are developing and for whom.	Reid and de Brentani (2010)
<b>Specificity (SP)</b>	<b>Please think about the market vision in the very early stages of developing breakthrough innovations in your company/SBU and indicate the degree to which you agree or disagree with these statements:</b>		Reid and de Brentani (2010)
	SP1	We have a very specific Market Vision statement that guides each NPD project.	„
	SP2	Our Market Vision provides clear direction to others in the company/SBU regarding what is being developed and for whom.	„
	SP3	Our Market Vision helps make tangible what is to be developed and for whom.	„
<b>Magnetism (MG)</b>	MG1	Our Market Vision clearly highlights the attractiveness of the market opportunity.	„
	MG2	Our Market Vision generates buy-in from other people and groups in the company/SBU.	„
<b>Form (FO)</b>	<b>Preamble: “When you first start thinking about what specific markets would benefit from your breakthrough innovations, you and your NPD team are able to spend an appropriate amount of time thinking and talking about...”</b>		„
	FO1	How end-users would ultimately interact with and use the breakthrough innovations.	„
	FO2	How the breakthrough innovations would fit into an overall system of use for potential customers.	„
	FO3	How customers might use the breakthrough innovations in their environments.	„
	FO4	The potentials for standardising the design of the breakthrough innovations.	„
<b>Scope (SC)</b>	SC1	What the most profitable target market would be for the breakthrough innovations.	„
	SC2	What the largest target market would be for the breakthrough innovations.	„
	SC3	What the most important target market would be for the breakthrough innovations.	„
<b>Clarity (CL)</b>	<b>Preamble: “After spending time discussing the specific markets for the breakthrough innovations within your NPD team...”</b>		<i>New preamble</i>
	CL1	It is generally clear who the target customers would be for the breakthrough innovations.	„
	CL2	It is generally clear what target customers’ needs would be for the breakthrough innovations.	„
	CL3	It is generally clear how breakthrough innovations would be used by the target customers.	„

#### 4.2.3.2 Reliability and Validity of MV

The reliability of the MV measure is shown in Table 4.14. MV measure exhibits good reliability, with coefficient alphas of specificity 0.891, magnetism 0.815, form 0.893, scope 0.900 and clarity 0.916. The coefficient alphas of MV ranged from 0.815 to 0.916, showing that they were well above the acceptable level of 0.5 to 0.6 (Nunnally & Bernstein, 1994; Venkatraman & Ramanujam, 1986) and were greater than the range of 0.7 that has recently been advocated (Cortina, 1993; de Vaus, 1995). The results indicate that the particular set of items adequately captures MV as a construct.

**Table 4.14: Reliability for MV measure**

Construct		Number of Items	Cronbach's Alpha
			N = 179
Market Vision (MV)	Specificity (SP)	3	0.891
	Magnetism (MG)	2	0.815
	Form (FO)	4	0.893
	Scope (SC)	3	0.900
	Clarity (CL)	3	0.916

To assess validity of the MV measure, internal consistency, average variance extracted (AVE) and correlation matrix were examined, and are shown in Table 4.15.

**Table 4.15: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – MV**

Construct	Internal Consistency	AVE				
		1	2	3	4	5
SP	0.90	<b>0.86</b>				
MG	0.82	1.03	<b>0.83</b>			
FO	0.89	0.70	0.72	<b>0.83</b>		
SC	0.90	0.50	0.57	0.77	<b>0.87</b>	
CL	0.92	0.56	0.54	0.66	0.61	<b>0.89</b>

The average variance extracted for each of the five indicators was well above 0.5, which suggests convergent validity. The average variance extracted for by specificity (0.86) was, however, lower than the correlation between specificity and magnetism (1.03), but was greater than the correlation between specificity and form (0.70), specificity and scope (0.50) and specificity and clarity (0.56). The results indicate a high correlation between the specificity and magnetism dimensions of the MV construct.

The average variance extracted for by magnetism (0.83) was higher than the correlation between magnetism and form (0.72), between magnetism and scope (0.57) and between magnetism and clarity (0.54). The average variance extracted by form (0.83) was greater than the correlation between form and scope (0.77) and between form and clarity (0.66).

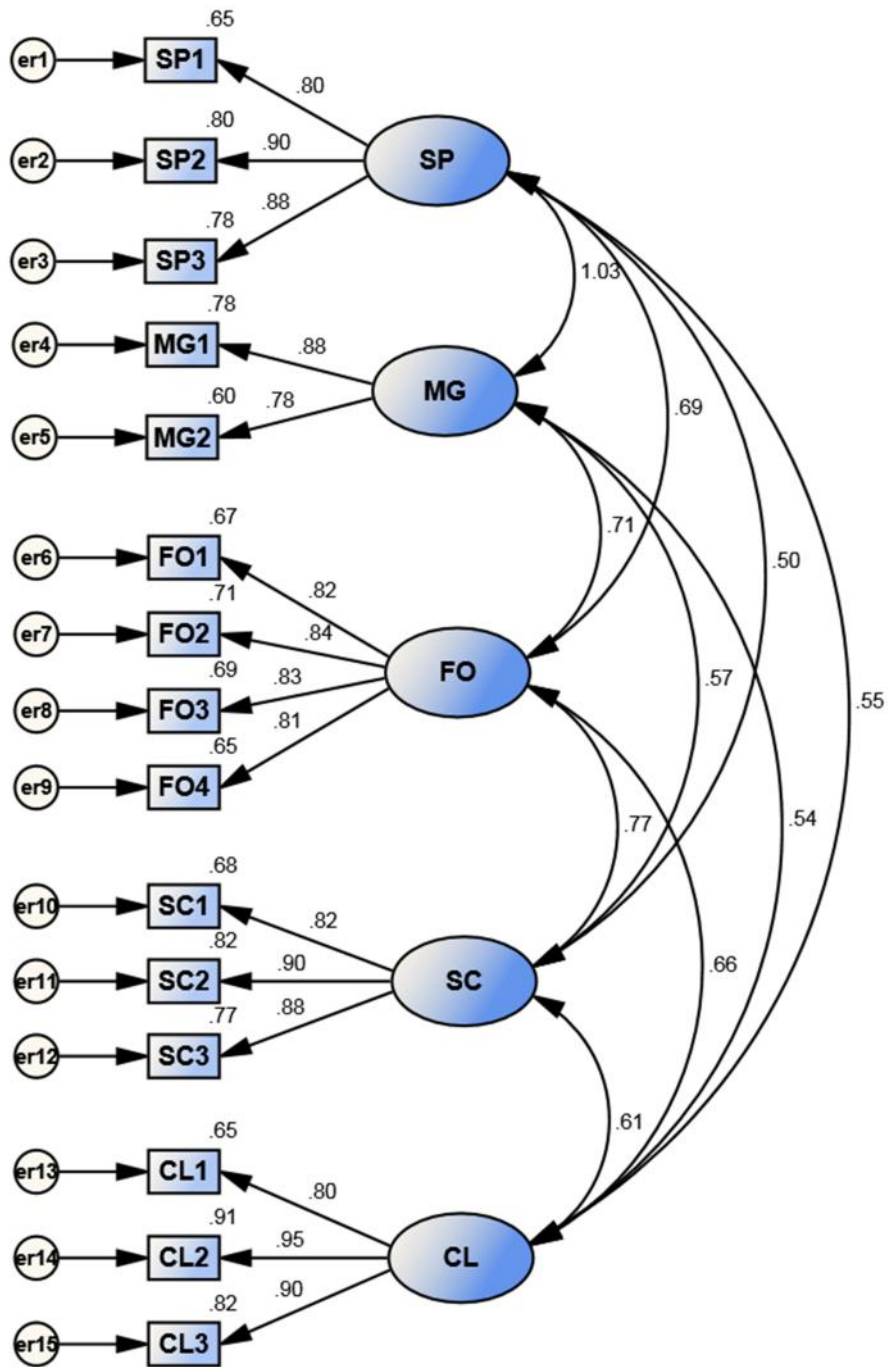
The average variance extracted for by scope (0.87) was greater than the correlation between scope and clarity (0.61). The average variance extracted for by clarity (0.89) was well above the correlation between clarity and specificity (0.56), between clarity and magnetism (0.54), between clarity and form (0.66) and between clarity and scope (0.61).

The high correlation between specificity and magnetism suggested an issue which might confound the clarity in the relationship with other constructs. Although the internal consistency measures of MV appeared to support the presence of convergent validity with scores higher than 0.8, and the goodness-of-fit analysis of MV indicated a somewhat acceptable fit (see Table 4.16). Further analysis was then undertaken to ensure that the dimensions were distinct measures of market vision.

**Table 4.16: Goodness-of-fit analysis – MV**

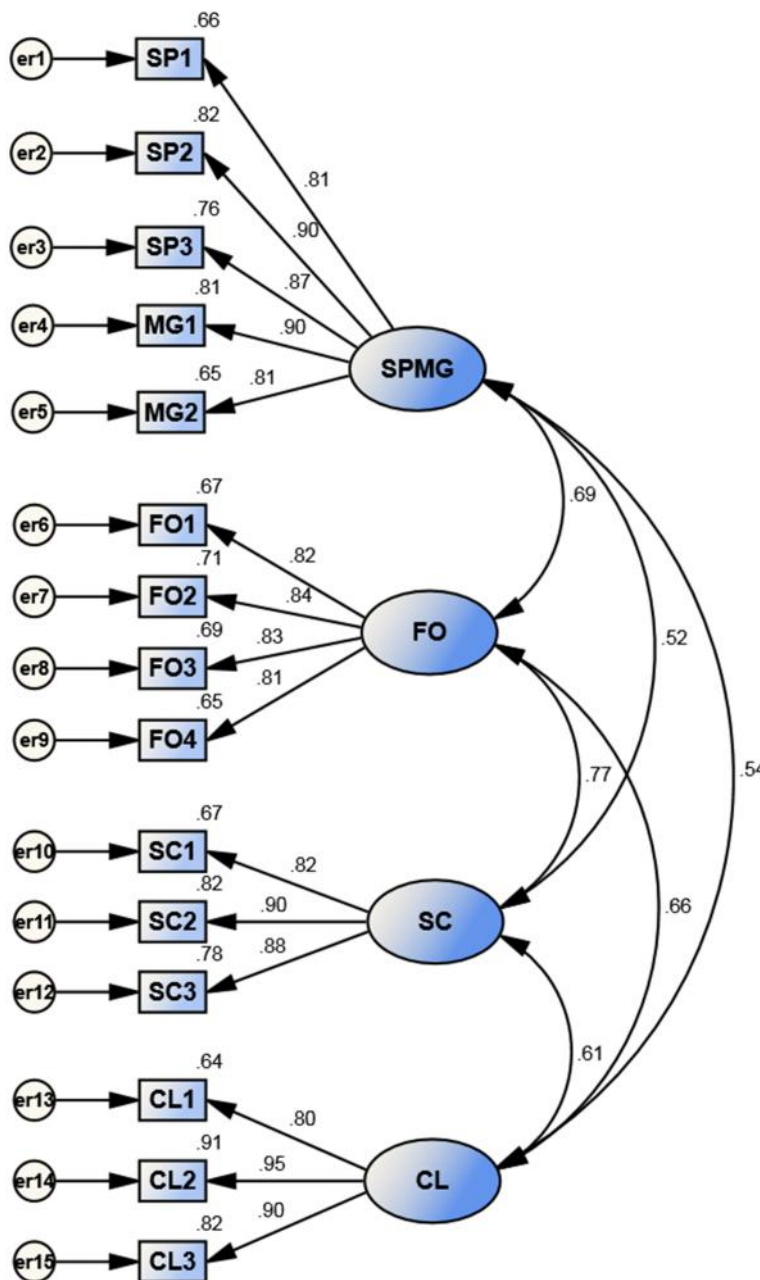
GOODNESS-OF-FIT MEASURE		RESULT	GOODNESS-OF-FIT MEASURE	RESULT
<b><u>Model Fit</u></b>			<b><u>Model Comparison</u></b>	
Chi-squared		195.397	Tucker-Lewis Index (TLI)	0.934
Degree of Freedom		80	Normed Fit Index (NFI)	0.919
p-value		0.000	Comparative Fit Index (CFI)	0.950
Cmin/df		2.442		
RMSEA		0.090		

Figure 4.4: Measurement Model – Original MV (adapted measure)



Further factor analysis was undertaken to examine the original MV construct. Subsequent re-analysis suggested the modification of the original MV construct by combining the specificity (SP) and magnetism (MG) dimensions into a single dimension (SPMG); the total of 15 items was the final measure of MV (see Figure 4.5). For the purpose of further regression analysis and the development of a structural model, the combination of specific and magnetism dimension is now referred to as “specific magnetism”(SPMG).

**Figure 4.5: Measurement Model – Final MV**



The reliability of the final MV measure is shown in Table 4.17. The final MV measure exhibits good reliability, with coefficient alphas of specific magnetism 0.929, form 0.893, scope 0.900 and clarity 0.916. The coefficient alphas of MV were greater than the range of 0.7 that has recently been advocated (Cortina, 1993; de Vaus, 1995). The results indicate that the finalised items share the common core of MV and adequately capture it as a construct.

**Table 4.17: Reliability for Final MV measure**

Construct		Number of Items	Cronbach's Alpha
			N = 179
Market Vision (MV)	Specific Magnetism (SPMG)	5	0.929
	Form (FO)	4	0.893
	Scope (SC)	3	0.900
	Clarity (CL)	3	0.916

The validity of the final MV measure was assessed using internal consistency, average variance extracted (AVE) and correlation matrix. These assessments are shown in Table 4.18. The average variance extracted for each of the four dimensions was well above 0.5, which demonstrates good convergent validity.

**Table 4.18: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – Final MV**

Construct	Internal Consistency	AVE			
		1	2	3	4
SPMG	0.93	<b>0.86</b>			
FO	0.89	0.70	<b>0.83</b>		
SC	0.90	0.52	0.77	<b>0.87</b>	
CL	0.92	0.54	0.66	0.61	<b>0.88</b>

The AVE accounted for by specific magnetism (0.86) was greater than the correlation between specific magnetism and form (0.70), between specific magnetism and scope (0.52) and between specific magnetism and clarity (0.54). Without modifications to the rest of the dimensions, the AVE accounted for by form, scope and clarity, including the correlations among each of the three indicators, remained the same.

The internal consistency measures further supported the presence of convergent validity of the constructs with internal consistency scores higher than 0.80 (Sarkar et al., 2001b). Overall, the results suggest that specific magnetism, form, scope and clarity are distinct measures of market vision. The goodness-of-fit analysis is presented in Table 4.19. The analysis indicates an acceptable model fit and a slightly improved fit compared to the previous model results in terms of Cmin/df (reduced from 2.442 to 2.413), RMSEA (reduced from 0.090 to 0.089) and TLI (increased from 0.934 to 0.935).

**Table 4.19: Goodness of fit analysis – Final MV**

<b>GOODNESS-OF-FIT MEASURE</b>	<b>RESULT</b>	<b>GOODNESS-OF-FIT MEASURE</b>	<b>RESULT</b>
<b><u>Model Fit</u></b>		<b><u>Model Comparison</u></b>	
Chi-squared	205.065	Tucker-Lewis Index (TLI)	0.935
Degree of Freedom	85	Normed Fit Index (NFI)	0.915
p-value	0.000	Comparative Fit Index (CFI)	0.948
Cmin/df	2.413		
RMSEA	0.089		

#### 4.2.4 Summary of Reliability and Validity for Main Independent Measures

The overall reliability for the main independent measures is shown in Table 4.20. The coefficient alphas of all the measures were greater than 0.7 (Cortina, 1993; de Vaus, 1995). The final results indicate that the particular set of the items for each of the dimensions adequately captures the underlying core of their constructs.

**Table 4.20: Overall Reliability for Main Independent Measures (Final)**

Construct			Number of Items	Cronbach's Alpha
				N = 179
Absorptive Capacity (ACAP)	Potential Absorptive Capacity (PACAP)	Acquisition of Knowledge (AQ)	3	0.868
		Assimilation of Knowledge (AS)	4	0.899
	Realised Absorptive Capacity (RACAP)	Transformation of Knowledge (TR)	4	0.942
		Exploitation of Knowledge (EX)	4	0.917
Market Visioning Competence (MVC)	Proactive Market Learning (PML)		3	0.794
	Idea-Networking (IDNW)		6	0.910
Market Vision (MV)	Specific Magnetism (SPMG)		5	0.929
	Form (FO)		4	0.893
	Scope (SC)		3	0.900
	Clarity (CL)		3	0.916

In addition, the validity of the independent measures was assessed through internal consistency, average variance extracted (AVE) and correlation matrix. Overall, the average variance extracted for each of the dimensions of the independent measures was shown to be above 0.5, which demonstrates good convergent validity. The internal consistency measures further supported the presence of convergent validity of the constructs with internal consistency scores higher than 0.80 (Sarkar et al., 2001b). The results suggest that each of the dimensions is a distinct measure of its constructs. Furthermore, the goodness-of-fit analysis of all the independent measures indicates an acceptable model fit.



## **4.3 Operationalisation, Reliability and Validity of Dependent Measures**

### **4.3.1 Before-Launch Stage Performance (BLSP)**

#### **4.3.1.1 Operationalisation of BLSP**

Corresponding to the conceptualisation of before-launch stage performance (BLSP) in Chapter 2, this construct captures the breakthrough integrity (BI) and early success with customers (ESC) dimensions. Both of these dimensions determine specific program level performance outcomes related to market-driving innovation at the before-launch stage.

#### ***Breakthrough integrity***

This study refers to “breakthrough integrity” (BI) as a clear and highly innovative concept of a potential new product is maintained after it enters the development and commercialisation phases. The definition of BI was developed with reference to the studies by Brown and Eisenhardt (1995), Clark and Fujimoto (1990), Clark and Fujimoto (1991), Lynn and Akgün (2001) and Seidel (2007). Brown and Eisenhardt (1995) asserted that “by focusing on establishing product integrity, senior management can ensure that an overall vision for the product is communicated to the project team and, thus, balance the autonomy gained through heavyweight leadership” (p. 363). The vision for new product and the meshing of an organisation’s competencies and strategies with the needs of the market can lead the project team to attain an effective product concept. In particular, the ability to maintain the radical and innovative characteristics of an original product concept is important for firms developing breakthrough innovations. This is because the development of a breakthrough innovation involves high risk and uncertainty and longevity of product development, often resulting in decisions to modify or “dumbed down” its innovativeness (McDermott & O’Connor, 2002; O’Connor & Veryzer, 2001).

The review of empirical studies has suggested that none of the current studies has captured the defined breakthrough integrity as a performance consequence of market vision. The concept of breakthrough integrity is only beginning to emerge and yet there is no existing or previously tested scale. The most relevant measure is related to the concept of “vision

stability” by Lynn and Akgün (2001). The study highlighted the importance of vision stability as a clear and supported vision throughout an NPD project, and measured it with three items: (1) “the pre-prototype design goals remained stable through launch”, (2) “the pre-prototype technical goals remained stable through launch” and (3) “the pre-prototype vision of this project remained stable through launch” (p.385). Nevertheless, the measure was insufficient to explain the concept of breakthrough integrity.

According to the previously identified constituents and the definition of breakthrough integrity, the concept of breakthrough integrity was operationalised. For the purpose of this research, the scale measurement of breakthrough integrity was developed to include three items, referring to the extent to which breakthrough innovations are able to: (1) maintain their innovativeness from the initial idea through to the final product launched, (2) maintain their originality from the initial idea through to the launch of the product and (3) resist pressure from management to modify the idea and reduce their breakthrough integrity. The final version of the items was also informed, prior to its administration, by feedback received from the industry experts and academics during the pre-test (as described in Chapter 3).

### ***Early Success with Customers***

In addition to the BI measure, early success with customers (ESC) was adopted as another dimension of BLSP. As noted in Chapter 2, this customer-related measure can be particularly useful in the case of market-driving innovation. The customer-related measure generally captures the degree to which the products are readily accepted and satisfied by customers (Griffin & Page, 1996), especially lead users or those looking for early and innovative solutions. The relevant measure for ESC was developed by Reid (2005) with three items, which are: (1) “early customers were satisfied (even prior to sales)”, (2) “early customers accepted the products stemming from the technology (even prior to sales)” and (3) “customers’ needs were (will be) satisfied better by these products than existing ones” (Reid, 2005, p.144). The ESC measure by Reid (2005) is, however, limited to products stemming from technology i.e. high-tech products. The present study extends the ESC measure to capture the early performance of both radical and really new innovations. The original items were therefore adapted based on the definition of ESC in this study, that is, the degree to which “early customers were always satisfied and readily accepted the

breakthrough innovations even prior to launching them”. Table 4.21 presents the BLSP measure and its BI and ESC dimensions, with a total of six items.

**Table 4.21: Measure for BLSP (adapted measure)**

Construct	Item	Statement/Question	Source
<b>Before-Launch Stage Performance (BLSP):</b> the extent in which a clear and highly innovative concept of a potential new product is maintained after it enters the development and commercialisation phases of being satisfied and accepted by early customers			Clark and Fujimoto (1991); Reid and de Brentani (2010); Seidel (2007)
<b>Breakthrough Integrity (BI)</b>	<b>Please think about how the breakthrough innovations developed by your company/SBU over the last three years have performed, from the early phase of the NPD process through to launch:</b>  <b>In terms of Breakthrough Integrity, please tell us to what extent “breakthrough innovations were able to...</b>		<i>New preamble</i>
	BI1	Maintain their innovativeness from the initial idea through to the final product launched.	Clark and Fujimoto (1990, 1991); Lynn and Akgün (2001); Seidel (2007)
	BI2	Maintain their originality from the initial idea through to the launch of the product.	„
	BI3	Resist the pressure from management to modify the idea and reduce their breakthrough integrity.	„
<b>Early Success with Customers (ESC)</b>	<b>In terms of Early Success with Customers, please tell us how strongly you disagree or agree with each of the following statements:</b>		<i>New preamble</i>
	ESC1	Early customers were always satisfied with our breakthrough innovations even prior to formally launching them.	Reid (2005)
	ESC2	Early customers readily accepted our breakthrough innovations even prior to formally launching them.	„
	ESC3	Early customers’ needs were better met through our breakthrough innovations than our existing ones.	„

#### 4.3.1.2 Reliability and Validity of BLSP

The reliability of the BLSP measure is shown in Table 4.22. The BLSP measure exhibits good reliability, with coefficient alphas of breakthrough integrity 0.789 and early success with customers 0.855. The results show that the coefficient alphas are higher than the acceptable level of 0.7 (Nunnally, 1967), which suggest that the particular set of items share a common core of BLSP and adequately capture it well as a construct.

**Table 4.22: Reliability for BLSP measure**

Construct			Number of Items	Cronbach's Alpha
				<i>N = 179</i>
<b>Market-Driving Innovation Performance (MDIP)</b>	Before-Launch Stage Performance (BLSP)	Breakthrough Integrity (BI)	3	0.789
		Early Success with Customers (ESC)	3	0.855

To assess the validity of the BLSP measure, the internal consistency, average variance extracted (AVE) and correlation matrix were examined (see Table 4.23). Overall, the average variance extracted for each of the two indicators was well above 0.5, which indicates good convergent validity.

**Table 4.23: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – BLSP**

Construct	Internal Consistency	AVE	
		1	2
<b>BI</b>	0.81	<b>0.76</b>	
<b>ESC</b>	0.86	0.58	<b>0.82</b>

The AVE accounted for by breakthrough integrity (0.76) was well above the correlation between breakthrough integrity and early success with customers (0.58). The AVE accounted for by early success with customers (0.82) was also well above the correlation between early success with customers and breakthrough integrity (0.58).

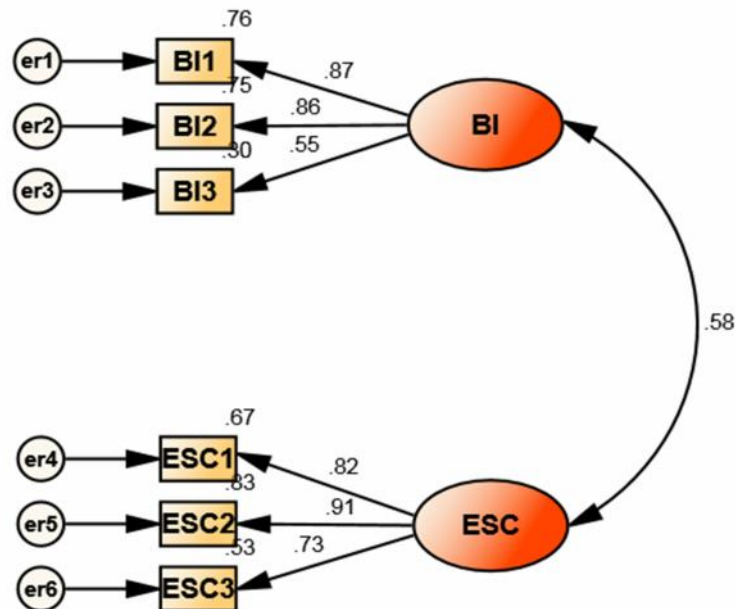
The internal consistency measures further supported the presence of convergent validity of the constructs with internal consistency scores above 0.8 (Sarkar et al., 2001b). The results suggest that breakthrough integrity and early success with customers are distinct measures of before-launch stage performance; the total of six items therefore remains.

The goodness-of-fit analysis for BLSP is shown in Table 4.24, which indicates that the model fits the data very well.

**Table 4.24: Goodness of fit analysis – BLSP**

GOODNESS-OF-FIT MEASURE		RESULT	GOODNESS-OF-FIT MEASURE		RESULT
<u>Model Fit</u>			<u>Model Comparison</u>		
Chi-squared		16.175	Tucker-Lewis Index (TLI)		0.962
Degree of Freedom		7	Normed Fit Index (NFI)		0.970
p-value		0.024	Comparative Fit Index (CFI)		0.982
Cmin/df		2.311			
RMSEA		0.086			

**Figure 4.6: Measurement Model – BLSP**



## 4.3.2 Post-Launch Stage Performance (PLSP)

### 4.3.2.1 Operationalisation of PLSP

As described in Chapter 2, post-launch stage performance (PLSP) was included as a dependent measure as part of market-driving innovation performance (the performance consequence of market vision) in the conceptual model. Accordingly, the PLSP construct captures the speed-to-market (STM) and windows of opportunity (WO) dimensions. Both of these dimensions determine specific program level performance outcomes related to market-driving innovation at the post-launch stage.

#### *Speed-to-market*

After reviewing empirical studies in regard to STM, the measurement scale developed by Lynn et al. (1999b) was selected as most the appropriate for one of the dimensions of PLSP. Based on the study by Lynn et al. (1999b), the STM measure was developed as a dependent measure of the influence of vision (goal). Specifically, vision was explained at the project level as having the three distinct dimensions of goal clarity, goal stability and goal support. The focus of the goal dimensions is on ensuring that the project goal is clear and remains stable to what is intended to be achieved, and that resources are provided to help the team to reach its goal. Importantly, vision stability was the practice that accounted for the most unique variance of speed-to-market, suggesting that a stable goal is critical for accelerating the new product development process (Lynn et al., 1999b). Notwithstanding the project level analysis of goal dimensions, the concept of project vision and its influence on speed-to-market is in line with the focus of an effective market vision and its performance consequence (STM) in this study.

Lynn et al. (1999b) original measure of speed-to-market was designed to capture four items: the extent to which (1) “top management was very pleased with the time it took us to bring this product to market”, (2) “the project was launched on or ahead of the original schedule”, (3) “the project was completed in less than what was considered normal and customary for our industry” and (4) “the project was developed and launched much faster than the major competitor for a similar product” (Lynn et al., 1999b, p.453). Correspondingly, the items were slightly modified to fit the context of breakthrough innovation in terms of the speed at which breakthrough innovations are moved to market.

Moreover, a new preamble was developed for the speed-to-market measure as there was no existing preamble following the measure developed by Lynn et al. (1999b). The aim of setting the preamble to speed-to-market measure was to provide a clear instruction leading the participants to think about the development of breakthrough innovation in terms of speed-to-market. The preamble states: “on average, over the last three years, in terms of how quickly breakthrough innovations were developed and launched, please tell us how strongly you disagree or agree with each of the following statements”. This was also worded to be consistent with the preamble to the windows of opportunity measure.

### ***Windows of opportunity***

This study adopted the windows of opportunity measure as another dimension of post-launch stage performance. The windows of opportunity measure is commonly used in empirical studies published in product innovation and management literature (de Brentani et al., 2010; Kleinschmidt, de Brentani & Salomo, 2010). The study by Kleinschmidt et al. (2007) used the resource-based view to investigate the influence of organisational resources and NPD process capabilities and routines on the performance of global new product development programs in terms of windows of opportunity and financial performance. The study also found a significant and positive impact of homework activities on windows of opportunity, where “homework activities” was described as “early evaluation of new product ideas, creating project definitions and studies assessing product potential in markets worldwide” (Kleinschmidt et al., 2007, p.426). In other words, the work at the front end of innovation (predevelopment work) influences the global NPD program performance in terms of windows of opportunity.

The context of the research and the theory-in-use (RBV) in the study of Kleinschmidt et al. (2007) seems to be consistent with the predominant lens (RBV) and framework of this study in respect to the impact of organisational processes (absorptive capacity) and early product innovation strategy (market visioning competence/market vision) on the success of market-driving innovation performance in terms of windows of opportunity and financial performance. Consequently, the windows of opportunity measure was adopted for this study, following the work of Kleinschmidt et al. (2007). Their original item referred to the extent to which, “on average, the international NPD program was successful in (1) opening new markets for our firm (division/SBU), (2) leading our firm into new product arenas –

that is, products we did not have three years ago, and (3) opening new technologies firm” (Kleinschmidt et al., 2007, p.441). For the purpose of this study, some of these items and the preamble were simplified and adapted to fit the unique context of breakthrough innovation.

Table 4.25 presents the PLSP measure and its STM and WO dimensions, with a total of seven items.

**Table 4.25: Measure for PLSP (adapted measure)**

Construct	Item	Statement/Question	Source
<b>Post Launch Stage Performance (PLSP):</b> the speed at which breakthrough innovations are moved to market and ultimately open new markets, product or technological arenas.			Kleinschmidt et al. (2007); Lynn et al. (1999b)
<b>Speed-to-Market (STM)</b>	<b>On average, over the last three years, in terms of how quickly breakthrough innovations were developed and launched, please tell us how strongly you disagree or agree with each of the following statements:</b>		<i>New preamble</i>
	STM1	Our breakthrough innovations were developed and launched faster than the major competitor for similar products.	Lynn et al. (1999b)
	STM2	Our breakthrough innovations were completed in less time than what is considered normal and customary for our industry.	„
	STM3	Our breakthrough innovations were launched on or ahead of the original schedule developed at initial project go-ahead.	„
	STM4	Top management was pleased with the time it took for breakthrough innovations to get to full commercialisation.	„
<b>Window of Opportunity (WO)</b>	<b>In terms of opening up new opportunities for your company/SBU, please tell us how successful your breakthrough innovations were in:</b>		Kleinschmidt et al. (2007)
	WO1	Opening new markets to your company/SBU?	„
	WO2	Leading your company/SBU into new product arenas (i.e., products you did not have three years ago)?	„
	WO3	Opening new technologies for your company/SBU to leverage?	„



### 4.3.2.2 Reliability and Validity of PLSP

The reliability of the PLSP measure is shown in Table 4.26. The PLSP measure exhibits good reliability, with coefficient alphas of speed-to-market 0.885 and windows of opportunity 0.868. The results of the coefficient alphas are greater than the acceptable level of 0.7 (Nunnally, 1967), which suggests that the particular set of items share the common core of PLSP and adequately capture it well as a construct.

**Table 4.26: Reliability for PLSP measure**

Construct			Number of Items	Cronbach's Alpha
				N = 179
Market-Driving Innovation Performance (MDIP)	Post-Launch Stage Performance (PLSP)	Speed-to-Market (STM)	4	0.885
		Windows of Opportunity (WO)	3	0.868

To assess the validity of the PLSP measure, the internal consistency and average variance extracted (AVE) were examined (shown in Table 4.27). Overall, the AVE for each of the two constructs was well above 0.5, which indicates good convergent validity.

**Table 4.27: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – PLSP**

Construct	Internal Consistency	AVE	
		1	2
STM	0.89	<b>0.82</b>	
WO	0.87	0.59	<b>0.83</b>

The AVE accounted for by speed-to-market (0.82) was well above the correlation between speed-to-market and windows of opportunity (0.59). The AVE accounted for by windows of opportunity (0.83) was well above the correlation between windows of opportunity and speed-to-market (0.59).

The internal consistency measures further supported the presence of convergent validity of the constructs with internal consistency scores above 0.8 (Sarkar et al., 2001b). The results

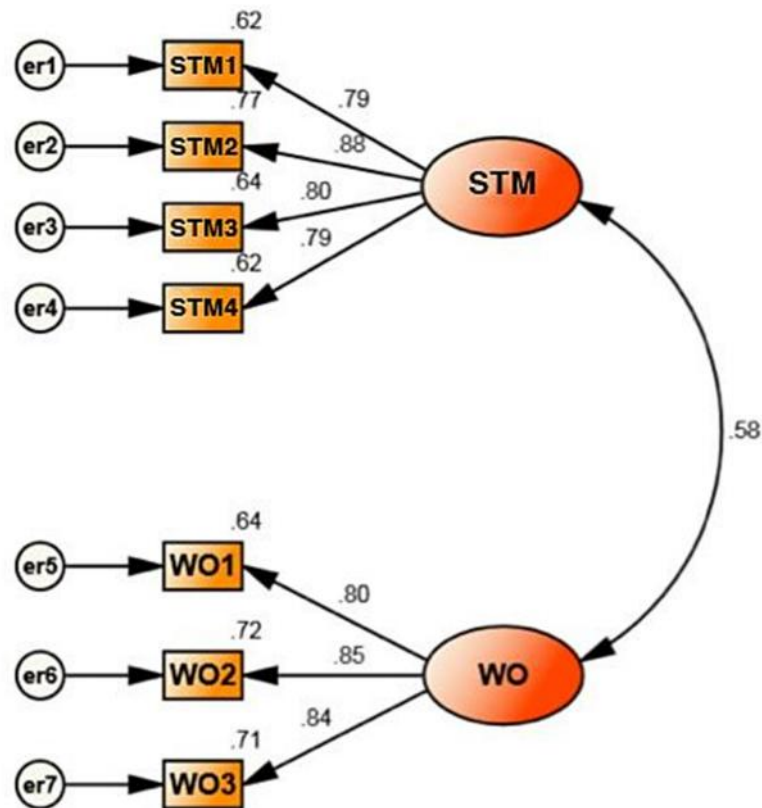
suggest that speed-to-market and windows of opportunity are distinct measures of post-launch stage performance; the total of 7 items therefore remains.

The goodness-of-fit analysis for PLSP is shown in Table 4.28, which indicates that the model fits reasonably well.

**Table 4.28: Goodness-of-fit analysis – PLSP**

GOODNESS-OF-FIT MEASURE	RESULT	GOODNESS-OF-FIT MEASURE	RESULT
<b>Model Fit</b>		<b>Model Comparison</b>	
Chi-squared	33.100	Tucker-Lewis Index (TLI)	0.955
Degree of Freedom	13	Normed Fit Index (NFI)	0.955
p-value	0.002	Comparative Fit Index (CFI)	0.972
Cmin / df	2.546		
RMSEA	0.093		

**Figure 4.7: Measurement Model – PLSP**



### 4.3.3 Financial Performance (FP)

#### 4.3.3.1 Operationalisation of FP

As reported in Chapter 2, this study adopted the financial performance (FP) measure as the final success measure of market-driving innovation performance.

Similar to the windows of opportunity measure, this study adopted the measure proposed by Kleinschmidt et al. (2007) for financial performance. The financial performance measure comprises the four original items, which capture the extent to which: (1) “over the last three years, in terms of sales (revenue) performance, how successful was your global NPD program in meeting its objectives?”, (2) in terms of profitability, “how successful was your global NPD program in meeting its profit objectives?”, (3) “what was the profitability of your global NPD program, relative to competitors?” and (4) “what was the impact on your global NPD program in terms of cost savings achieved?” (Kleinschmidt et al., 2007, p.441). For the purpose of this research, these items and the preamble were simplified and adapted to fit the unique context of breakthrough innovation.

Table 4.29 presents the FP measure and a total of four items.

**Table 4.29: Measure for FP (adapted measure)**

Construct	Item	Statement/Question	Source
<b>Financial Performance (FP):</b> the extent to which breakthrough innovations meet their sales (value/volume) and profit objectives relative to the resources invested in them.			Kleinschmidt et al. (2007)
<b>Financial Performance</b>	<b>Preamble: “In terms of sales and profitability performance in your company/SBU, how successful were your breakthrough innovations in...”</b>		„
	FP1	Meeting your sales volume objectives (units sold)?	„
	FP2	Meeting your sales value objectives (revenue generated)?	„
	FP3	Meeting your profit objectives?	„
	FP4	Being profitable relative to the resources invested in them?	„

### 4.3.3.2 Reliability and Validity of FP

The reliability of the FP measure is shown in Table 4.30. The FP measure exhibited good reliability, with coefficient alpha of 0.931. The results of the coefficient alpha are much greater than the acceptable level of 0.7 (Nunnally, 1967), which suggest that the particular set of items share the common core of FP and adequately capture it well as a construct.

**Table 4.30: Reliability for FP measure**

Construct			Number of Items	Cronbach's Alpha
				N = 179
<b>Market-Driving Innovation Performance (MIP)</b>	Final Success	Financial Performance (FP)	4	0.931

### 4.3.4 Summary of Reliability and Validity for Dependent Measures

#### 4.3.4.1 Operationalisation of Market-Driving Innovation Performance (MDIP)

In summary, market-driving innovation performance (MDIP) in this study captures the adopted measures of before-launch stage performance (BLSP: breakthrough integrity and early success with customers), post-launch stage performance (PLSP: speed-to-market and windows of opportunity) and financial performance of market-driving innovation. This provides a total of 17 items for MDIP measure.

In other words, MDIP refers to the extent to which “a clear and highly innovative concept of a potential new product is maintained after it enters the development phase of being satisfied and accepted by early customers and quickly moves into commercialisation, opening a new market or product/technological arena and ultimately generating financial returns” for a firm.

The purpose of capturing MDIP was specifically to form the construct that measures several dimensions of market-driving innovation based on the key nonfinancial (strategic) and

financial outcomes and to categorise the outcomes by a different time horizon (Cordero, 1990; Utterback & Abernathy, 1975).

#### 4.3.4.2 Reliability and Validity of MDIP

The reliability of the MDIP measure overall is shown in Table 4.31. The MDIP measure exhibits good reliability, with coefficient alphas of breakthrough integrity 0.789, early success with customers 0.855, speed-to-market 0.885, windows of opportunity 0.868 and financial performance 0.931. The results show that all the coefficient alphas are higher than the acceptable level of 0.7 (Nunnally, 1967), which suggests that each set of items share the common core of MDIP and adequately captures it well as a construct.

**Table 4.31: Reliability for MDIP measure**

Construct			Number of Items	Cronbach's Alpha
				N = 179
<b>Market-Driving Innovation Performance (MDIP)</b>	Before-Launch Stage Performance (BLSP)	Breakthrough Integrity (BI)	3	0.789
		Early Success with Customers (ESC)	3	0.855
	Post-Launch Stage Performance (PLSP)	Speed-to-Market (STM)	4	0.885
		Windows of Opportunity (WO)	3	0.868
	Final Success	Financial Performance (FP)	4	0.931

To assess the validity of the MDIP measure, the internal consistency, average variance extracted (AVE) and correlation matrix were examined and are shown in Table 4.32. Overall, the average variance extracted for each of the five constructs was well above 0.5, which indicates good convergent validity.

**Table 4.32: Internal consistency, square roots of average variance extracted and correlation matrix and model fit – MDIP**

Construct	Internal Consistency	AVE				
		1	2	3	4	5
<b>BI</b>	0.81	<b>0.76</b>				
<b>ESC</b>	0.86	0.58	<b>0.82</b>			
<b>STM</b>	0.89	0.52	0.54	<b>0.82</b>		
<b>WO</b>	0.87	0.51	0.57	0.59	<b>0.83</b>	
<b>FP</b>	0.93	0.51	0.47	0.54	0.63	<b>0.88</b>

The AVE accounted for by breakthrough integrity (0.76) was greater than the correlation between breakthrough integrity and early success with customers (0.58), and was also greater than the correlation between breakthrough integrity and speed-to-market (0.52), the correlation between breakthrough integrity and windows of opportunity (0.51) and the correlation between breakthrough integrity and financial performance (0.51). The AVE accounted for by early success with customers (0.82) was greater than the correlation between early success with customers and speed-to-market (0.54), and was also greater than the correlation between early success with customers and windows of opportunity (0.57) and between early success with customers and financial performance (0.47).

The AVE accounted for by speed-to-market (0.82) was greater than the correlation between speed-to-market and windows of opportunity (0.59), and the correlation between speed-to-market and financial performance (0.54). The AVE accounted for by windows of opportunity (0.83) was greater than the correlation between windows of opportunity and financial performance (0.63). The AVE accounted for by financial performance (0.88) was greater than the correlation between financial performance and breakthrough integrity (0.51), the correlation between financial performance and early success with customers (0.47), the correlation between financial performance speed-to-market (0.54) and the correlation between financial performance and windows of opportunity (0.63).

The internal consistency measures further support the presence of convergent validity of the constructs with internal consistency scores above 0.8 (Sarkar et al., 2001b). The results suggest that breakthrough integrity, early success with customers, speed-to-market,

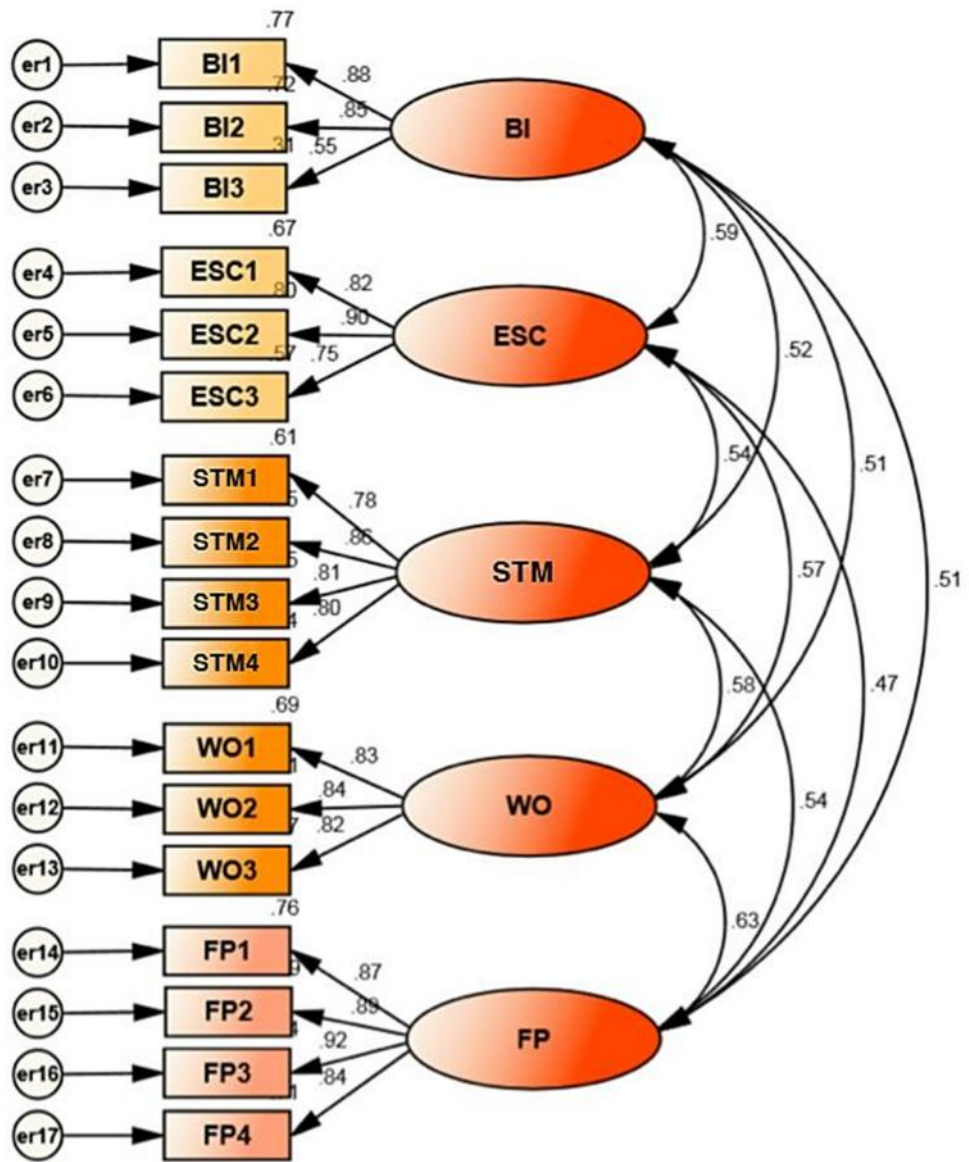
windows of opportunity and financial performance are distinct measures of market-driving innovation performance; the total of 17 items therefore remains.

The goodness-of-fit analysis for MDIP is shown in Table 4.33, which indicates that the model fits reasonably well.

**Table 4.33: Goodness of fit analysis – MDIP**

GOODNESS-OF-FIT MEASURE		RESULT	GOODNESS-OF-FIT MEASURE		RESULT
<u>Model Fit</u>			<u>Model Comparison</u>		
Chi-squared		213.893	Tucker-Lewis Index (TLI)		0.937
Degree of Freedom		109	Normed Fit Index (NFI)		0.903
p-value		0.000	Comparative Fit Index (CFI)		0.949
Cmin / df		1.962			
RMSEA		0.074			

Figure 4.8: Measurement Model – MDIP





## **4.4 Operationalisation, Reliability and Validity of Moderation Measures**

In this study, the proposed moderators which are expected to influence the impact of market vision on before-launch stage performance (BLSP) and post-launch stage performance (PLSP) are: (1) external environment (EE), (2) NPD process rigidity (NPDR) and (3) firm size (number of employees).

### **4.4.1 External Environment (EE)**

#### **4.4.1.1 Operationalisation of EE**

The role of the external environment (EE) as a moderator on the effectiveness of different strategic choices or market orientation has been highlighted in many new product development studies (e.g. Li & Atuahene-Gima, 2001; Lukas & Ferrell, 2000; Yap & Souder, 1994). As described in Chapter 2, the moderating role of the external environment was proposed to influence the impact of MV on before-launch stage performance and post-launch stage performance. There are a few scales that can be used to measure the external environment. The original external environment scale was developed by Jaworski and Kohli (1993) with a total of 17 items. The study investigates the roles of technological turbulence, market turbulence and competitive intensity as moderators between traditional market orientation and general business performance.

The review of empirical studies on environmental moderators in conjunction with the feedback received from academic and industry experts indicated that Zhang and Duan (2010) external environmental measure appeared to be the most appropriate measure for this study. The study further refined the EE measure on parsimonious grounds using the scales derived from Jaworski and Kohli (1993). This was done through factor analysis, which resulted in the removal of some ambiguous items such as “our competitors are relatively weak” and “we cater too many of the same customers that we used to in the past” (Jaworski & Kohli, 1993, p.68). As typically characterised, the EE measure has three commonly used dimensions: competitive intensity, technological turbulence and market turbulence. Their final measure consists of 11 items in total (Zhang & Duan, 2010).

Further justification for adopting the scale of Zhang and Duan (2010) was their study's purpose and context, which appeared to be closely related to the framework of this thesis. One of the aims of Zhang and Duan (2010) study was to "empirically examine whether proactive and responsive market orientation impact new product performance directly and indirectly via firm's innovativeness" (Zhang & Duan, 2010, p.850). The study emphasised the importance of differentiating the types of market orientation strategies and their impact on new product performance, rather than following only the traditional market orientation. As noted in Chapter 2, proactive market orientation emerged as an essential concept in the case of breakthrough innovation and was captured in the market visioning competence construct. Additionally, the study adopted the concept of a firm's innovativeness (Hurley & Hult, 1998) and assessed its role as a mediator between market orientation strategy and new product performance. Similar to this study, Zhang and Duan (2010) highlighted the importance of improving a firm's innovative capacity, that is, its capacity to develop and introduce new ideas or product innovations.

More importantly, Zhang and Duan (2010) study aimed to "investigate the moderating role of external environmental variables in the MO-product innovation performance link" (p.850). Zhang and Duan (2010) stated that "understanding these relationships can provide useful insights into how organizations should choose their priority of market orientation strategy in order to promote new product performance under different environment conditions" (p.850). This appears to be consistent with the framing of this thesis in that the early strategic direction (the emergent MV) was proposed to influence market-driving innovation performance in different environment conditions.

Lastly, Zhang and Duan (2010) gathered empirical evidence from manufacturing firms in mainland China using a quantitative survey. The informants were highly familiar with new product development, R&D and marketing strategy, and were asked about product innovation performance during the last three years. This context appears to be similar to the framework of this thesis, including a developing country as the region of data collection. In consequence, the external environment measure developed by Zhang and Duan (2010) was adopted for this study with 11 items in total. A new preamble was developed to support the use of the external environment measure.

Table 4.34 presents the EE measure including its preamble and a total of 11 items.

**Table 4.34: Measure for EE (adapted measure)**

Construct	Item	Statement/Question	Source
<b>External Environment (EE):</b> the degree of uncertainty of the external environment in terms of technological turbulence, market turbulence and competitive intensity.			Jaworski and Kohli (1993); Zhang and Duan (2010)
Technological Turbulence (TT)	<b>Please think about the external business environment facing your company/SBU by indicating the degree to which you agree or disagree with the following statements:</b>		<i>New preamble</i>
	TT1	The technology in our industry is changing rapidly.	Zhang and Duan (2010)
	TT2	Technological changes provide big opportunities in our industry.	„
	TT3	A large number of new product ideas have been made possible through technological breakthroughs in our industry.	„
Market Turbulence (MT)	MT1	In our kind of business, customers product preferences change quite a bit over time.	„
	MT2	Our customers tend to look for new products all the time.	„
	MT3	We are witnessing demand for our products and services from customers who never bought them before.	„
	MT4	New customers tend to have product-related needs that are different from those of our existing customers.	„
Competitive Intensity (CI)	CI1	Competition in our industry is cut-throat.	„
	CI2	There are many “promotion wars” in our industry.	„
	CI3	Anything that one competitor can offer, others can match readily.	„
	CI4	Price competition is a hallmark of our industry.	„

#### 4.4.1.2 Reliability of EE

The reliability of the EE measure is shown in Table 4.35. The EE measure exhibits good reliability, with coefficient alphas of technological turbulence 0.817, market turbulence 0.761 and competitive intensity 0.771. The results show that the coefficient alphas are higher than the acceptable level of 0.7 (Nunnally, 1967), which suggests that the set of items share the common core of EE and adequately captures it well as a construct.

**Table 4.35: Reliability for EE measure**

Construct			Number of Items	Cronbach's Alpha
				N = 179
Moderators	External Environment (EE)	Technological Turbulence (TT)	3	0.817
		Market Turbulence (MT)	4	0.761
		Competitive Intensity (CI)	4	0.771

## 4.4.2 NPD Process Rigidity (NPDR)

### 4.4.2.1 Operationalisation of NPDR

As defined in Chapter 2, NPD process rigidity (NPDR) reflects the formality of a process, such as having clearly defined gates, which may result in rigidity or inflexibility inherent in the NPD process. Similar to the windows of opportunity and financial performance measures, the measure for NPD process rigidity was adopted based on 'NPD process formality' measure developed by Kleinschmidt et al. (2007). The original scale of NPD process formality consisted of three items. For the purpose of this research, the scale was adapted to consist of five items; three items were the existing items and the additional two items were formulated mainly from the studies by Sethi and Iqbal (2008) and Wind and Mahajan (1997). The two newly formulated items are the degree to which an NPD process: (1) is quite linear and inflexible; there is little scope to do things differently and (2) reinforces the *status quo* by solving customers' existing problems or stated preferences in current markets. The existing preamble to the NPD process formality measure was also simplified and adapted to fit the context of breakthrough innovation.

Table 4.36 presents the NPDR measure and a total of five items.

**Table 4.36: Measure for NPDR (adapted measure)**

Construct	Item	Statement/Question	Source
<b>NPD Process Rigidity:</b> the degree of having highly formalised or inflexible stage-gate process and clearly defined go/no-go decision points (or gates).			Sethi and Iqbal (2008); Wind and Mahajan (1997)
<b>NPD Process Rigidity (NPR)</b>	<b>Please think about the New Product Development (NPD) Process and stages associated with the development of the breakthrough innovations in your company/SBU and indicate the degree to which you agree or disagree with these statements:</b>		Kleinschmidt et al. (2007)
	NPR1	Our company/SBU uses a formal NPD process-that is, standardised set of stages and go/no-go decisions to guide all new product activities from idea to launch.	„
	NPR2	Our NPD process has clearly defined go/no-go decision points (or gates) for each stage in the process.	„
	NPR3	Our NPD process has defined gatekeepers who review projects at each gate and make go/no-go decision.	„
	NPR4	Our NPD process is quite linear and inflexible; there is little scope to do things differently.	<i>New item derived from Sethi and Iqbal (2008)and Wind and Mahajan (1997)</i>
	NPR5	Our NPD process reinforces the status quo by solving customers' existing problems or stated preferences in current markets.	„

#### 4.4.2.2 Reliability of NPDR

The reliability of the NDPR measure is shown in Table 4.37. The NDPR measure exhibits good reliability with coefficient alphas of 0.817. The results show that the coefficient alphas are higher than the acceptable level of 0.7 (Nunnally, 1967) and that the particular set of items share the common core of NPDR and adequately capture it well as a construct.

**Table 4.37: Reliability for NPDR measure**

Construct	Number of Items	Cronbach's Alpha
		N = 179
Moderators	NPD Process Rigidity	5 0.817

### 4.4.3 Firm Size

#### 4.4.3.1 Operationalisation of Firm Size

The data regarding number of employees was collected categorically in nature. A single question regarding the firm size was used: “How many employees are there within your company or SBU?” The informants were asked to refer to their strategic business unit (SBU) or, when the firm had a single SBU, to their firm. The categories were treated statistically as an ordinal scale with the scale points running from 1 – 7, where 1 relates to a company of small size and 7 relates to a company of large size (7 categories: 1- 20, 21 – 40, 41 – 60, 61 -100, 101 – 200, 201 – 500, 500+). This is similar in approach used by other researchers (e.g. Gronum, Verreynne & Kastle, 2012). The categories of firm size used in this way also become amenable for correlation analysis in which positive or negative correlations with other variables represent the influence of larger or smaller firms. For use in moderation analysis firms were split into two groups (Burgelman & Sayles, 1986; Simon, 1945), where small- and medium-sized firms were clustered together ( < 60 employees) and large-sized firms were clustered (over 60 employees).

#### 4.4.4 Summary of Reliability for Moderation Measures (EE/NPDR)

The overall reliability of the moderation measures for external environment and NPD process rigidity is shown in Table 4.38. The coefficient alphas of all the measures were greater than 0.7 (Cortina, 1993; de Vaus, 1995). The results indicate that the set of items for each of the dimensions/indicators adequately captures the underlying core of their constructs.

**Table 4.38: Reliability for Moderation Measures**

Construct			Number of Items	Cronbach's Alpha
				N = 179
Moderators	External Environment (EE)	Technological Turbulence (TT)	3	0.817
		Market Turbulence (MT)	4	0.761
		Competitive Intensity (CI)	4	0.771
	NPD Process Rigidity		5	0.817

## **4.5 Summary of Properties of Measurement**

### **4.5.1 Nomological Validity**

“Nomological validity” refers to “the degree to which predictions based on a concept are confirmed within the context of a larger theory” (Bagozzi, 1979, p.14). The evaluation of nomological validity was undertaken via the correlation coefficients. The purpose was to evaluate the extent to which the relationships described in theory can be proved by the construct of interest (Peter & Churchill, 1986). Theoretically, the hypothesised relationships should be supported by the analysis of the empirical data, which entails a rigorous theoretical framework for the research models (Peter & Churchill, 1986; Ruekert & Churchill, 1984).

In this study, nomological validity was ensured through the solid theoretical framework which was developed as described in Chapter 2 on the basis of which the identification of relationships between the latent variables is possible. Overall, the results appear to support the expected magnitude and significance of the correlations among the constructs and dimensions, thereby lending support to concurrent validity.

Table 4.39 presents the descriptive scales and correlations coefficients and the reliability estimates. The value of the reliability estimates (Cronbach alpha/composite reliability) for each construct was well above the required level (0.70) that has been advocated (Cortina, 1993; de Vaus, 1995; Sarkar et al., 2001b), providing evidence of construct validity overall.

**Table 4.39: Descriptive scales and correlations coefficients, and reliability estimates**

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Financial Performance																				
2 Windows of Opportunity	0.57**																			
3 Speed-to-Market	0.50**	0.53**																		
4 Early Success with Customers	0.47**	0.51**	0.52**																	
5 Breakthrough Integrity	0.48**	0.44**	0.47**	0.56**																
6 Absorptive Capacity - Acquire Knowledge	0.31**	0.48**	0.34**	0.36**	0.26**															
7 Absorptive Capacity - Assimilate Knowledge	0.33**	0.48**	0.46**	0.38**	0.25**	0.54**														
8 Absorptive Capacity - Transform Knowledge	0.39**	0.48**	0.55**	0.39**	0.35**	0.53**	0.58**													
9 Absorptive Capacity - Exploit Knowledge	0.33**	0.57**	0.49**	0.48**	0.40**	0.65**	0.65**	0.67**												
10 Market Visioning Competence - Proactive Market Learning	0.40**	0.50**	0.44**	0.39**	0.40**	0.45**	0.49**	0.53**	0.60**											
11 Market Visioning Competence - Idea Networking	0.33**	0.51**	0.47**	0.43**	0.40**	0.58**	0.63**	0.61**	0.76**	0.57**										
12 Market Vision - Specific Magnetism	0.27**	0.50**	0.44**	0.40**	0.35**	0.54**	0.61**	0.55**	0.69**	0.62**	0.67**									
13 Market Vision - Form	0.32**	0.46**	0.42**	0.45**	0.33**	0.56**	0.55**	0.59**	0.64**	0.58**	0.73**	0.65**								
14 Market Vision - Scope	0.14	0.25**	0.28**	0.23**	0.13	0.48**	0.40**	0.42**	0.50**	0.45**	0.52**	0.50**	0.71**							
15 Market Vision - Clarity	0.34**	0.42**	0.39**	0.31**	0.27**	0.46**	0.44**	0.50**	0.51**	0.51**	0.55**	0.54**	0.61**	0.55**						
16 Number of Employees (Firm Size)	-0.04	-0.09	-0.18*	-0.26**	-0.25**	-0.18*	-0.20**	-0.03	-0.20**	-0.16*	-0.24**	-0.24**	-0.16*	-0.15*	-0.14					
17 External environment - Technical Turbulence	0.17*	0.32**	0.25**	0.25**	0.11	0.39**	0.29**	0.42**	0.34**	0.34**	0.31**	0.30**	0.35**	0.28**	0.27**	0.04				
18 External environment - Market Turbulence	0.21**	0.31**	0.29**	0.31**	0.26**	0.42**	0.30**	0.42**	0.34**	0.38**	0.41**	0.33**	0.36**	0.27**	0.34**	-0.04	0.58**			
19 External environment - Competitive Intensity	0.06	0.07	0.08	0.12	0.05	0.19*	0.12	0.20**	0.15*	0.20**	0.15*	0.12	0.24**	0.24**	0.15*	0.22**	0.35**	0.46**		
20 NPD Process Rigidity	0.29**	0.33**	0.47**	0.27**	0.26**	0.35**	0.41**	0.51**	0.43**	0.44**	0.44**	0.45**	0.49**	0.43**	0.44**	0.11	0.45**	0.42**	0.40**	
<b>Mean</b>	4.89	5.10	4.52	5.14	4.36	5.58	5.13	4.89	5.46	5.22	5.33	5.28	5.35	5.46	5.60	3.91	5.45	5.35	5.40	5.12
<b>S.D.</b>	1.15	0.93	1.35	1.06	1.09	1.10	1.27	1.20	1.03	1.00	1.04	1.07	0.94	0.99	0.91	2.33	1.05	0.91	1.09	0.99
<b>Cronbach</b>	0.93	0.87	0.89	0.86	0.79	0.87	0.90	0.94	0.92	0.79	0.91	0.93	0.89	0.90	0.92	N/A	0.82	0.76	0.77	0.82
<b>CR</b> $\alpha$	0.93	0.87	0.89	0.86	0.81	0.88	0.90	0.94	0.92	0.79	0.91	0.93	0.89	0.90	0.92	N/A	N/A	N/A	N/A	N/A
<b>AVE</b>	0.88	0.83	0.82	0.82	0.76	0.84	0.83	0.90	0.85	0.74	0.79	0.86	0.83	0.87	0.88	N/A	N/A	N/A	N/A	N/A

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).



## 4.5.2 Inter-Construct Correlation

Table 4.40 displays the correlations of the various dimensions of the constructs in a correlation matrix. All constructs exhibited the average variance extracted (AVE) of above 0.50, considered indicative for convergent validity. Further, the AVE for each of the measures has to be greater than its shared variance with any of the other construct to suggest a discriminant validity (Fornell & Larcker, 1981). While this condition was satisfied for most of the constructs and their dimensions, there were some minor issues. The average variance accounted by exploitation of knowledge (0.85) was marginally higher than the correlation between exploitation of knowledge and idea networking (0.81). The average variance accounted by proactive market learning (0.74) was equivalent to the correlation between proactive market learning and specific magnetism (0.74). The average variance accounted by idea networking (0.79) was slightly lower than the correlation between idea networking and form (0.81).

Despite these slightly lower AVEs, there is still theoretical and explanatory utility in keeping these constructs separate. As all other measures indicated sufficient construct validity, the decision was made not to further purify the measures in order to maintain the theoretical richness of the constructs. Overall, there is support for the assumption of convergent validity and an assessment that all constructs and their dimensions are satisfactorily construct discriminant, and thus they are retained for the development of the structural equation modelling.

**Table 4.40: Inter-construct correlation**

Construct	Internal Consistency	AVE														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		ACAP				MVC		MV				MDIP				
		AQ	AS	TR	EX	PML	IDNW	SPMG	FO	SC	CL	BI	ESC	STM	WO	FP
AQ	0.88	<b>0.84</b>														
AS	0.90	0.59	<b>0.83</b>													
TR	0.94	0.58	0.64	<b>0.90</b>												
EX	0.92	0.65	0.71	0.70	<b>0.85</b>											
PML	0.79	0.53	0.60	0.62	0.68	<b>0.74</b>										
IDNW	0.91	0.66	0.70	0.66	0.81	0.70	<b>0.79</b>									
SPMG	0.93	0.58	0.67	0.57	0.69	0.74	0.72	<b>0.86</b>								
FO	0.89	0.62	0.61	0.65	0.66	0.69	0.81	0.70	<b>0.83</b>							
SC	0.90	0.50	0.44	0.44	0.49	0.52	0.57	0.52	0.77	<b>0.87</b>						
CL	0.92	0.46	0.48	0.54	0.51	0.56	0.59	0.54	0.66	0.61	<b>0.88</b>					
BI	0.81	0.32	0.30	0.34	0.42	0.47	0.43	0.38	0.34	0.16	0.29	<b>0.76</b>				
ESC	0.86	0.36	0.43	0.41	0.54	0.46	0.49	0.43	0.49	0.25	0.33	0.58	<b>0.82</b>			
STM	0.89	0.38	0.53	0.59	0.52	0.50	0.53	0.46	0.47	0.31	0.43	0.52	0.54	<b>0.82</b>		
WO	0.87	0.52	0.54	0.53	0.61	0.60	0.58	0.56	0.52	0.28	0.47	0.51	0.57	0.59	<b>0.83</b>	
FP	0.93	0.33	0.37	0.41	0.33	0.43	0.36	0.28	0.35	0.15	0.35	0.51	0.47	0.54	0.63	<b>0.88</b>

**Legend:**

<b>ACAP = Absorptive Capacity</b>	<b>MV = Market Vision</b>	<b>PLSP = Post-Launch Stage Performance</b>
<b>PACAP = Potential Absorptive Capacity</b>	CL = Clarity (of market vision)	STM = Speed-to-Market
AQ = Acquisition (of knowledge)	SC = Scope (of market vision)	WO = Window of Opportunity
AS = Assimilation (of knowledge)	SPMG = Specific Magnetism (of market vision)	<b>FP = Financial Performance</b>
<b>RACAP = Realised Absorptive Capacity</b>	FO = Form (of market vision)	
TR = Transformation (of knowledge)	<b>MDIP = Market-Driving Innovation Performance</b>	
EX = Exploitation (of knowledge)	<b>BLSP = Before-Launch Stage Performance</b>	
<b>MVC = Market Visioning Competence</b>	BI = Breakthrough Integrity	
PML = Proactive Market Learning	ESC = Early Success with Customers	
IDNW = Idea Networking		

## **4.6 Demographics**

The general characteristics of the respondents' job, company and product development activities were collected. The categories of the demographic data were predominantly drawn from Product Development Management Association (PDMA) research on new product development best practices (Griffin, 1997b). Examples of the demographic data include: job title and duration with the firm, organisational structure and new product effort structure, annual turnover and percentage spent on R&D, and number of product innovations introduced in the last three years to reflect a more recent product development activities of the company/SBU (see Appendix 2 for more details).

## **4.7 Chapter Summary**

This chapter explained how the constructs, as described in Chapter 2, were operationalised and assessed for reliability and validity. Drawing from the literature review, the core of this thesis is the focus on breakthrough integrity (BI), which is the ability to maintain a clear and highly innovative concept of a potential new product from the front end of breakthrough innovation through to launch (Clark & Fujimoto, 1990, 1991; Reid & de Brentani, 2010; Seidel, 2007). As there was no existing scale published for BI, the development of the measurement scale items was based on how BI was defined in this study and drawn from relevant studies in the product innovation, marketing and management literature. The rest of the measurement instruments were drawn primarily from the scales developed by other researchers in product innovation and management literature. Some of the existing scales were slightly adapted while a few new items had to be developed specifically to fit the context of the front end of breakthrough innovation. The original meaning of each of the measurement items was maintained and validated by the academics and industry experts familiar with the area of study prior to the administration of the survey.

The measurement scales, both new and existing, were evaluated on the basis of the empirical data via Cronbach's alpha, factor analysis and correlation analysis. The analysis of the results suggests that, overall, the constructs exhibit acceptable reliability and validity in terms of their content and their convergent, discriminant and nomological validity. Chapter 5 reports on the assessment of the constructs in relation to the hypothesised relationships proposed in the conceptual model, and presents the results and a discussion of the findings.

## **CHAPTER 5: RESULTS AND DISCUSSION**

### **5.1 Introduction**

The previous Chapter 4 described the operationalisation of the constructs and the assessment for reliability and validity.

Chapter 5 presents the results of the analysis undertaken to examine the hypotheses developed in this thesis, as listed below.

#### **Absorptive Capacity as an Antecedent to Market Visioning Competence**

*H1a: ACAP has a significant and positive impact on MVC.*

*H1b: PACAP has a significant and positive impact on MVC.*

*H1c: RACAP has a significant and positive impact on MVC.*

#### **Market Visioning Competence and Market Vision**

*H2: MVC has a significant and positive impact on MV.*

#### **Performance Consequences of Market Vision**

*H3: MV has a significant and positive impact on before-launch stage performance.*

*H4: MV has a significant and positive impact on post-launch stage performance.*

#### **Market-Driving Innovation Performance**

*H5: Before-launch stage performance has a significant and positive impact on post-launch stage performance.*

*H6: Before-launch stage performance has a significant and positive impact on financial performance.*

*H7: Post-launch stage performance has a significant and positive impact on financial performance.*

### **Proposed Moderation Effects**

*H8a: The relationship between MV and before-launch stage performance is negatively influenced by CI, TT and MT.*

*H8b: The relationship between MV and post-launch stage performance is negatively influenced by CI, TT and MT.*

*H9a: The degree of NPD process rigidity negatively influences the relationship between MV and before-launch stage performance.*

*H9b: The degree of NPD process rigidity negatively influences the relationship between MV and post-launch stage performance.*

*H10a: Large firm size (number of employees) positively influences the relationship between MV and before-launch stage performance.*

*H10b: Large firm size (number of employees) positively influences the relationship between MV and post-launch stage performance.*

## **5.2 Data Analysis**

To examine the proposed hypotheses, the direct relationships between variables were first tested through the use of simple and multiple regression analyses. This included several tests undertaken to meet the assumptions of multiple regression prior to the analysis. Then, partial least square structural equation modelling (PLS-SEM) was utilised for a more comprehensive analysis of the hypothesised relationships.

### **5.2.1 Multiple Regression**

Multiple regression is viewed as one of the best estimates of a dependent variable from a number of independent variables (Hair et al., 2010; Malhotra, Peterson & Kleiser, 1999; Tabachnick & Fidell, 2007). It is a set of statistical techniques based on correlation that facilitates the exploration of the interrelationships among a set of variables. Specifically, there are three main types of multiple regression. These are standard (simultaneous), hierarchical (sequential) and stepwise. The standard technique is the most widely used method that simultaneously tests the relationship between an entire set of independent (predictor) variables entered into the equation. Thus, each variable is evaluated in terms of its predictive power over that offered by all the other independent variables. In regard to hierarchical regression, the independent variables are entered into the question in a specific order in steps or blocks where they are assessed in terms of their contributions to the prediction of the dependent variable, after other variables have been controlled for. With the stepwise regression model, the independent variables being entered into the SPSS program are selected based on the incremental explanatory power adding to the regression equation (Hair et al., 2010).

In the context of this research, the standard regression approach was considered to be the most appropriate for the context of this research because the purpose of the analysis was to examine the relationship between the whole set of independent and dependent variables. Accordingly, SPSS (version 21) was utilised to run the standard regression analysis (both simple and multiple). The key measures of the standard regression analysis are the adjusted R square values and the F-ratio, which indicate the percentage of variance of the dependent variable and

its significance. Further, the beta and t-values also evaluate the importance and significance of the independent variable in predicting the dependent variable. In this regard, two-tailed t-tests and confidence intervals were used as the basis to determine support for the hypotheses. The two-tailed p values are reported in Tables 5.1 to 5.11, using a significance level of  $p < 0.05$  or at 95% confidence interval.

Section 5.3 presents the regression analysis of the impacts of absorptive capacity (ACAP) and its subsets of potential absorptive capacity (PACAP) and realised absorptive capacity (RACAP) on market visioning competence (MVC). Section 5.4 presents the impact of market visioning competence (MVC) on market vision (MV). Section 5.5 presents the analysis of performance consequences of MV. This includes the impacts of MV on before-launch stage performance (BLSP) and post-launch stage performance (PLSP). Section 5.6 presents the analysis of market-driving innovation performance (MDIP). This involves the assessment of the associations between BLSP, PLSP, and ultimately financial performance (FP). Section 5.7 examines the proposed moderating effects of the external environment (EE), NPD process rigidity (NPDR) and firm size (number of employees [NOE]) on the relationships between MV and BLSP, and between MV and PLSP.

### **5.2.1.1 Assumptions of Multiple Regression**

Multiple regression makes several underlying assumptions about the data being analysed, which need to be accounted for. Prior to the multiple regression analysis, several tests were undertaken to ensure there had been no violation. These tests were: sample size, multicollinearity, outliers, normality, linearity and homoscedasticity of residuals and independence error.

- **Sample Size**

An appropriate sample size is required to facilitate generalisability. There are varying views regarding the appropriate sample size. As indicated in Section 3.4.2.3, Tabachnick and Fidell (2007) recommend a formula to determine requirements for sample size, that is,  $N > 50 + 8m$ ,



where  $N$  is the required sample size (number of participants), and  $M$  is the number of independent variables. The final sample size in the present study of 179 participants is well above this criterion. The maximum number of predictors used in any one model totalled 10, which yielded a required sample size of 130 participants, which was less than the 179 managers who participated in this study. Accordingly, there was a sufficient sample size to examine all the hypothesised models.

- **Multicollinearity**

Multicollinearity occurs when the correlation among the independent variables are highly correlated (generally .90 or higher) (Hair et al., 2010, p.200). This can create problems when conducting multiple regression equations, as high correlations among independent variables can result in two or more variables explaining the same area of variance in the dependent variable. This makes it difficult to separate the effects of the independent variables on the dependent variable (Field, 2009; Malhotra et al., 2006).

As shown in Table 4.40, a correlation matrix indicated that none of the variables were highly correlated, with correlations generally around 0.5 and a few exceptions at around 0.7. These exceptions were made through confirmatory factor analysis and the analysis of variance extracted that they were discriminantly valid. This indicates no substantial collinearity.

To further ensure a lack of collinearity, the two most common diagnostics were, however, substantiated: tolerance and its inverse, the variance inflation factor (VIF) (Hair et al., 2010). The tolerance level is a direct measure that indicates how much of the variability of the specified independent variable is not explained by other independent variables, and should not be less than 0.10 (Tabachnick & Fidell, 2007). A small tolerance level indicates that there is a degree of collinearity between variables. All of the regression equations in this study showed tolerance levels much higher than 0.10. This suggested that collinearity was unlikely to be a problem for the regression equations. To determine an appropriate level of tolerance, VIF is a second measure of multicollinearity, and should not be greater than 10.00 (Grewal, Cote & Baumgartner, 2004; Tabachnick & Fidell, 2007). All the observed variables were examined and found to be within the range of acceptability.

- **Outliers**

Outliers are a combination of values that are unusually very high or very low, which can be problematic for multiple regression (Hair et al., 2010). Detecting outliers or extreme values was part of the initial data screening process. A case-wise plot was used to identify and detect outlying cases for all regression equations. According to Tabachnick and Fidell (2007), standardised residual values above 3.3 or less than -3.3 are identified as outliers. In this regard, four cases were identified as “unusual” or outliers. Nonetheless, the Cook’s Distance value in the residuals statistics table was far below 1.00 in each case. Tabachnick and Fidell (2007, p.75) indicate that cases with values larger than 1 can present a major problem. Therefore, these findings suggest that there was no undue influence on the regression results.

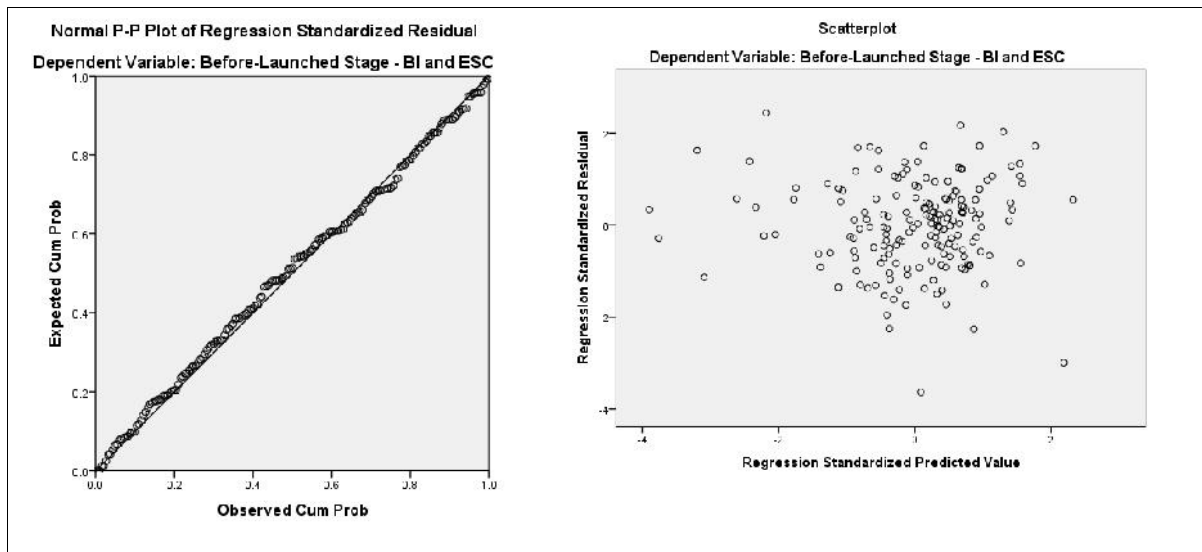
- **Normality, Linearity, and Homoscedasticity**

Multivariate normality is defined by Tabachnick and Fidell (2001) as “the assumption that each variable and all linear combinations of the variable are normally distributed” (p. 70). Homoscedasticity and linearity are elements of normality. Linearity is based on the assumptions that the dependent variable scores should have linear relationship with the residuals. Homoscedasticity is based on the assumption that the residuals around the dependent variables should have the same variance for all predicted scores (Field, 2009; Tabachnick & Fidell, 2001). All these assumptions consider many aspects of the distribution of scores and the underlying relationship between variables.

Accordingly, the assumptions relating to each were examined using residual scatterplots for each regression equation in this study. The residuals, or differences between the obtained and predicted dependent variable scores, were normally distributed in a straight line around a line that was drawn through the O axis point (a reasonably straight diagonal line from bottom left to top right). Therefore, there was no evidence of violation.

The scatterplots for all regression equations were non curvilinear (see Figure 5.1). Specifically, most of the scores were concentrated in the centre, along the 0 point. This indicates that there was no clear relationship between the residuals and predicted values, thereby supporting the assumptions for linearity and homoscedasticity.

**Figure 5.1: Example of Normal Probability of Residual Scatterplot**



- **Independence of Error**

“Independence of error” refers to the assumption that the residual terms of any two observations should be uncorrelated. The Durbin-Watson test was utilised to test for serial correlations between errors in regression models (Field, 2009). In particular, the test statistic works by checking for autocorrelation between the residuals and should result in a score of close to 2.00 (Norusis, 1993).

When the independence of error terms and the residuals’ statistics were tested, the scores ranged from 1.646 to 1.983. This shows normality of error distribution, supporting that the assumption was not violated.

### 5.2.2 Partial Least Squares Structural Equation Modelling (PLS-SEM)

Structural Equation Modelling (SEM) is important for a thorough examination of the hypotheses suggested by the conceptual model in this study. The analysis of results is built upon the use of multiple regression to assess the direct relationships between independent and dependent variables. It can, however, only be applied to one dependent variable at a time. SEM examines the interrelationships expressed similarly in a series of multiple regression equations, and further estimates multiple and interrelated dependence relationships among all of the variables involved in the model (Hair et al., 2010).

SEM can be referred to as covariance structure analysis, latent variable analysis, or the names of SEM programs (e.g., Linear Structural Relations [LISREL] or AMOS) (Hair et al., 2010). There are principally two types of SEM methods: covariance-based techniques (CB-SEM) and variance-based partial least squares (PLS-SEM). These methods have the same foundation of SEM. It is the ability to test complete theories and concepts that has made SEM, particularly CB-SEM, a quasi-standard in marketing research (Hair, Sarstedt, Ringle & Mena, 2012b).

Recently, PLS-SEM has become a commonly used method in various disciplines, including marketing, and has been applied in several studies published in many leading journals. The PLS-SEM is also referred to as PLS path modelling in the literature (Hair et al., 2012b; Ringle et al., 2010). The method has been justified in the *Journal of the Academy of Marketing Science* by Hair et al. (2012b), as an increasingly popular alternative to CB-SEM. Hair et al. (2012b) identified more than 200 studies using PLS-SEM applications published in a 30-year period from 1981 to 2010 in the 30 top-ranked marketing journals, including *Journal of Marketing Research*, *Journal of Consumer Research* and *Journal of Product Innovation Management*. Published studies in the *Journal of Product Innovation Management* have used PLS-SEM to look into many issues related to new product development such as new product idea screening (e.g. Hammedi et al., 2011), success in global new product development (e.g. de Brentani et al., 2010) and the commercial success of new products (e.g. D'Aveni, Canger & Doyle, 1995).

PLS structural equation modelling or variance-based partial least squares (PLS-SEM) originates from econometrics and chemometrics research (Hair et al., 2010), and was introduced by Wold (1975). PLS-SEM is a regression-based technique that emerged from path analysis and has become a prevailing approach to studying casual models involving latent constructs which are indirectly measured by various indicators (Ringle et al., 2010). In a PLS structural model, the paths estimated are standardised regression coefficients (beta values). These path coefficients are estimated based on ordinary least squares (OLS) to reduce the residual variance. The factor loadings are for the measurement items on the constructs. Further PLS-SEM does not make “assumptions about the population or scale of measurement” to estimate model parameters (Fornell & Bookstein, 1982, p.443; Fornell & Larcker, 1981), observation independence or variables metrics (Barclay, Higgins & Thompson, 1995). Hence, the context of regression, path analysis and principal component analysis can be applied to interpret and explain findings (Chin & Newsted, 1999; Ringle et al., 2010).

The rationale for selecting PLS-SEM as the estimation model is that it best suits this study’s research objective, the type of model and the data characteristics (Fornell & Bookstein, 1982; Reinartz, Haenlein & Henseler, 2009). There are primarily five reasons for choosing PLS-SEM over covariance-based methods (CB-SEM) for this study. First, PLS-SEM application (Ringle et al., 2005) has begun to be recognised by a growing number of researchers for its distinctive methodological features (Henseler, Ringle & Sinkovics, 2009). According to Albers (2009), PLS-SEM is also regarded as the method of choice in success factor studies in marketing research. Thus, it was deemed to be suitable for the context of the analysis of this study as the main objective is to understand the critical success factors at the front end of the development process of a market-driving innovation.

Second, the aim of PLS-SEM is to maximise the amount of variance of the dependent variable explained by the independent variables in the model (Chin & Newsted, 1999). The approach of the more widely known CB-SEM is differently implemented (Haenlein & Kaplan, 2004), for instance, in the LISREL software tool that “attempts to minimise the difference between the sample covariance and those predicted by the theoretical model” (Chin & Newsted, 1999,

p.309). In consequence, PLS-SEM seemed more appropriate than CB-SEM for predicting the hypothesised relationships (Chin, 1998).

Third, PLS-SEM is a prediction-oriented approach, appropriate for particular types of model. In this study, the type of conceptual model appeared to be a “balanced model”, with approximately the same number of endogenous latent variables and exogenous latent variables (Hair et al., 2012b, p. 421). This type of model is unlike a focused model where a small number of endogenous latent variables are explained by many exogenous latent variables in the model or an unfocused model where the endogenous latent variables are rather higher than the exogenous latent variables. PLS-SEM’s prediction goal suits a balanced model or a focused model, while a CB-SEM is likely to be more appropriate for explaining unfocused models (Hair et al., 2012b). Thus, it was reasonable to apply PLS-SEM to estimate and explain the balanced model of this study.

Fourth, PLS-SEM supports the use of the final sample size of this study. For any statistical techniques, the sample size needs to be considered in the context of data characteristics. This is also the case for PLS-SEM. Compared to traditional CB-SEM techniques, PLS-SEM is viewed as a technique that works particularly well for testing models with a relatively small sample size. PLS-SEM is applicable even in the case of a very small sample size, as low as 50 cases (Chin & Newsted, 1999). CB-SEM, however, generally requires a sample size of more than 200 cases (Boomsma & Hoogland, 2001). As this study introduced a model to examine the relationships between ACAP, MVC/MV and market-driving innovation performance, and the sample size is relatively small ( $n = 179$ ), PLS-SEM therefore appeared to be well-suited. More importantly, the applicability of PLS-SEM to a small sample size has often been justified as a reason for selecting this method to estimate a model in marketing research (Hair et al., 2012b).

Fifth, PLS-SEM (SmartPLS by Ringle et al., 2005) has an ability to test interaction effects or moderating effects. These effects are evoked by variables whose variation influences the strength or the direction of a relationship between an independent (exogenous) and a dependent (endogenous) variable (Henseler & Chin, 2010; Henseler & Fassott, 2010). For each of the moderating effects, the methodology suggested by Chin, Marcolin, and Newsted (2003) was

applied to the PLS model accordingly. All indicators of the moderator and the corresponding predictor variable were multiplied to calculate indicators measuring the interaction effect. These sets of indicators were then inserted into the PLS model as an independent variable in order to calculate the associated path coefficients.

The core disadvantage of PLS-SEM is that its parameter estimates are not optimal with a small sample size or a small number of indicators per latent variable. This is regarded as PLS-SEM bias/consistency (Reinartz et al., 2009). In this manner, the conceptual model in this study contains exclusively reflective constructs. To deal with this weakness of PLS-SEM, Chin et al. (2003) recommend a minimum sample size of ten times the number of the incoming paths on a construct. This study's sample (n = 179) exceeded this minimum requirement; a total number of 110 cases was required to meet the general rule of thumb. As noted in Section 3.4.2.3, the appropriate number of cases needed for this study was calculated.

The next section presents the results and a discussion of the regression analysis for the main study of this thesis.

The common abbreviations are presented in the following legend:

**Legend:**

<b>ACAP = Absorptive Capacity</b>	<b>MV = Market Vision</b>
<b>PACAP = Potential Absorptive Capacity</b>	CL = Clarity (of market vision)
AQ = Acquisition (of knowledge)	SC = Scope (of market vision)
AS = Assimilation (of knowledge)	SPMG = Specific Magnetism (of market vision)
<b>RACAP = Realised Absorptive Capacity</b>	FO = Form (of market vision)
TR = Transformation (of knowledge)	<b>MDIP = Market-Driving Innovation Performance</b>
EX = Exploitation (of knowledge)	<b>BLSP = Before-Launch Stage Performance</b>
<b>MVC = Market Visioning Competence</b>	BI = Breakthrough Integrity
PML = Proactive Market Learning	ESC = Early Success with Customers
IDNW = Idea Networking	<b>PLSP = Post-Launch Stage Performance</b>
	STM = Speed-to-Market
	WO = Window of Opportunity
	<b>FP = Financial Performance</b>

## Main Study

### 5.3 Absorptive Capacity and Market Visioning Competence

*H1a. ACAP has a significant and positive impact on MVC.*

*H1b. PACAP has a significant and positive impact on MVC.*

*H1c. RACAP has a significant and positive impact on MVC.*

Firms with absorptive capacity have been described as being more proficient at developing new products, particularly breakthrough innovations (e.g. Newey & Shulman, 2004). Accordingly, it was hypothesised that firms with ACAP will also exhibit evidence of being proficient in developing MVC. The perspective is drawn from the literature in the essence that “firms that are competent with market visioning are good at the exploratory learning process” (Reid & de Brentani, 2010, p.509). Similarly, ACAP and its PACAP/RACAP subsets are firm-specific learning capabilities by which firms acquire, assimilate, transform and exploit knowledge to develop newly created knowledge and competencies (Zahra & George, 2002). The learning capability reflected in ACAP, likewise appears to act as a key antecedent to MVC. The relationship between ACAP and MVC is therefore proposed, as discussed in Chapter 2.

Table 4.39 presented the correlations between each of the variables in the conceptual model and these indicated that a significant relationship exists between the dimensions of ACAP and MVC, ranging from the results of 0.45 to 0.76 significant at the  $p < 0.01$  level, whilst confirming that they measure different constructs.

To evaluate the relationship between ACAP and MVC, the aggregate construct of ACAP was first entered into a simple bivariate regression analysis with the dimensions of MVC, and then the subsets of ACAP as well as its individual dimensions were subsequently entered into a multiple regression analysis as a further test of the relationship. Table 5.1 presents the results of these analyses.



**Table 5.1: Regression Models: Absorptive Capacity and Market Visioning Competence**

	Market Visioning Competence Dimensions					
	Market Visioning Competence (aggregate)		Proactive Market Learning (PML)		Idea Networking (IDNW)	
	Beta	t-value	Beta	t-value	Beta	t-value
<b>Simple regression model</b>						
<b>Absorptive Capacity (aggregate)</b>	0.750***	15.10	0.607***	10.17	0.723***	13.93
R Square	0.563		0.369		0.523	
Adjusted R Square	0.561		0.365		0.520	
F-ratio	228.043***		103.438***		193.968***	
<b>Multiple regression model 1</b>						
Potential Absorptive Capacity (PACAP)	0.338***	4.89	0.222**	2.65	0.373***	5.14
Realised Absorptive Capacity (RACAP)	0.483***	6.98	0.442***	5.29	0.419***	5.77
R Square	0.578		0.383		0.535	
Adjusted R Square	0.573		0.376		0.530	
F-ratio	120.515***		54.662***		101.205***	

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

**Table 5.1: Regression Models: Absorptive Capacity and Market Visioning Competence (Continued)**

	Market Visioning Competence Dimensions					
	Market Visioning Competence (aggregate)		Proactive Market Learning (PML)		Idea Networking (IDNW)	
	Beta	t-value	Beta	t-value	Beta	t-value
<b>Multiple regression model 2</b>						
Acquisition of Knowledge (AQ)	0.072	1.18	0.030	0.38	0.096	1.49
Assimilation of Knowledge (AS)	0.189**	3.03	0.149	1.86	0.186**	2.85
Transformation of Knowledge (TR)	0.133*	2.10	0.176*	2.17	0.066	1.00
Exploitation of Knowledge (EX)	0.515***	7.06	0.379***	4.05	0.530***	6.96
R Square	0.644		0.415		0.610	
Adjusted R Square	0.635		0.401		0.601	
F-ratio	78.553***		30.841***		68.143***	

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

### Simple Regression:

The adjusted R square values indicate that ACAP explains approximately 56% of the variance of the aggregate construct of MVC. Regarding the dimensions of MVC, ACAP explains 37% of the variance of proactive marketing learning (PML) and 52% of the variance of idea networking (IDNW). All results were significant at p<0.001. ACAP was therefore determined to have a significant positive relationship with MVC. In terms of dimensions of MVC, ACAP was also strongly related to both dimensions (  $\beta = 0.607$  and  $0.723$ ) at the significance level of p<0.001. The results seem to suggest that the ACAP as an aggregate measure performs as well as when utilising the separate dimensions.

### **Multiple Regression:**

The results of the multiple regression analysis are reported in the multiple regression models 1 and 2 in Table 5.1. In the multiple regression model 1, the results indicate that the subsets of ACAP explain a significant proportion of the variance in MVC. This is evidenced by the R square values which show that PACAP and RACAP explain approximately 58% of the aggregate level of MVC, and explain 38% of the variance of PML and 53% of the variance of IDNW. In addition, RACAP was found to be the most closely associated with both PML ( $\beta = 0.442$ ), and IDNW ( $\beta = 0.419$ ). To a lesser extent, PACAP was found to be closely associated with both PML and IDNW ( $\beta = 0.222$  and  $0.373$ ). Accordingly, all results were significant at the level of  $p < 0.001$ .

In the multiple regression model 2, there are four dimensions under ACAP or PACAP and RACAP in which the R Square values explain approximately 64% of MVC at an aggregate level, and explain 40% of the variance of PML and 60% of the variance of IDNW. More specifically, exploitation of knowledge (EX) was found to be the most closely associated with both PML ( $\beta = 0.379$ ), and IDNW ( $\beta = 0.530$ ), at the significant level of  $p < 0.001$ . Assimilation of knowledge (AS) and transformation of knowledge (TR) play different roles in influencing two dimensions of MVC. On one hand, AS was found to be closely associated with IDNW ( $\beta = 0.186$ ;  $p < 0.01$ ). On the other hand, TR was found to be associated with PML ( $\beta = 0.176$ ;  $p < 0.05$ ). The capability to assimilate, transform and exploit knowledge is central to translating prior knowledge, and accumulated diverse experiences (what are already known) into frame-breaking insights or market-driving ideas (Bertels et al., 2011; Cohen & Levinthal, 1990; Da Silva & Davis, 2011; Sun & Anderson, 2010). These capabilities verify the ability of a firm to raise creativity as well as to perceive an opportunity (Broring et al., 2006), hence having close associations with MVC.

The results of the regression analyses provide support for H1a, H1b and H1c that ACAP overall and its potential and realised subsets of PACAP and RACAP have significant positive impacts on MVC. These results are in line with the findings in the literature review. The constructs ACAP and MVC were both drawn from the resource-based view (RBV) and its sub-set of

dynamic capabilities literature. ACAP and MVC appeared as the constructs that are likely to have the greatest impact on early performance (EP) or the front end of the NPD effort (e.g. Chen et al., 2009; Reid & de Brentani, 2010; Sun & Anderson, 2010; Tsai, 2001; Zahra & George, 2002).

Cast in RBV, the conceptualisation of ACAP and MVC highlights the importance of the exploratory learning process that enables knowledge creation and building through information sharing. At the broader organisational level, ACAP involves a combination of learning capabilities through a set of organisational routines and process (Zahra & George, 2002). At the NPD program level, MVC involves the ability of individuals in NPD team to link new ideas or advanced technologies to future market opportunities (Reid & de Brentani, 2010). The relationship between these two constructs is important given that both entail a firm's dynamic capabilities to build new product exploration capabilities and resources in changing environmental conditions. The outcomes of the exploratory learning process are firm-specific competitive advantage and superior performance (Harvey et al., 2010; Kostopoulos et al., 2011; Reid & de Brentani, 2010).

### ***Exploitation of Knowledge (EX)***

Of the four dimensions of ACAP, EX was the most dominant dimension that influences both the dimensions of market visioning competence (PML: proactive market learning and IDNW: idea networking). The observed strengths of EX on PML and IDNW were not surprising. Fundamentally, EX involves a firm's ability to exploit new knowledge to develop something new such as a new product (Zahra & George, 2002). This ability is considered critical in facilitating PML, the discovery of unarticulated customer needs and incorporating solutions into new products.

In addition, EX involves management support and an emphasis on product prototyping to test a product concept before starting actual development. The testing of a product concept may encourage the use of several forecasting and market estimation techniques before making a final market selection as described in PML. Further, EX involves a firm's ability to work more effectively by adopting new technologies and new ideas (Flatten et al., 2011). It is therefore

understandable that EX can enhance IDNW by allowing individuals who champion breakthrough innovations to embrace the new technologies or new ideas and work more effectively to gain support from others within the firm.

### ***Assimilation and Transformation of Knowledge (AS and TR)***

The results also indicate that AS and TR influence different dimensions of MVC. The association between AS and IDNW is significant and positive, as both dimensions appear to highlight the importance of a firm's information sharing and senior management support for new product developments. AS generally involves cross-departmental communication and meetings demanded by senior management. The cross-departmental communication pulls together a network of people from different disciplines and functions. In this respect, the central focus of AS is effective communication across departments in order to exchange information quickly on new developments, problems and achievements (Flatten et al., 2011). These abilities influence IDNW by means of enabling breakthrough product champions to share market-driving ideas quickly with other people in the firm through established cross-departmental support and communication. The breakthrough product champions may also be able to obtain the support of senior management and key decision makers early in the NPD process and broaden their internal and external networks around the products and technologies. Sun and Anderson (2010, p. 144) supported this view that "teams consisting of individuals who have diverse experiences and who have previously worked together are more likely to create radical innovations".

In particular, the capability of assimilation is created by "socio-psychological process of interpretation" (Sun & Anderson, 2010, p.144). The interpretive process can be carried out through a "dialogue" process among members in the network. The dialogue is important as it develops values of honesty and trust between members, making it easy to share sensitive information. "Group members' cognitive maps are effectively revealed and any radical insights are given a chance to come to verbal fruition, rather than being dominated by the prevailing beliefs and assumptions of the organization" (Sun & Anderson, 2010, p.144). Cross-departmental communication supports the dialogue process, articulating solution-finding. Team

members in the network, including the breakthrough product champions (IDNW), can therefore assimilate novel connections and radical knowledge.

Moreover, the finding of the regression analyses suggests that TR has a significant, positive impact on proactive market learning (PML). TR involves employees' ability to successfully combine their existing knowledge with new knowledge. This ability creates new insights that influence PML by allowing employees to discover additional needs of customers of which they are unaware. Further the capability of transformation means that employees are able to absorb new knowledge and apply it to practical work as well as making it available for other purposes (Flatten et al., 2011). This absorbed new knowledge can also be used in market forecasting and estimation, as reflected in PML.

#### ***Acquisition of Knowledge (AQ)***

While the aggregate relationship between MVC and ACAP indicates a strong association, which is supported by the two subsets of ACAP and its three dimensions of AS, TR and EX, acquisition of knowledge appears to have no association with MVC – neither PML nor IDNW. A possible explanation may be that MVC focuses on discovering unarticulated customer needs to incorporate into future product-markets. AQ is, however, described as the way in which management expects employees to acquire externally relevant information from both within and beyond their existing industry (Flatten et al., 2011). Thus, the value of AQ may be less apparent when the focus of MVC appeared to lean toward the abilities of the individuals or NPD team members to transform and exploit knowledge into new products, as opposed to acquiring new knowledge.

A recent study by Ritala and Hurmelinna-Laukkanen (2013) on potential absorptive capacity and radical innovation highlighted that acquisition of knowledge for radical innovation may not be as effective when there is an exchange of similar information and knowledge. As reflected in AQ, acquisition of knowledge within the industry may lead firms to focus more on the development of incremental innovations. This is particularly the case when competing firms decided to collaborate with each other in order to create higher value and a larger market. Only when sensitive information and knowledge is protected and secure enough for it to be shared

can the value-creating effects of potential absorptive capacity materialise in the form of radical innovations (Ritala & Hurmelinna-Laukkanen, 2013).

Although the external sources of knowledge have been regarded as important to market-driving innovation (e.g. de Brentani & Reid, 2012; Reid & de Brentani, 2004), firms may find it difficult to acquire relevant information and knowledge essential for the development of a new product. The search for new information may also be constrained to what the individuals or NPD team members defined as relevant to their existing products. Individuals may often overlook information that could be used for the development of future products, especially for breakthrough innovations, because they view the information as irrelevant or inconsistent with the firm's values (Christensen & Overdorf, 2000).

Another possible reason for not seeking knowledge from external sources may be that breadth of new knowledge can be sourced and explored internally within the firm through cross-departmental communication (Sun & Anderson 2010). In this regard, the importance of cross-departmental communication was described in the capability of assimilation (AS). The capability is related to exploratory learning and individual's intuition especially entrepreneurial intuition. More specifically, it is an individual's ability to seek unfamiliar situations in order to access new and diverse experiences through an existing network. This is consistent with the aspect of networking explained in MVC by means of breadth or size, variety, and centrality (Reid & de Brentani 2010). The ability to take in new ideas and violate prior beliefs or assumptions may allow an individual to come up with something beyond incremental innovation. "The greater the breadth of their prior knowledge, the greater is their ability to explore new sources of knowledge" (Sun & Anderson, 2010, p.143).

## 5.4 Market Visioning Competence and Market Vision

*H2: MVC has a significant and positive impact on MV.*

It was noted in the literature review in Chapter 2 that the empirical study of Reid and De Brentani (2010) indicated the important association between MVC and its resultant MV for a radically new, high tech products. This study builds on extending the work of Reid and de Brentani (2010) on MVC/MV by exploring both radical and really new innovations collectively and across different industry contexts at the NPD program level. “Really new innovations”, in this study, refer to products that build on an existing or a new/novel “idea” or “technology” to create new market. By including really new innovations, the exploratory learning process underlying MVC is extended to include an exploration of ideas that can create shared mental models of future product-markets or MV. It was therefore hypothesised that firms that are competent with market visioning or MVC would be able to create MV of radically or really new products.

Table 4.40 presented the correlations between each of the variables in the conceptual model. These indicated a significant relationship between the dimensions of MVC and MV ranging from the results of 0.45 to 0.73 significant at the  $p < 0.01$  level, whilst confirming that they measure different constructs.

To further evaluate the relationship between MVC and MV, the aggregate construct of MVC was first entered into a simple bivariate regression analysis with the dimensions of MV, and then the individual dimensions of MVC were entered into a multiple regression analysis as a further test of the relationship. Table 5.2 presents the results of these analyses.



**Table 5.2: Regression Models: Market Visioning Competence and Market Vision**

	Market Vision Dimensions									
	Market Vision (aggregate)		Specific Magnetism (SPMG)		Form (FO)		Scope (SC)		Clarity (CL)	
	Beta	t-value	Beta	t-value	Beta	t-value	Beta	t-value	Beta	t-value
<b>Simple regression model</b>										
<b>Market Visioning Competence (aggregate)</b>	0.781***	16.64	0.719***	13.77	0.738***	14.54	0.544***	8.63	0.595***	9.85
R Square	0.610		0.517		0.544		0.296		0.354	
Adjusted R Square	0.608		0.515		0.542		0.292		0.350	
F-ratio	276.991***		189.647***		211.441***		74.501***		96.974***	
<b>Multiple regression model</b>										
Proactive Market Learning (PML)	0.404***	6.96	0.412***	6.39	0.254***	4.12	0.219**	2.82	0.295***	3.96
Idea Networking (IDNW)	0.473***	8.15	0.396***	6.14	0.571***	9.26	0.390***	5.02	0.372***	4.98
R Square	0.610		0.518		0.560		0.300		0.354	
Adjusted R Square	0.606		0.512		0.555		0.292		0.347	
F-ratio	137.777***		94.551***		111.955***		37.764***		48.290***	

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

### **Simple Regression:**

The adjusted R square values indicate that MVC explains approximately 61% of the variance of the aggregate construct of MV. Regarding the dimensions of MV, MVC explains 52% of the variance of specific magnetism (SPMG), 54% of the variance of form (FO), 29% of the variance of scope (SC) and 35% of the variance of clarity (CL). All results were significant at  $p < 0.001$ . MVC was therefore determined to have a significant positive relationship with MV. In this regard, MVC was strongly related to all dimensions of MV ( $r = 0.719, 0.738, 0.544$  and  $0.595$  at the significance level of  $p < 0.001$ ). More specifically, MVC was most significantly related to FO ( $r = 0.738$ ) and SPMG ( $r = 0.719$ ) of MV. The association of MVC and FO may be explained by the fact that both constructs focus on discovering unarticulated needs of customers and how they can be incorporated into new products that are suitable for the user environment. Furthermore, the association between MVC and SPMG makes sense from the perspective that both seem to highlight the importance of generating “buy-in” from others in the firm (Reid & de Brentani, 2010).

### **Multiple Regression:**

The results of the multiple regression analysis reported in the lower half of Table 5.2 indicate that MVC explains a significant proportion of the variance in MV. This is evidenced by the R square values which show that the dimensions of MVC explain approximately 61% of the aggregate level of MV, and explain 51% of the variance of SPMG, 56% of the variance of FO, 29% of the variance of SC and 35% of the variance of CL.

Within the dimensions of MVC, PML was found to be the dimension most closely associated with SPMG ( $r = 0.412$ ). On the other hand, IDNW was found to be the most closely associated with all the other dimensions, which were FO ( $r = 0.571$ ), SC ( $r = 0.390$ ) and CL ( $r = 0.372$ ). As a whole, all results of PML and IDNW were significant across all dimensions of MV at the level of  $p < 0.001$ .

The results of the regression analyses provide support for H2 that MVC has a significant positive relationship with MV. The observed strength between the two constructs was not

surprising. It is supported by the earlier finding of Reid and de Brentani (2010) and consistent with the findings in the literature review in Chapter 2 regarding the association of MVC and MV. MVC was identified as an essential competence in creating an effective mental image, or MV of a radically new/really new product.

### ***Proactive Market Learning (PML)***

PML can be identified as a key element influencing SPMG. Recalling the construct measurement in Chapter 4, market learning tools (ML) and proactive market orientation (MO) were the constructs of MVC grouped into PML. In the notion of MO, PML involves an exploration of customers' latent needs, solutions to customers' unarticulated needs or discovering new needs to be incorporated into new products (Narver et al., 2004). Highly proactive behaviour is vital in developing breakthrough innovations. This is particularly true during the idea generation stage of the NPD process. Prior to development, the exploration of new needs (PML) can help firms to envision for future market opportunities that did not exist previously in the market (Sandberg, 2007). This helps to simplify the mental model (MV) of the future product-market for it to highlight the attractiveness of the market opportunity (as reflected in SPMG).

In the notion of ML, PML also involves combinations of forecasting and market estimation techniques to vision for the future market (Reid & de Brentani, 2010). Forecasting tools such backcasting, scenario planning and user analysis through probe-and-learn processes have been identified as appropriate for breakthrough innovations (Deszca et al., 1999; Lynn et al., 1996). These tools emphasise exploring customers' current usage and possible future usage as well as the level of customer-product interaction (O'Connor, 1998). This exploratory learning process, as reflected in PML dimension, can therefore create shared mental models of future market (MV) that enables NPD teams to grasp what is to be developed and for whom.

### ***Idea Networking (IDNW)***

Another dimension of MVC is IDNW. This dimension is a combination of “idea driving” and “networking”, as explained in Chapter 4. The notion of idea driving involves the extent to which champions or idea drivers are able to push market-driving ideas through to the front end of the NPD process. Idea drivers are willing to make decisive contributions to an innovation as well as accelerating commitment from senior management and key decision makers to the proposed idea. This role is critical because a breakthrough innovation requires an organisation to go through a process of change, to develop new organisational and/or technological competencies. Moreover, the notion of networking is a fundamental element of MVC, which entails external webs of relationships. The individuals involved in the external webs are boundary spanners who perform the tasks of connecting the organisation with the external environment (Reid & de Brentani, 2004). These networks can draw in a diversity of new knowledge and product applications beyond those of current customers and markets.

Accordingly, the aspects of IDNW help to explain its close association with FO of MV. FO is referred to an NPD team’s discussion regarding user interactions with the breakthrough innovations. Thus, the implication is that IDNW allows the NPD team to ease into the established networks driven by both the boundary spanners and the idea drivers. NPD team members can spend time together broadening their thinking and forming the required discussion. This may lead the NPD team to move quickly to reach a clear consensus of an image of a future product-market or MV and its target market as well as target customers. This process also seems to explain the rest of the associations between IDNW and SPMG, SC and CL.

## **5.5 Performance Consequences of Market Vision**

### **5.5.1 Before-Launch Stage Performance**

*H3: MV has a significant and positive impact on before-launch stage performance.*

In Chapter 2, Literature Review, it was proposed that market vision (MV) has a significant and positive impact on before-launch stage performance (BLSP). The elements of BLSP are part of the measures of market-driving innovation performance (MDIP), which include breakthrough integrity (BI) and early success with customers (ESC). When organisational members have a market vision, this can influence the development of radically new or really new products and the likelihood of achieving BI and ESC with the ability to maintain product innovativeness and satisfy early customers with products that have maintained their radicalness or innovative integrity (O'Connor et al., 2008; Reid & de Brentani, 2010).

To evaluate the relationship between MV and BLSP, the aggregate construct of MV was first entered into a simple bivariate regression analysis with the dimensions of BLSP, and then the individual dimensions of MV were entered into a multiple regression as a further test of the relationship. Table 5.3 presents the results of these analyses.

**Table 5.3: Regression Models: Market Vision and Before-Launch Stage Performance**

	Before-Launch Stage Performance Dimensions					
	Before-Launch Stage Performance (aggregate)		Breakthrough Integrity (BI)		Early Success with Customers (ESC)	
	Beta	t-value	Beta	t-value	Beta	t-value
<b>Simple regression model</b>						
<b>Market Vision (aggregate)</b>	0.419***	6.15	0.353***	5.02	0.424***	6.22
R Square	0.176		0.125		0.180	
Adjusted R Square	0.171		0.120		0.175	
F-ratio	37.756***		25.181***		38.740***	
<b>Multiple regression model</b>						
Specific Magnetism (SPMG)	0.235**	2.69	0.226*	2.48	0.180*	2.07
Form (FO)	0.389***	3.57	0.295**	2.60	0.459***	4.24
Scope (SC)	-0.261**	-2.72	-0.246*	-2.46	-0.210*	-2.20
Clarity (CL)	0.100	1.14	0.109	1.19	0.051	0.58
R Square	0.240		0.173		0.247	
Adjusted R Square	0.222		0.154		0.229	
F-ratio	13.724***		9.120***		14.254***	

+ = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

**Simple Regression:**

The adjusted R square values indicate that MV explains approximately 17% of the variance of the aggregate construct of before-launch stage performance (BLSP). Regarding the dimensions of BLSP, MV explains 12% of the variance of BI and 18% of the variance of ESC. All results were significant at p<0.001. MV was therefore determined to have a significant positive relationship with the elements of BLSP. In terms of the dimensions of BLSP, MV was most significantly related to ESC ( = 0.424). Although the view of market visioning in this study was broadened to include really new products, the results are in line with the findings of Reid

and de Brentani (2010). An effective MV allows an NPD team to focus on delivering unique benefits and value to customers, thereby significantly and positively impacting on ESC (Reid & de Brentani, 2010).

### **Multiple Regression:**

The results of the multiple regression analysis reported in the second half of Table 5.3 show that the constituents of MV explain approximately 22% of the variance of BLSP at an aggregate level, and explain 15% of the variance of BI and 23% of the variance of ESC.

The results of the regression analyses provide support for H3 that MV has a significant positive impact on BLSP. Within the dimensions of MV, FO was found to be most significantly related to both BI ( $\beta = 0.295$ ) and ESC ( $\beta = 0.459$ ) at the significance level of  $p < 0.001$ . To a lesser extent, SPMG was found to be closely associated with both BI ( $\beta = 0.226$ ) and ESC ( $\beta = 0.180$ ) at the significance level of  $p < 0.05$ . Interestingly, SC was found to have a significant negative relationship with both BI ( $\beta = -0.246$ ) and ESC ( $\beta = -0.210$ ) at the significance level of  $p < 0.05$ . However, CL has no explanatory power to either BI ( $\beta = 0.109$ ) or ESC ( $\beta = 0.051$ ) performance.

### ***Form (FO)***

In the dimensions of MV, it was not surprising to find FO to be the most significantly related to BI and ESC performance. FO involves an NPD team's appropriate time spent on discussing end-user interactions with the breakthrough innovations. It also refers to the question of how the breakthrough innovations would fit into an overall system of use for potential customers (Reid & de Brentani, 2010). The aspects of "how" and end-user interaction in FO, are deemed appropriate to the development of breakthrough innovations. Simply asking customers what they want is likely to result in "me-too" products. To explore customers' usage of a new product or "product outcome" is important for turning customer input into breakthrough innovation (Ulwick, 2002).

More specifically, understanding the end-user interaction with a breakthrough innovation in FO can reveal the real meaning of the product, thereby impacting on BI performance. This rationale is supported by the studies on design-driven innovation by Verganti (2009) and vision in product design (ViP) by Hekkert and van Dijk (2011), which found that a unique “product meaning” can be revealed through a lens of user interaction with a product. If the real meaning of the product is recognised and valued by the NPD teams, it is likely that its integrity will be maintained for the development of new products. By identifying a clear and specific product meaning early in the NPD process, the high level of innovativeness and originality of a new product can be justified in order to resist the pressure from the management to modify the idea and reduce the breakthrough integrity. This is likely to allow the breakthrough ideas to emerge into the development stage and to commercialisation. As such, FO has a critical role to play in terms of achieving BI performance. The study of Lynn et al. (1999b, p.450) referred to visions as goals and supported the association of FO and BI (in reverse) in that “if a goal is unclear or not supported by top management or team leaders, then the goal would probably be unstable and experience changes as the project progressed”.

In a similar vein, FO is also significant in terms of achieving ESC. Since a breakthrough innovation is developed with consideration of how it fits into an overall system of use for potential customers, as reflected in FO, it is likely that early customers will readily accept such innovations. Reid and de Brentani (2010, p. 509) supported this notion: “Having a vision of the point of interaction between potential customer and potential product – that is, the MV FORM – enables the firm to develop new products that are likely to meet customer needs and wants”. When a product’s real meaning is explored and developed into new products, this can bring about new meanings or value to the customers. The needs of customers can be better met through the new products and hence result in superior customer satisfaction. Singh and Tromp (2011, p.3) stated that “radical innovations don’t provide people with an improved interpretation of what they already know but it purposes a different and unexpected meaning, which is unsolicited and is what people were actually waiting for”.



### *Specific Magnetism (SPMG)*

The results also explain a significant level of strength observed between SPMG and BLSP dimensions. Chapter 4 described why the original dimensions of MV, specificity and magnetism, were merged into a new factor called “specific magnetism” (SPMG) to create discriminant validity. SPMG involves a specific, tangible market vision statement that enables an NPD team to create “buy-in” from others in the firm. Support from other people and groups in the firm can lead to gain management support, likewise, helps to maintain BI performance.

In addition, SPMG has a significant positive impact on ESC performance. SPMG indicates that MV clearly highlights an attractive market opportunity during the early stages of the development. Further, it provides a clear direction for others in the firm regarding what is being developed and for whom. This dimension of MV helps to ensure that the NPD team and others in the firm are committed to a vision that has a high likelihood of impacting on a particular market and being taken up by particular types of potential users. Hence, the NPD team can maintain their focus on developing new products that would provide new benefits for target users. By focusing on delivering the MV, the firm can therefore achieve early customer satisfaction and acceptance.

### *Scope (SC)*

The result indicates a significant negative impact of SC on both dimensions of BLSP. SC relates to how an NPD team spending an appropriate amount of time thinking about and discussing the target market for the breakthrough innovations. The central discussions, reflected in SC, relate to the target market for the breakthrough innovation, i.e., what would be the most profitable, the most important and/or the largest target market (Reid & de Brentani, 2010).

In fact, the negative finding of SC suggests that it has an adverse influence on the likelihood of achieving BI and ESC performance. This finding somewhat contradicts past scholarship which stated that SC is a significant element of MV and positively contributes to the ESC of radically new, high-tech products (Reid & de Brentani, 2010). The SC result in this study is, nonetheless, in line with the findings of other researchers who also considered that the assessments of

market size and market potential are less important in the early phases of developing breakthrough innovations (e.g. Christensen, 1997; O'Connor, 1998). To spend too much time thinking about what would be the most important or the largest target market for a breakthrough innovation may not be valuable because those markets may not have emerged. Further, the negative influence of SC suggests that the more time an NPD team spends on thinking about and discussing the target market, the more they are at risk of losing the originally desired highly innovative concept or BI. This might cause the NPD team to lose their focus on delivering the unique benefits to potential customers (Christensen & Overdorf, 2000).

### ***Clarity (CL)***

The CL dimension of MV does not have any significant direct relationship with either BI or ESC performance. In this study, CL reflects a clear market vision that is derived from the result of the NPD team's discussion on the specific markets for breakthrough innovations (as reflected in FO and SC). The MV itself only facilitates what would be the image of a product-market in regard to who the target customers would be and what their needs would be for the breakthrough innovations, as well as how the breakthrough innovations would be used by those target customers. One plausible explanation for this observation is that CL or market vision clarity may often appear to be unclear, especially in the early stage or before-launch stage of developing breakthrough innovations. In the highly uncertain environments of breakthrough innovations, it may be difficult for everyone in the team to clearly articulate who the specific target market would be in reality. The specific target market for the breakthrough innovations may be a subjective matter (Lynn & Akgün, 2001; Rice et al., 1998). The clarity of MV, likewise, may not always be warranted, particularly to account for a unique variance in either BI or ESC in the early stage or before-launch stage performance of breakthrough innovations. In fact, CL was described as an extrinsic dimension of MV because the vision is likely to become clearer and strengthen over time when a breakthrough innovation evolves over the stages of the NPD process (Reid & de Brentani, 2010).

### 5.5.2 Post-Launch Stage Performance

*H4: MV has a significant and positive impact on post-launch stage performance.*

In addition to its role in impacting on the elements of before-launch stage performance, MV was proposed to influence elements of post-launch stage performance (PLSP). As stated previously, PLSP is part of the measures of market-driving innovation performance, which include speed-to-market (STM) and windows of opportunity (WO). Cast in RBV, MV is a result of resource-based dynamic capabilities built upon various exploratory learning processes, as reflected in MVC. Thus, the resultant market vision is an effective mental image of a feasible and potentially prosperous future product-market option (Reid & de Brentani, 2010). It would be a reasonable expectation that MV stemming from dynamic capability (MVC) would typically enable firms to deliver breakthrough innovations to future markets in a timely manner (Chen, Damanpour & Reilly, 2010; Goktan & Miles, 2011). Having a more clearly defined MV is likely to reduce reworking and avoid changes in direction for an NPD team, thereby speeding up the product development cycle (Kim & Wilemon, 2002a; Lynn & Akgün, 2001). Moreover, the mental image of a future market (MV) should encourage firms to take advantage of pioneering opportunities (Kleinschmidt et al., 2007). It was therefore proposed that if organisational members have a market vision, this would influence the development of radical or really new innovations and the likelihood of achieving speed-to-market and opening up windows of opportunity for the firm.

To evaluate the relationship between MV and PLSP, the aggregate construct of MV was first entered into a simple bivariate regression analysis with the dimensions of PLSP, and then the individual dimensions of MV were entered into a multiple regression to further test the relationship. Table 5.4 presents the results of these analyses.

**Table 5.4: Regression Models: Market Vision and Post-Launch Stage Performance**

	Post-Launch Stage Performance Dimensions					
	Post-Launch Stage Performance (aggregate)		Speed-to-Market (STM)		Windows of Opportunity (WO)	
	Beta	t-value	Beta	t-value	Beta	t-value
<b>Simple regression model</b>						
Market Vision (aggregate)	0.525***	8.21	0.463***	6.96	0.510***	7.89
R Square	0.276		0.215		0.260	
Adjusted R Square	0.272		0.210		0.256	
F-ratio	67.387***		48.424***		62.212***	
<b>Multiple regression model</b>						
Specific Magnetism (SPMG)	0.288**	3.49	0.247**	2.84	0.301***	3.64
Form (FO)	0.285**	2.77	0.239*	2.21	0.314**	3.05
Scope (SC)	-0.147	-1.62	-0.102	-1.06	-0.224*	-2.47
Clarity (CL)	0.193*	2.33	0.168 <sup>+</sup>	1.92	0.196*	2.36
R Square	0.321		0.246		0.321	
Adjusted R Square	0.306		0.229		0.305	
F-ratio	20.578***		14.202***		20.522***	

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

**Simple Regression:**

The adjusted R square values indicate that MV explains approximately 28% of the variance of the aggregate construct of post-launch stage performance (PLSP). Regarding the dimensions of PLSP, MV explains 21% of the variance of STM ( = 0.436) and 26% of the variance of WO ( = 0.510). All results were significant at p<0.001.

**Multiple Regression:**

The results of the multiple regression analysis reported in the second half of Table 5.4 suggest that MV explains some proportion of the variance of PLSP. This is evidenced by the adjusted R

square values which show that the dimensions of MV explain approximately 31% of the variance of PLSP at an aggregate level, and explain 23% of the variance of speed-to-market (STM) and 31% of the variance of windows of opportunity (WO).

The results of the regression analyses support H4 that MV has a significant positive relationship with PLSP. In the dimensions of MV, specific magnetism (SPMG) was found to have the strongest positive relationship with STM ( $\beta = 0.247$ ;  $p < 0.01$ ). On the other hand, form (FO) was found to be most significantly related to WO ( $\beta = 0.314$ ;  $p < 0.001$ ). Similarly to the finding for H3, scope (SC) was found to have a negative relationship to speed-to-market; the relationship was however nonsignificant ( $\beta = -0.102$ ). In addition, the results indicate a significant negative relationship between SC and WO ( $\beta = -0.224$ ;  $p < 0.05$ ). Clarity (CL) has some explanatory power to WO ( $\beta = 0.196$ ;  $p < 0.05$ ), and to a lesser extent influences STM ( $\beta = 0.168$ ;  $p < 0.10$ ).

#### ***Specific Magnetism (SPMG)***

In the dimensions of MV, SPMG was found to be the most significant dimension related to STM. SPMG was described as a clear and specific market statement that helps make tangible what is to be developed and for whom (Reid & de Brentani, 2010; Tassarolo, 2007). STM, in this study, captures the degree to which a breakthrough innovation is completed on or ahead of the original schedule for moving from initial conception to its full commercialisation, and thereby pleasing top management (Chen, Reilly & Lynn, 2005; Kessler & Chakrabarti, 1999; McNally et al., 2011).

The close association between SPMG and STM performance seems reasonable. A clear and specific market vision (as reflected in SPMG) can reinforce the NPD team and other organisational members to move as one to attract future market opportunity. This is likely to speed up the entire product development process (STM). Previous research supports this finding that a clear product concept or product vision is significantly linked to NPD speed or time performance (e.g. Chen et al., 2010; Lynn, Reilly & Akgün, 2000; Lynn et al., 1999b; Swink, 2003). An ambiguous or too broad vision or poorly framed goals may lead to more uncertainty and disagreements in the NPD team. As a result, the team members may end up

working towards different goals and directions. It is therefore vital to keep the vision focused so as not to delay the project's original schedule and completion time (Chen et al., 2010).

### ***Form (FO)***

It is understandable to find that, of all the elements, FO is the most closely associated with WO performance. As previously stated, the underlying explanation of FO highlights the importance of understanding user interaction with a product that uncovers the product's true meaning. This true meaning results in a more clearly defined new product that brings a different and unexpected value to customers (Hekkert & van Dijk, 2011). Accordingly, the new product is likely to fulfil the customers' latent or unarticulated needs, which they may be unable to explicate before the product becomes available in the market. These needs only come to consciousness when the firm launches the new product (Slater & Narver, 2000). The new product directs customer's preferences and behaviour in new directions, and is often perceived to be better than what had previously been available. FO, likewise, has a significant influence on the likelihood of achieving WO performance, through opening up new markets or new technologies or leading the firm into new product arenas (Hills & Sarin, 2003; Kleinschmidt et al., 2007).

### ***Scope (SC)***

The SC dimension of MV was found to have negative relationships with STM and WO performance. This negative impact of SC on STM and WO performance is in line with H3. In regard to speed-to-market, the result was negative but not statistically significant. In regard to windows of opportunity, the result was significant but negative. As previously described, SC refers to the amount of time spent discussing what might be the most profitable, largest or most important target markets for a breakthrough innovation (Reid & de Brentani, 2010). The result suggests that spending too much time focusing on target markets would not lead the firm to achieve WO or to open a new market or new technologies or product arena.

Developing breakthrough innovations may not result in high profits but may be strategically important. Yet despite the fact that highly innovative products might attract those customers at

the high end of the market, there is an additional overhead cost associated with their special features and functions. Eventually, this could turn the target market that once promised a high gross profit into an unattractive one (Christensen & Overdorf, 2000). Focusing too much on the value of the target market might force managers to go for incremental innovations with lower cost and risk and likely more immediate profitability. Thus, the firm is likely to lose the focus on developing breakthrough innovations, thereby missing opportunities to seize control of the future market (Hamel & Prahalad, 1994a).

The finding of SC is well entrenched in many studies that have referred to breakthrough innovation as “disruptive” changes to both a firm’s core competencies and the customers in the mainstream market (e.g. Christensen, 1997; Hamel & Prahalad, 1994a; Utterback, 1994). This type of product requires new organisational capabilities to cope with the changes and drive the market rather than being driven by the market. The traditional questions to assess the target market, as reflected in SC, therefore appear to be inappropriate to the early phases of the NPD process (O'Connor, 1998).

### ***Clarity (CL)***

Although CL does not have any impact on before-launch stage performance, CL was found to have some explanation of WO and also tentatively of STM performance. These findings are not surprising since the vision is likely to become clearer after tangible product prototyping or the probe-and-learn process, or at the post-launch stage performance (Lynn et al., 1996). At the post-launch stage, it is possible for the NPD team to identify and acknowledge who the real buyers are. CL, therefore, appears to be relevant to post-launch stage performance.

In particular, CL is most strongly associated with WO. The study of Kleinschmidt et al. (2007) on “up-front homework activities” and their impact on WO supports the importance of this association. The activities reflected in homework activities help to understand specific types of customers and typically result in more clearly defined new products that are responsive to markets (Kleinschmidt et al., 2007). In this regard, firms are more likely to “pioneer” the opportunity by means of “being the first to introduce a new product to market” (Hills & Sarin, 2003, p.14). Hence, CL seems to influence the development of radically or really new products

and the likelihood of opening up windows of opportunity for the firm. Kleinschmidt et al. (2007, p.426) stated “the right type and level of homework should result in reduced rework, should speed up the NPD cycle, and should make the process more efficient”. This may also help to explain a tentatively significant result observed between CL and speed-to-market (STM).

While CL of MV was not significant to STM at 95% level of confidence interval (z-value = 1.96), it was significant at 90% level of confidence interval (z-value = 1.645). Although this is a tentative result, the finding is consistent with the past scholarship of Lynn and Akgün (2001) in that vision clarity is positively related to new product success, that is, the degree to which “the product met or exceeded overall senior management’s expectation” (Lynn & Akgün, 2001, p.385). One of the items measuring STM involves the degree to which “top management was pleased with the time it took for breakthrough innovations to get to full commercialisation” (Dayan & Elbanna, 2011, p. 174). In this respect, the measures of both STM and new product success are seen to involve the aspect of satisfying senior management. This suggests that CL may have a role in terms of achieving senior management’s satisfaction. As CL was found to have significant positive relationship with new product success, it also has some explanation of STM.

In a similar vein, CL has been found to be a significant determinant of speed-to-market in many studies (e.g. Chen et al., 2010; Swink, 2003; Wheelwright & Clark, 1992). CL, as one dimension of an effective market vision, is particularly important for breakthrough innovations given that the NPD team and others in the firm have to confront an unfamiliar environment. There will be a high level of anxiety if team members do not have clear vision of what needed to be accomplished. Breakthrough innovation requires an organisational change in terms of new organisational and/or technological competency for the development of a new line of product that explores new idea or technologies. Schein (1993) stated that a psychologically safe environment must be created for a change to happen, that is, team members have to see a direction and a manageable path forward. A clearly identified product definition and target market can direct the focus of team members to the objectives of the project. A well-articulated and acknowledged vision across the team and departments avoids ambiguity and changes in



directions while the new product is developed (Harter, Krishnan & Slaughter, 2000; Lynn et al., 2000; Swink, 2003; Wheelwright & Clark, 1992). Chen et al. (2010, p.28) supported the impact of CL on STM: “For fast development of a new product (whether simple, complex, radical or incremental), NPD teams need to have clear product visions and support from top managers throughout the process”.

## **5.6 Market-Driving Innovation Performance**

### **5.6.1 Before-Launch Stage and Post-Launch Stage Performance**

*H5: Before-launch stage performance has a significant and positive impact on post-launch stage performance.*

There is an implied relationship between before-launch stage performance (BLSP) and post-launch stage performance (PLSP). The before-launch stage performance, as discussed in Chapter 2, is the extent to which a clear and highly innovative concept of a potential new product is maintained after it enters the development and commercialisation phases of being satisfied and accepted by early customers (Brown & Eisenhardt, 1995; Clark & Fujimoto, 1991; Reid & de Brentani, 2010; Seidel, 2007). As such, BLSP is likely to influence PLSP or the extent to which market-driving innovations opened a window of opportunity on a new category of products or on a new market for the firm (Chen et al., 2005; de Brentani et al., 2010; Kessler & Chakrabarti, 1999; McNally et al., 2011).

To further evaluate this relationship, the aggregate construct of BLSP was first entered into a simple bivariate regression analysis with the dimensions of PLSP, and then the individual dimensions of BLSP were entered into a multiple regression analysis as a further test of the relationship. Table 5.5 presents the results of these analyses.

**Table 5.5: Regression Models: Before-Launch Stage Performance and Post-Launch Stage Performance**

	Post-Launch Stage Performance Dimensions					
	Post-Launch Stage Performance (aggregate)		Speed-to-Market (STM)		Windows of Opportunity (WO)	
	Beta	t-value	Beta	t-value	Beta	t-value
<b>Simple regression model</b>						
<b>Before-Launch Stage performance (aggregate)</b>	0.593***	9.79	0.544***	8.62	0.517***	8.03
R Square	0.352		0.295		0.267	
Adjusted R Square	0.348		0.291		0.263	
F-ratio	95.962***		74.220***		64.501***	
<b>Multiple regression model</b>						
Breakthrough Integrity (BI)	0.286***	4.00	0.271***	3.61	0.223**	2.93
Early Success with Customers (ESC)	0.409***	5.73	0.364***	4.85	0.389***	5.12
R Square	0.380		0.316		0.298	
Adjusted R Square	0.373		0.308		0.290	
F-ratio	53.877***		40.702***		37.275***	

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

**Simple Regression:**

The adjusted R square values indicate that BLSP explains approximately 35% of the variance of PLSP at an aggregate level. Regarding the dimensions of PLSP, BLSP explains 29% of the variance of STM and 26% of the variance of WO. Both results were very significant at p<0.001. This determines that BLSP has a significant positive relationship with both the STM and WO dimensions of PLSP at (  $\beta = 0.544$  and  $\beta = 0.517$ ) respectively.

### **Multiple Regression:**

The results of the multiple regression analysis reported in the second half of Table 5.5 indicate that the BLSP dimensions explain a significant proportion of the variance in PLSP. This is evidenced by the adjusted R square values which show that the dimensions of BLSP explain approximately 37% of the variance of PLSP at an aggregate level, and explain 31% of the variance of STM and 29% of the variance of WO at the significance level of  $p < 0.001$ .

ESC performance was found to have the strongest relationship with both dimensions of PLSP. More specifically, ESC was the most closely associated with both STM and WO ( $\beta = 0.364$  and  $\beta = 0.389$  respectively) at the significance level of  $p < 0.001$ . Albeit it to a lesser extent, BI was also found to have a strong association with STM and WO performance ( $\beta = 0.271$  and  $\beta = 0.223$ , respectively), at the significance level of  $p < 0.001$  and  $p < 0.01$ , respectively.

The results of the regression analyses support H5 in suggesting that BLSP is positively related to PLSP. The relationship between BLSP and PLSP is intuitively palatable, as predicted. It would be expected that the greater the performance in the before-launch stage, the greater the likelihood of achieving speed-to-market and windows of opportunity.

### ***Early Success with Customers (ESC)***

The impacts of ESC performance on STM and WO performance outcomes seem to make reasonable sense, considering that the measurement items of ESC, which include early customer satisfaction and acceptance of the breakthrough innovations, would directly enable the NPD team to speed up the development process (STM) in converting promising ideas into launched products. In doing so, the firm is likely to become the first to introduce the new product to market, ultimately opening up new opportunities (WO) for the firm.

### ***Breakthrough Integrity (BI)***

The impacts of BI performance on STM and WO performance were not surprising. In Chapter 2, it was reported that the importance of maintaining the highly innovative product concept of a

potential new product from the front end and through to the final launch has been highlighted in previous studies (e.g. Brown & Eisenhardt, 1995; Clark & Fujimoto, 1990, 1991; Lynn & Akgün, 2001; Seidel, 2007). For breakthrough innovations, inherent ambiguity may cause a shift in the product concept during the development process and create confusion among NPD team members. This may cause delays in decisions that require team coordination and may contribute to lower-than-expected market results (Seidel, 2007). The ability to maintain BI helps to maintain the momentum of the NPD team members and their commitment to the desired objectives. The NPD team can share clear objectives and directions with others both inside and outside the firm (team members and customers). This may speed up the development of a breakthrough innovation, making it possible to launch the new product on time or even ahead of the original schedule, as reflected in STM, thereby satisfying top management. The close association between BI and STM is also in line with the study by Tassarolo (2007), which found that a clear product vision – clear objectives and a well-recognised strategy for the development process – is positively related to speed-to-market.

BI has a direct positive impact on a firm in opening up new market opportunities (WO). The maintenance of BI ensures the creation of superior products for the marketplace. This can be referred to as “product advantage”, by having “superiority and/or differentiation over competitive offerings” (Henard & Szymanski, 2001, p. 364). Breakthrough innovation, as a highly innovative product, captures these aspects of product advantage. This allows the firm to enter into a new market or new technological domain and consequently results in long-term product advantage (Cooper, 1996; Henard & Szymanski, 2001).

Overall, the before-launch stage performance (BLSP) appears to be consistent with the outcome of the “fuzzy front end”, “up-front homework”, and “homework or front end activities” of developing a product innovation (e.g. Cooper, 1996; McNally et al., 2011). The front end activities involve a preliminary assessment of the market and technology which results in new products that are clearly defined (Kleinschmidt et al., 2007; McNally et al., 2011). The outcome of the front end activities is similar to BLSP – that is, the results of having an early and clear definition provided by effective market vision. The resulting homework activities have shown to significantly impact on the NPD process, primarily through faster speed-to-market and

higher product quality (McNally et al., 2011). BLSP simplifies the NPD process as well as identifying windows of opportunity (Kleinschmidt et al., 2007). This highlights the influence of BLSP on both dimensions of PLSP. BLSP can impact both the focus and efficiency of the entire NPD process, particularly the actual product development from the beginning. The outcome of this before-launch stage of the development therefore determines the product's likelihood of success in the market (Song & Parry, 1997b).

### **5.6.2 Before-Launch Stage Performance and Financial Performance**

*H6: Before-launch stage performance has a significant and positive impact on financial performance.*

Before-launch stage performance (BLSP) and its dimensions can be key determinants for firms developing market-driving innovations to ultimately achieve financial performance (FP). Breakthrough integrity (BI) and early success with customers (ESC) dimensions of BLSP, resulting from MV, capture the front end outcome in ensuring that a clear and highly innovative concept of a potential new product is maintained after it enters the development and commercialisation phases of being satisfied and accepted by early customers. The expectation is that the higher the level of before-launch stage performance (BLSP), the higher the level of overall financial performance (FP) in terms of sales and profitability i.e. meeting profit or sales volume objectives (units sold) or being profitable relative to the resources invested in such product. A direct positive relationship was therefore hypothesised to exist between BLSP and FP in the conceptual model as proposed in Chapter 2.

To further evaluate the relationship between BLSP and FP, the aggregate construct of BLSP was first entered into a simple bivariate regression analysis with FP. Then the individual dimensions of BLSP were entered into a multiple regression analysis as a further test of the relationship. Table 5.6 presents the results of these analyses.

**Table 5.6: Regression Models: Before-Launch Stage Performance and Financial Performance**

	Financial Performance (FP)	
	Beta	t-value
<b>Simple regression model</b>		
<b>Before-Launch Stage performance (aggregate)</b>	0.528***	8.28
R Square	0.279	
Adjusted R Square	0.275	
F-ratio	68.514***	
<b>Multiple regression model</b>		
Breakthrough Integrity (BI)	0.314***	4.09
Early Success with Customers (ESC)	0.293***	3.82
R Square	0.287	
Adjusted R Square	0.278	
F-ratio	35.352***	

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

### Simple Regression:

The adjusted R square value indicates that BLSP explains approximately 28% of the variance of FP. The result was significant at p<0.001. In this respect, BLSP was determined to have a strong positive association with FP ( = 0.528). The result appears to be consistent with studies on up-front homework (predevelopment work) and its impact on profitability. Up-front homework emphasises the need for an early product definition before the actual development of the product (Cooper, 1996; Deighton, Rizley & Keane, 2012). Similarly, the expected outcome following the before-launch stage performance is generally a clearly defined (highly innovative) product concept. The resultant outcomes at this stage (BLSP) can therefore determine the business case for a full-fledged development project, and ultimately the success rate and profitability of the new product (FP) (Cooper, 1996).

### **Multiple Regression:**

The results of the multiple regression analysis reported in the second half of Table 5.6 show that BLSP explains approximately 28% of the variance for FP. The results of the regression analyses provide support for H6, suggesting that BLSP is positively related to FP.

### ***Breakthrough Integrity (BI)***

In the dimensions of BLSP, BI was found to have the strongest association with FP ( $\beta = 0.314$ ;  $p < 0.001$ ). The association of BI and FP appears to be consistent with the findings of Cooper (1996). The measurement items of BI, as previously described, were related to the maintenance of an originally desired, highly innovative product concept of a potential new product from the initial idea through to the final product launched. This results from having a clear and specific early-stage mental model of a product-market as reflected in MV. According to Cooper (1996), it was found that such sharp and stable, early product definition has a very strong impact on both the financial performance and the firm's total new product efforts. It can improve the project success rate by 59.2%, and has a higher project success rate and market share of 3.7 and 1.6 times, respectively, than projects lacking product-definition.

### ***Early Success with Customers (ESC)***

To a lesser degree than BI, ESC was found to be significantly associated with FP ( $\beta = 0.293$ ;  $p < 0.001$ ). The items used to measure ESC in this study were developed based on the lead user concept proposed by von Hippel (1978) and (Griffin & Page, 1996). Lead user analysis involves identifying and leveraging primarily innovative customers or users whose needs are ahead of the market trend (Cooper & Edgett, 2008). The users are integral part of the development process in defining and testing solutions for the next new product, that is, a "probing and learning" process Lynn et al. (1996). Customers are bound to verify the performance of an early version of the product in their use environment. This may result in redesigning the product, to ensure that early customers' needs would be better met, hence providing early customer satisfaction and acceptance (Deighton et al., 2012).

In view of that, the outcome measurement of ESC primarily relies on confirmation (success) with early customers in ensuring that customers' needs are better met through breakthrough innovations than those existing ones, and in addition, customers are satisfied and readily accepted breakthrough innovations even prior to formally launching them. The importance of this front end outcome (ESC) to financial performance makes reasonable sense. Studies have found that a new product that highlights the concerns of the customers or users is strongly associated with the profitability of the business unit's total new product efforts (Cooper, 1996; Cooper & Edgett, 2008). In particular, if the customers accept a product from the early stages of the NPD process, there is likely to be good sales results (Reid & de Brentani, 2010). Thus, early customer satisfaction and acceptance (ESC) was determined to have a strong relationship with financial performance.

### **5.6.3 Post-Launch Stage Performance and Financial Performance**

*H7: Post-launch stage performance has a significant and positive impact on financial performance.*

Similar to before-launch stage performance (BLSP), post-launch stage performance (PLSP) is considered to be linked to the level of overall financial performance (FP). The dimensions of PLSP, which are speed-to-market (STM) and windows of opportunity (WO), are anticipated to have a downstream positive effect on FP, providing that breakthrough innovations were developed and launched quickly, thus opening up new opportunities for the firm. A direct positive relationship was therefore hypothesised between PLSP and FP in the conceptual model.

To further evaluate the relationship between PLSP and FP, the aggregate construct of PLSP was firstly entered into a simple bivariate regression analysis with FP, and the individual dimensions of PLSP were then subsequently entered into a multiple regression analysis as a further test of the relationship. Table 5.7 presents the results of these analyses.



**Table 5.7: Regression Models: Post-Launch Stage Performance and Financial Performance**

	Financial Performance (FP)	
	Beta	t-value
<b>Simple regression model</b>		
<b>Post-Launch Stage Performance (aggregate)</b>	0.575***	9.34
R Square	0.330	
Adjusted R Square	0.327	
F-ratio	87.306***	
<b>Multiple regression model</b>		
Speed-to-Market (STM)	0.276***	3.98
Windows of Opportunity (WO)	0.429***	6.19
R Square	0.385	
Adjusted R Square	0.378	
F-ratio	55.169***	

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

### Simple Regression:

The adjusted R square value indicates that PLSP explains approximately 33% of the variance of FP. The result was significant at p<0.001. PLSP was therefore determined to have a strong positive relationship with FP (β = 0.575). In addition, PLSP explains slightly more variance of FP than BLSP does (33% versus 28%). A plausible explanation may be that at the before-launch stage, how the product will perform in the market is still uncertain. FP may become more apparent at PLSP when the breakthrough innovations have been launched, ultimately opening a new market or product/technological arena.

### Multiple Regression:

The results of the multiple regression analysis reported in the second half of Table 5.7 show that disaggregated PLSP explains 38% of the variance of FP. In the dimensions of PLSP, WO

was found to have the strongest association with FP ( $\beta = 0.429$ ;  $p < 0.001$ ). Albeit it to a lesser extent, STM was found to be significantly associated with FP ( $\beta = 0.276$ ;  $p < 0.001$ ).

The results of the regression analyses provide support for H7, suggesting that the PLSP and its dimensions STM and WO are positively related to FP. This finding is consistent with earlier studies where highly significant ( $p < .001$ ), positive effects of STM and WO have been found on FP (de Brentani et al., 2010; Kleinschmidt et al., 2007). Based in RBV and new product development (NPD) literature, achieving competitive advantage is the ultimate key to a firm's superior financial performance and long-term success (Griffin & Page, 1996; Smith et al., 1996). The short-term performance is nonetheless assessed in terms of a firm's ability to increase efficiency (speed-to-market) and market share or to open a new category of products or a new market.

#### ***Speed-to-Market and Windows of Opportunity (STM and WO)***

STM and WO are seen as antecedents to FP in that the elements create opportunities to generate returns from NPD. The NPD team that can move breakthrough innovations quickly onto launch (STM) is likely to lead their firm to achieve first-mover advantage and ultimately yield financial returns. This is also often a result of an effective time-to-market plan, which allows the NPD team to minimise cost overruns caused by errors or delays. The result of STM is in line with an empirical study by de Brentani et al. (2010) that time-to-market (denoted the same concept as speed-to-market) has a significant and positive impact on financial performance.

Further, de Brentani et al. (2010) also highlighted the significant impact of WO by stating that “even more important for ensuring superior financial outcome is the identification and exploitation of windows of opportunity” (p.154). This may help to explain the stronger association between WO and FP than between STM and FP. Kleinschmidt et al. (2007) supported the significant impact of WO on financial outcomes in the context of global NPD program by indicating that “the higher the performance in opening windows of opportunity, the higher the financial performance” (p.427). The findings in this study are consistent with the RBV and empirical results in NPD research. It supports the premise that the ability to obtain

market or technology leadership through STM and WO has a significant influence on a firm's competitive advantage and ultimately superior financial performance.

## 5.7 Proposed Moderation Effects

A moderator analysis in the form of a SPSS macro (MODPROBE) was used to probe the hypothesised interactions (Hayes & Matthes, 2009). Several moderators were involved to test the interactions that may exist between the relationships of MV and before-launch stage performance (BLSP) and post-launch stage performance (PLSP). These were:

- 1) **External Environment** (EE): competitive intensity (CI), technological turbulence (TT) and market turbulence (MT);
- 2) **NPD process rigidity** (NPDR);
- 3) **Firm size** or number of employees (NOE).

The output of the MODPROBE macro is a regression that estimates the effect of the focal predictor (F) at specified values of a moderator variable (M). The interaction between F and M represents a single degree-of-freedom (df), showing a single regression coefficient. The output also provides conditional effects (low, medium, high) of M as well as estimates the effect of F at those values (Hayes & Matthes, 2009).

It must be noted that the option of Mean Center F and M was selected prior to the estimation of the model in this study. The purpose of the option is to standardise and interpret the values of F and M (Hayes & Matthes, 2009). The option of Mean Center is commonly used by empirical marketing researchers (e.g. Echambadi & Hess, 2007; Kromrey & Foster-Johnson, 1998). This option has often been selected as it is understood to reduce nonessential multicollinearity. Mean Center and non-centered appear to yield identical hypothesis tests on the interaction terms (Echambadi & Hess, 2007; Kromrey & Foster-Johnson, 1998). In other words, the coefficients, the beta and the t-statistic of the interaction terms are functionally identical regardless of

whether the option Mean Center is checked. Nonetheless, the linear effects between the mean-centered data and the uncentered data would reveal a different result.

The coefficients of mean-centered data represent main effects of the variables, as opposed to simple effects. The main effects indicate the effects of each variable when the other variables are at their mean values. The simple effects are those data without mean-center. They represent the effects of each variable when the other variables are at zero value. The zero value may provide a concrete understanding of the patterns. The mean values, however, better describe the overall relationships. This study mean-centered the predictors for more meaningful and interpretive purposes (Hayes, 2005; Hayes & Matthes, 2009).

### **5.7.1 External Environment (EE)**

From the literature review in Chapter 2, the impact of the External Environment (EE) as a moderator of the relationship between MV and BLSP was proposed. That relationship can be affected by the factors of EE, which are: competitive intensity (CI), technological turbulence (TT) and market turbulence (MT). Thus, the following hypothesis examines whether the factors of EE have any negative moderating impact on the link between MV and BLSP.

*H8a: The relationship between MV and before-launch stage performance is negatively moderated by CI, TT and MT.*

To evaluate whether CI, TT and MT moderate the relationship between MV and BLSP, a moderator analysis in the form of an SPSS macro, MODPROBE, was used to probe the interactions in the SPSS program (Hayes & Matthes, 2009). The CI, TT and MT were respectively entered into the SPSS MODPROBE script dialog box as a moderator variable (M), where MV is the focal predictor (F) and BLSP is the dependent variable (Y). Table 5.8 presents the results of these analyses.

**Table 5.8: Moderation Effects of External Environment between MV and Before-Launch Stage Performance**

Model (BLSP)	CI		TT		MT	
EE Interaction Model		t		t		t
Constant	6.898	69.57***	6.897	66.69***	6.913	67.10***
MV	0.109	6.37***	0.100	5.67***	0.088	4.88***
EE	0.025	0.27 (n.s.)	0.079	0.77 (n.s.)	0.291	2.54*
MV x EE	0.027	2.10*	0.015	1.04 (n.s.)	0.007	0.43 (n.s.)
<b>R-square</b>	0.196		0.182		0.205	
<b>F-ratio (df)</b>	14.231	3, 175	13.013	3, 175	15.081	3, 175
Conditional effects		t		t		t
low	0.080	4.06***	0.084	3.80***	0.081	3.89***
medium	0.109	6.37***	0.100	5.67***	0.088	4.88***
high	0.138	5.74***	0.116	4.77***	0.095	3.59***

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

The results of the moderator analysis only partially support H8a. The results suggest that the relationship between MV and BLSP is contingent on competitive intensity (CI), but not on technological turbulence (TT) or market turbulence (MT). In this regard, MV has a significant effect in the BLSP model, with ( $\beta = 0.109$ ,  $t = 6.37$ ,  $p < 0.001$ ). Although CI itself has no significant effect in the BLSP model ( $\beta = 0.025$ ,  $t = 0.27$ , not significant), the interaction term between MV and CI is nonetheless statistically significant ( $\beta = 0.027$ ,  $t = 2.10$ ,  $p < 0.001$ ). This suggests that CI is a “pure” moderator. Specifically, the positive coefficient of the interaction means that the effect of MV on BLSP becomes more positive as CI increases. In addition, the conditional effects indicate that the regression for low ( $\beta = 0.080$ ,  $t = 4.06$ ,  $p < 0.001$ ), medium ( $\beta = 0.109$ ,  $t = 6.37$ ,  $p < 0.001$ ) and high ( $\beta = 0.138$ ,  $t = 5.74$ ,  $p < 0.001$ ) levels of CI are statistically significant and positive. That is, the greater the extent of competitive intensity in the business environment the more MV influences BLSP. For TT and MT, the interaction terms of MV x TT and MV x MT are not statistically significant in the BLSP model with ( $\beta = 0.015$ ,  $t = 1.04$ ) and ( $\beta = 0.007$ ,  $t = 0.43$ ). This indicates that both TT and MT are not moderators.

The result regarding competitive intensity was somewhat surprising. The hypothesis was stated in the opposite direction – that CI negatively impacts on the relationship between MV and BLSP. The positive influence of CI, however, appears to make reasonable sense when seen in the context of other research and the study focus on radical innovation. As stated in Chapter 2, CI refers to high levels of competitive activity in an industry. This is suggestive of low industry concentration, by means of having a large number of competitive players in the industry (Robinson, 1988). A low industry concentration often applies to a young industry where the market is still emerging and fallout has yet to occur (Levitt, 1965). This is particularly the case in the early stages of radical innovation, taking the examples of the computer industry and nanotechnology in their early days (Reid & de Brentani, 2012). In this regard, having more industry players often creates market uncertainties and a tendency for firms to lose their competitive positions (Zhang & Duan, 2010). There are likely to be many alternative new products in the market, which allow customers to easily switch from one product to another (Jaworski & Kohli, 1993; Kohli & Jaworski, 1990; Slater & Narver, 1994).

Increased competitive intensity may put environmental pressure on firms to opt for a proactive behaviour to try to deliver superior customer value. This involves the development of more radically new or really new products in order to steer demand and serve customers better than the competitive alternatives (Santos-Vijande & Álvarez-González, 2007). In this context, firms need to be more focused and proficient in discovering customers' needs, specifically latent exigencies (Li, Lin & Chu, 2008). This may result in dominant product designs or new ideas for future product-market (MV) emerging more quickly to be translated into the breakthrough integrity (BI dimension of BLSP). In contrast, firms would often lack enthusiasm in the absence of competitive intensity for undertaking or emphasising breakthrough innovations. Garcia et al. (2003, p.326) said that “in environments with little competitive pressure, a need to continually introduce new innovative products into the marketplace is not a major necessity for maintaining market share”. Further, strong competition may also increase customers' awareness and acceptance of a breakthrough innovation, leading to early success with customers (ESC dimension of BLSP) because of the innovation being endorsed by several players in the industry. This finding appears to be consistent with the finding by Reid and de Brentani (2012)

that a low level of industry concentration (nanotechnology sector) has a positive moderating effect on the relationship between MV and early success with customers.

Contrary to expectations, the linkage between MV and BLSP seems to be robust in contexts categorised by changing levels of technological turbulence (TT) and market turbulence (MT). TT refers to an external environment of a firm where technology is changing rapidly (Jaworski & Kohli, 1993), and thus analysing new technology opportunities and maintaining their applications for new products can be difficult. With MT, it was expected that the ability to translate MV into BLSP would be hindered by the high degree of uncertainty in the market, and hence it would be difficult to predict future market preferences. As MV appears to be an important determinant of BLSP, it may possibly be that the underlying image of MV refers to a future product-market that is able to drive the market or industry rather than being driven by them. Thus, a firm's innovative efforts particularly on breakthrough innovations should not be disrupted by rapid changes in technology opportunities (TT) or the varying needs of the customers and market demand (MT).

*H8b: The relationship between MV and post-launch stage performance is negatively moderated by CI, TT and MT.*

In addition to the role of the external environment (EE) in impacting on the relationship between MV and before-launch stage performance, this thesis has also proposed that the external environment (EE) influences the relationship between MV and post-launch stage performance (PLSP). The relationship may be affected by one or more of the factors of EE, namely, competitive intensity (CI), technological turbulence (TT) and market turbulence (MT). Therefore, H8b examines whether CI, TT and MT have any negative moderating influence on the relationship between MV and PLSP.

To evaluate the moderating effects of the external environment factors, CI, TT and MT were respectively entered into the SPSS MODPROBE (Hayes & Matthes, 2009) script dialog box as a moderator variable (M), where MV is the focal predictor (F) and PLSP is the dependent variable (Y). Table 5.9 presents the results of these analyses.

**Table 5.9: Moderation Effects of External Environment between MV and Post-Launch Stage Performance**

Model (PLSP)	CI		TT		MT	
EE Interaction Model	t		t		t	
Constant	7.033	67.00***	7.058	64.83***	7.067	64.47***
MV	0.152	8.44***	0.133	7.13***	0.129	6.72***
EE	0.015	0.15 (n.s.)	0.214	2.00*	0.280	2.30*
<b>MV x EE</b>	<b>0.030</b>	<b>2.24*</b>	<b>0.004</b>	<b>0.26 (n.s.)</b>	<b>-0.001</b>	<b>-0.04 (n.s.)</b>
<b>R-square</b>	0.296		0.292		0.297	
<b>F-ratio (df)</b>	24.526	3, 175	24.052	3, 175	24.646	3, 175
Conditional effects	t		t		t	
low	0.120	5.75***	0.128	5.49***	0.129	5.83***
medium	0.152	8.44***	0.133	7.13***	0.129	6.72***
high	0.185	7.29***	0.137	5.34***	0.128	4.56***

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

Similar to the previous findings on BLSP, the moderating impact of CI, TT and MT on the relationship between MV and PLSP only partially supported H8b. The results suggest that the relationship between MV and PLSP is contingent on CI, but not on TT or MT. In this regard, MV has a significant effect in the PLSP model ( $\beta = 0.152$ ,  $t = 8.44$ ;  $p < 0.001$ ). Despite the fact that CI itself has no significant effect in the PLSP model ( $\beta = 0.015$ ,  $t = 0.15$ , not significant), the interaction term between MV x CI indicates a statistically significant result ( $\beta = 0.030$ ,  $t = 2.24$ ;  $p < 0.05$ ). This suggests again that CI is a “pure” moderator. More specifically, the positive coefficient of the interaction means that the effect of MV on PLSP becomes more positive as CI increases. Additionally, the conditional effects show that the regression for low ( $\beta = 0.120$ ,  $t =$



5.75;  $p < 0.001$ ), medium ( $\beta = 0.152$ ,  $t = 8.44$ ;  $p < 0.001$ ) and high ( $\beta = 0.185$ ,  $t = 7.29$ ;  $p < 0.001$ ) levels of CI are very highly significant and positive. Indeed, the greater the extent of competitive intensity in the business environment the more MV influences post-launch stage performance. For TT and MT, the significant effects were found at  $p < 0.05$  in the PLSP model ( $\beta = 0.214$ ,  $t = 2.00$ , and  $\beta = 0.280$ ,  $t = 2.30$ ) but the interaction terms of MV x TT and MV x MT are not statistically significant, with ( $\beta = 0.004$ ,  $t = 0.26$  not significant) and ( $\beta = -0.001$ ,  $t = -0.04$ , not significant). This shows that TT and MT are not “pure” moderators.

It is interesting that competitive intensity was found to positively moderate the relationship, instead of having a negative impact as proposed. One rationale for this finding is that such intensified competition (CI) is likely to move innovations (MV) through the firm and to market more speedily to compete in the market (D'Aveni, 1994). This is often due to the fact that if there is a new market opportunity appealing to two firms at the same time, the one that can react faster to the opportunity is likely to win (D'Aveni et al., 1995). A firm's ability to translate MV into a radically new or really new product more rapidly than their competitors in the race to take advantage of a future market opportunity is therefore critical (Calantone et al., 2003). In particular, such a new product can create market and/or industry disruption and erode the competitive advantage of other firms (D'Aveni, 1994; D'Aveni et al., 1995). Thus, it is understandable that competitive intensity has a positive impact on the ability to translate MV into post-launch stage performance in terms of increased speed-to-market (STM) (i.e. being the first mover), and opening up a new market or a new technology or product arena (WO) for the firm.

The nonsignificant impacts of technological turbulence and market turbulence on the MV/PLSP relationship suggest that MV is an important determinant of post-launch stage performance. Firms must therefore strive to create and sustain MV in their efforts to attain higher performance at post-launch stage regardless of the environment in which they operate.

### **5.7.2 NPD Process Rigidity (NPDR)**

*H9a: The degree of NPD process rigidity negatively influences the relationship between MV and before-launch stage performance.*

*H9b: The degree of NPD process rigidity negatively moderates the relationship between MV and post-launch stage performance.*

Drawing from the literature review presented in Chapter 2, it was proposed that the degree of NPD process rigidity (NPDR) negatively influences the impact of MV on before-launch stage performance (BLSP) and post-launch stage performance (PLSP). NPDR, a stage-gate-like NPD process, appears to be generally linear and primarily focuses on solving customers' existing problems (market-driven). Previous studies have suggested that a predetermined market-driven routine and process can result in a negative performance effect on market-driving innovation (Bonner et al., 2002; de Brentani, 2001; Garcia et al., 2003). H9a and H9b were therefore proposed to examine the possible negative influence of NPDR on the relationship between MV and BLSP/PLSP.

To evaluate whether NPDR influences MV in translating into BLSP and PLSP, the aggregate construct of NPD process rigidity was entered into the SPSS MODPROBE (Hayes & Matthes, 2009) script dialog box as a moderator variable (M), where MV is the focal predictor (F), and BLSP and PLSP are the dependent variables (Y). Table 5.10 presents the results of these analyses.

**Table 5.10: Moderation Effects of NPD Process Rigidity**

Model	H9a (BLSP)		H9b (PLSP)	
Interaction Model		t		t
Constant	6.854	65.36***	7.025	65.17***
MV	0.098	5.03***	0.111	5.51***
NPD Process Rigidity (NPDR)	0.146	1.28 (n.s.)	0.464	3.95***
<b>MV x NPDR</b>	0.025	1.99*	0.014	1.06 (n.s.)
<b>R-square</b>	0.202		0.341	
<b>F-ratio (df)</b>	14.797 (3, 175)		30.211 (3, 175)	
Conditional effects		t		t
low	0.074	3.60***	0.097	4.62***
medium	0.098	5.03***	0.111	5.51***
high	0.123	4.74***	0.125	4.66***

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

The results suggest that NPDR is a moderator which impacts on the relationship between MV and BLSP. In this regard, MV has a significant effect in the BLSP model ( $\beta = 0.098$ ,  $t = 5.03$ ;  $p < 0.001$ ). Although NPDR itself has no significant effect in the BLSP model ( $\beta = 0.146$ ,  $t = 1.28$ , not significant), the interaction term between MV x NPDR indicates a statistically significant result ( $\beta = 0.025$ ,  $t = 1.99$ ;  $p < 0.05$ ). This suggests that NPDR is a “pure” moderator. Specifically, the positive coefficient of the interaction means that the effect of MV on BLSP becomes more positive as NPDR increases. Further, the conditional effects show that the regression for low ( $\beta = 0.074$ ,  $t = 3.60$ ;  $p < 0.001$ ), medium ( $\beta = 0.098$ ,  $t = 5.03$ ;  $p < 0.001$ ) and high ( $\beta = 0.123$ ,  $t = 4.74$ ;  $p < 0.001$ ) degrees of NPDR are very highly significant and positive. That is, the greater the degree of NPDR the greater the increase in before-launch stage performance. This counters to what was expected in H9a.

The results suggest that NPDR does not have any moderating influence on the relationship between MV and PLSP. Despite the fact that both MV and NPDR have significant effects at  $p < 0.001$  in the PLSP model ( $\beta = 0.111$ ,  $t = 5.51$ , and  $\beta = 0.464$ ,  $t = 3.95$ ), the interaction terms of MV x NPDR is not statistically significant ( $\beta = 0.014$ ,  $t = 1.06$ , not significant). This

indicates that NPDR is not a “pure” moderator in the PLSP model. NPDR may, however, have a direct effect on post-launch stage performance.

For H9a, the moderating impact of NPDR on the relationship between MV and BLSP was only partially supported by the findings. Surprisingly, the degree of NPD process rigidity was found to positively influence the relationship between MV and BLSP. One rationale for this finding might be that scale items of NPDR measure have framed the respondents’ thoughts in terms of a formal process, rather than an inflexible one. The measurement items referred to a formal NPD process, that is, a standardised set of stages and go/no-go decision points (gates), together with defined gatekeepers or reviewers associated with the development of breakthrough innovations in the firm. These items were similar to the scales used by Kleinschmidt et al. (2007) in regard to “NPD process formality”. Although adjustments were made on the items to respond to the scope of company/SBU level NPD programs, the NPDR measure may have been perceived by the respondents to refer to a process or a formal logical progression to manage breakthrough innovations.

In fact, a study by Schmidt et al. (2009) found radical NPD projects to be using more decision points (gates) for each stage of the process than incremental projects. This suggests that a formal process is of particular importance for breakthrough innovations in order to keep the project on track. The findings in this study regarding NPDR are in line with those of Schmidt et al. (2009). The impact of MV on before-launch stage performance is more effective when there is a higher degree of formality – clearly defined go/no-go decision points and the involvement of senior management to implement supportive NPD processes.

Given the high uncertainties and costs associated with the development of breakthrough innovations, especially in the early stages, having a somewhat formalised NPD process to control such projects seems reasonable (Reid & de Brentani, 2004; Schmidt et al., 2009). Uncertainty and risks can be gradually diminished at each stage through a formalised NPD process (Van Oorschot, Sengupta, Akkermans & Van Wassenhove, 2010). Accordingly, NPD process formality can be viewed as an important organisational resource, and it has been linked to NPD success and superior performance (Cooper, 1999; Griffin, 1997b; Kleinschmidt et al.,

2007). A formalised NPD process is characterised by “early and sharp” product definition (Biazzo, 2009), which also appears to be consistent with MV in this study. Having a formalised NPD process may help firms to translate the MV of a radically new or really new product into successful before-launch stage performance, by maintaining breakthrough integrity (BI) and achieving early success with customers (ESC). It may also help firms to avoid the mistakes of investing in the “wrong” types of project (Van Oorschot et al., 2010). Overall, a high degree of NPD process formality may provide the base needed for MV to cope with the uncertainties and complexity of NPD efforts in breakthrough innovation.

For H9b, the moderating impact of NPDR on the MV/PLSP relationship was found to be nonsignificant. Despite the importance of having a formal process, as evident in H9a, the impact of NPDR may be offset by the decrease in the survival rate over the course of the development process, and thus be unable to influence post-launch stage performance. Indeed, firms do kill off more breakthrough ideas (MV) than incremental ones. This is particularly the case for highly innovative ideas that may eventually open new markets, as they are often inconsistent with the firm’s value. As such, the survival rate for breakthrough projects (MV) decreases rapidly as the project progresses through each gate of the NPD process (Schmidt et al., 2009). Moreover, having several decision points may slow down the development process, causing projects to fall behind the original schedule developed at the initial project go-ahead. These balanced effects may be what underlie the nonsignificant impact of NPDR on the relationship between MV and PLSP (STM/WO).

### **5.7.3 Firm Size (Number of Employees)**

*H10a: Large firm size (number of employees) positively influences the relationship between MV and before-launch stage performance.*

*H10b: Large firm size (number of employees) positively influences the relationship between MV and post-launch stage performance.*

Firm size (number of employees) was proposed to positively influence the impact of MV on before-launch stage performance (BLSP) and post-launch stage performance (PLSP). The number of employees (NOE) is an indication of firm size. Firm size is categorised according to NOE (Burgelman & Sayles, 1986; Simon, 1945), where small- and medium-sized firms have up to 60 employees and large-sized firms have over 60 employees.

The proposed hypothesis was based on the assumption that having a large number of employees or a large firm size, provides a better chance of success with innovation (Chandy & Tellis, 2000; Griffin & Page, 1996). Large firms have “slack resources” (deep pockets), that is, a high level of available resources (Bower, 1970). The advantage of a firm having slack resources is improved NPD performance, particularly for market-driving innovation, supported by financial capital, social capital, human resources and information resources. A firm with slack resources can support extensive R&D, learning about new technologies/markets, and can provide marketing expenditure (Bower, 1970). More information can also be derived through social networking with, for example, government, suppliers and labour, which leverages the firm’s experience in product market learning. Further, the large and well established firms often have long-term relationships with their social networks, channels power and reputation. Such channels power may also protect the firms against environmental pressures from immediate and intensive competition. This is typically what small start-up firms do not have (Levinthal, 1994). H10a and H10b therefore examine whether firm size (NOE) has any positive moderating influence on the impact of MV on BLSP and PLSP.

To evaluate whether firm size influences MV in translating into BLSP and PLSP, NOE was entered into the SPSS MODPROBE (Hayes & Matthes, 2009) script dialog box as a moderator variable (M), where MV is the focal predictor (F), and BLSP and PLSP are the dependent variables (Y). Table 5.11 presents the results of these analyses.

**Table 5.11: Moderation Effects of Firm Size (Number of Employees)**

Model	H10a (BLSP)		H10b (PLSP)	
Interaction Model	t		t	
Constant	6.928	69.28***	7.129	67.16***
MV	0.091	5.26***	0.130	7.12***
Firm Size (NOE)	-0.119	-2.75**	-0.040	-0.88 (n.s.)
<b>MV x Firm Size</b>	0.000	0.04 (n.s.)	0.019	2.59*
<b>R-square</b>	0.210		0.305	
<b>F-ratio (df)</b>	15.505	3, 175	25.538	3, 175
Conditional effects	t		t	
low	0.090	3.42***	0.086	3.06**
medium	0.091	5.26***	0.130	7.12***
high	0.091	4.39***	0.175	7.91***

<sup>+</sup> = p<0.10, \* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

The results suggest that firm size does not have any moderating influence on the relationship between MV and BLSP. Although both MV and firm size have significant effects in the BLSP model at p<0.001 and p<0.01 respectively (  $\beta = 0.091$ ,  $t = 5.26$ , and  $\beta = -0.119$ ,  $t = -2.75$ ), respectively, the interaction term of MV x firm size is not statistically significant (  $\beta = 0.000$ ,  $t = 0.04$ , not significant). As a result, this indicates that firm size is not a “pure” moderator in the BLSP model, which counters what was predicted in H10a. Firm size, however, may have a direct effect on BLSP.

The results also suggest that firm size is a moderator impacting on the relationship between MV and PLSP. In this regard, MV has a significant effect in the PLSP model ( $\beta = 0.130$ ,  $t = 7.12$ ;  $p < 0.001$ ). Even though the firm size itself has no significant effect in the PLSP model ( $\beta = -0.040$ ,  $t = -0.88$ , not significant), the interaction term between MV x firm size indicates a statistically significant result ( $\beta = 0.019$ ,  $t = 2.59$ ;  $p < 0.05$ ). This suggests that firm size is a “pure” moderator, lending support to H10b. In particular, the positive coefficient of the interaction means that the effect of MV on PLSP becomes more positive as NOE increases. Moreover, the conditional effects show that the regression for low ( $\beta = 0.086$ ,  $t = 3.06$ ;  $p < 0.001$ ), medium ( $\beta = 0.130$ ,  $t = 7.12$ ;  $p < 0.001$ ) and high ( $\beta = 0.175$ ,  $t = 7.91$ ;  $p < 0.001$ ) levels of NOE are very highly significant and positive. That is, the greater the number of employees (or the larger the firm), the greater the improvement in post-launch stage performance.

For H10b, the moderating hypothesis of firm size (number of employees) on the relationship between MV and PLSP was supported by the findings. As large firms have access to slack resources, the impact of MV on PLSP is greater due to an increased commercialisation budget size, people resources, improved communication networks and market learning systems. Typically, the costs associated with the project increase as the project progresses over the NPD process (Van Oorschot et al., 2010). In particular, the development of breakthrough innovation can be very risky and costly. Large firms have access to greater financial resources and are able to spread the costs and associated risk in the economy of scale. A study by Schmidt et al. (2009) also found that the number of reviewers or decision makers (review team) increases over the stages of the NPD process for radical innovations. Radical innovation require more reviewers (number of team members) across the gates than incremental ones do, particularly in the later stages of the NPD process (Schmidt et al., 2009). A large network of people may speed up the learning process of translating MV into a new product launch more quickly (STM) and open up new opportunities for the firm (WO). Given the associated high costs, risk and uncertainties of bringing radical products to market, the requirement for more resources at the post-launch stage of the NPD process appears to be understandable.

For H10a, the moderating impact of the firm size (NOE) on the relationship between MV and BLSP was not supported by the findings. The balanced effect of firm size (NOE) may be what



underlies its nonsignificant impact on the relationship between MV and BLSP in this study. Despite the impetus and opportunity provided through slack resources such as the extensive communication channels of large firms, this may also hamper the transfer of information and decision making and influence the before-launch stage performance (BLSP) of the radical NPD process (Burgelman & Sayles, 1986; Tushman & Anderson, 1986). At the BLSP, information sharing regarding the future product-market (MV) is critical for creating buy-in from people in the firm. Go/no-go decisions need to be made to translate the MV of a radically new or really new product into the development stage and through to launch (Reid & de Brentani, 2004). Large firms tend to be characterised by inertia, which has a negative influence on the ability to drive and maintain highly innovative ideas (BI), and facilitate market learning to achieve early success with customers (ESC) (Dougherty & Heller, 1994; Kanter, 1988). This could levy a strong counterbalance by hindering the translation of MV into BLSP.

## 5.8 Section Conclusion

This section of Chapter 5 provided a number of implications. Absorptive capacity (ACAP) and its subsets of potential and realised absorptive capacities (PACAP and RACAP) were found to have a significant and positive impact on market visioning competence (MVC). More specifically, RACAP has more impact on MVC than PACAP. RACAP is the main source of performance improvements and is particularly associated with MVC through the capability to transform and exploit knowledge into new products that recognise the needs of future markets.

As predicted, MVC was found to have a strong, significant and positive impact on market vision (MV). MV has a stronger impact on post-launch stage performance (PLSP) than on before-launch stage performance (BLSP). In the dimensions of MV, form was found to have the strongest influence on BLSP. While clarity does not have any significant impact on BLSP, it has a significant and positive influence on PLSP. Furthermore, scope appeared to be the only dimension of MV that has negative impacts on both BLSP and PLSP. As with BLSP, a significant and positive impact was found on PLSP. PLSP, however, explains slightly more variance of financial performance (FP) than BLSP, as would be expected.

In addition to these findings, competitive intensity was found to positively influence the relationship between MV and BLSP/PLSP. While NPD process rigidity significantly and positively influences the relationship between MV and BLSP, firm size (number of employees) was found to significantly and positively influence the relationship between MV and PLSP.

The regression analyses overall supported the main relationships between ACAP, MVC/MV, BLSP/PLSP and FP, with statistically significant results. Moreover, the results appeared to support the proposed conceptual model. To further assess these relationships, the final analysis involved partial least squares structural equation modelling to facilitate an examination of the various relationships simultaneously.

## **5.9 Partial Least Square Structural Equation Modelling: Integrated Model**

The aim of this integrated path modelling is to further test the hypothesised relationships and to estimate multiple and interrelated dependence relationships among all of the variables in the model. Partial least square structural equation modelling (PLS-SEM) allows an evaluation of complex modelling for this particular study, including models with (1) hierarchical construct, (2) mediating effects and (3) moderating effects (Chin et al., 2003).

The measurement and path models were estimated using SmartPLS version 21.0 (Ringle et al., 2005). The level of statistical significance of path coefficients and loadings of both the measurement and the structural models was determined using a Bootstrap re-sampling procedure. The Bootstrap re-sampling entailed generating 500 sub-samples of cases randomly selected, with replacement, from the original data, and a sample size identical to the number of valid observations or the original sample (Efron & Tibshirani, 1993). Bootstrapping is recommended since PLS-SEM does not rely on data distributions. Direct inference statistical tests of the model fit and the model parameters are not presented as CB-SEM does (Chin, 2010). However, PLS-SEM is robust in handling the complex models due to this bootstrapping – a non-parametric technique based on iterative algorithm for estimating standard errors of the model parameters (Henseler et al., 2009).

In determining the path models for this study, the regression results were further reviewed to work out how best to structure the model. Accordingly, ACAP overall, as a single measure, was deemed to be limited for examining the degree to which it influences MVC. Thus, PACAP and RACAP, as subsets of ACAP, were used to explore their relations to MVC. Preliminary model testing was conducted to validate the final measurement. Details of the assessment of the measurement are presented in the next section. This will be followed by the analysis of the structural model set up to test the proposed hypotheses in Section 5.9.2.1. Section 5.9.2.2 presents the analysis and results of the mediating effects of MV construct and the final model (fully-mediated) where additional relationships between PACAP/RACAP and MV were added

to the model to test for statistical significance. Lastly, Section 5.9.2.3 presents the results of the hypothesised moderating effects based on the fully-mediated model.

### 5.9.1 Preliminary Model Testing

Preliminary model testing helps to ensure a certain degree of construct reliability and validity prior to setting up the actual partial least squares (PLS) model. In this regard, the idea networking (IDNW) dimension of MVC emerged as having a degree of cross-loading with MV and RACAP (0.753 and 0.753), suggesting some discriminant validity issue. These findings are consistent with the correlations table (as indicated in Section 4.5.1). In Table 4.39, IDNW was found to correlate highly with the exploitation of knowledge (EX) dimension of ACAP (EX is under RACAP) and the form (FO) dimension of MV at 0.76 and 0.73 respectively. In addition, previous CFA results (AVE) found in AMOS (version 21.0) showed that IDNW is correlated highly with FO at 0.81. Although there was utility in keeping IDNW as a distinct measure, the high correlation may confound the clarity in the relationship between ACAP, MVC and MV for the development of the structural equation model. The subsequent re-analysis suggested a removal of IDNW from the original MVC construct. Thus, MVC became an observed variable, which now consists of fewer items. Table 5.12 presents the final items of MVC.

**Table 5.12: Final items for MVC Construct (adapted measure)**

Construct	Item	Statement/Question
<b>Market Visioning Competence (MVC):</b> the ability of individuals or NPD team in organisations to link new ideas or advanced technologies to future market opportunities.		
<b>Proactive Market Learning (PML)</b>	PML1	We use several forecasting and market estimation techniques before making a final market selection.
	PML2	We continuously try to discover additional needs of our customers of which they are unaware.
	PML3	We incorporate solutions to unarticulated customer needs in our new products and services.

To evaluate PLS models for the study, the procedure advocated by Hulland (1999) was followed. The estimated models were validated and interpreted in two phases. First, the reliability and validity of the measurement model (outer model) were assessed to specify the relationship between a latent variable and its observed or manifest variables. Second, the structural models (inner models) were tested to specify the relationships between unobserved or latent variables.

In PLS outer relationships or outer model, it is important to evaluate the types of models whether the measurement involves reflective or formative indicator constructs (Bollen & Lennox, 1991). This is to determine the appropriate methods for subsequent data analysis and the criteria for reliability and validity testing (Diamantopoulos & Winklhofer, 2001). A reflective measurement model has the direction of causality flows from the construct to the indicators (latent construct to the manifest variables). Thus, the construct is viewed as the cause that determines its measures or indicators. Further, the indicators of reflective constructs are interchangeable, strongly correlated and sharing common antecedents and consequences. In contrast, a formative measurement model has the direction of causality flows from the indicators to the construct. Thus, the indicators have a casual effect on the construct and determine the value of a construct (Henseler et al., 2009). As indicated in Chapter 4, all the constructs in this study were conceptualised as being of reflective nature. The adequacy of the measurement model was re-validated after the removal of IDNW by examining indicator and construct reliability, as well as discriminant validity.

Indicator reliability is determined by the factor loadings or outer loadings as reflected in SmartPLS (Ringle et al., 2005), which should exceed 0.7 (Chin, 1998). This is to indicate a shared variance of 50% or greater between the item and the construct (Sarkar, Echambadi, Cavusgil & Aulakh, 2001a). It can also be acceptable when the factor loadings are higher than 0.4 (Hulland, 1999). Accordingly, the individual item reliabilities were examined by assessing loadings of the measures on the respective constructs. The outer loadings of the constructs were found to exceed the cut-off suggested by Chin (1998) and Hulland (1999), with the lowest loading 0.77 and all other constructs with loadings greater than 0.80. Overall, the statistics indicate that all the items validate good individual-item reliabilities.

Construct reliability is determined by the composite reliability (CR), which should ideally exceed 0.7 for all constructs (Tenenhaus, Vinzi, Chatelin & Lauro, 2005). According to Fornell and Larcker (1981), CR as a measure for internal consistency is superior to Cronbach's alpha because the loadings estimated are used in its computation within the causal model. In the case of PLS, this measure does not assume equal weights of indicators (Chin, 1998).

Table 5.13 presents the internal consistency, square roots of average variance extracted and correlation matrix results. Internal consistency (CR) was found to be greater than 0.87 for all constructs, thereby indicating that the reliabilities are satisfactory (Hulland, 1999).

**Table 5.13: Internal Consistency, Square Roots of Average Variance Extracted, and Correlation Matrix**

<i>Construct</i>	<i>Internal Consistency</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
1   BLSP	0.88	<b><i>0.78</i></b>					
2   MV	0.90	0.44	<b><i>0.69</i></b>				
3   MVC	0.88	0.45	0.66	<b><i>0.71</i></b>			
4   PACAP	0.87	0.41	0.70	0.54	<b><i>0.77</i></b>		
5   PLSP	0.87	0.63	0.56	0.54	0.58	<b><i>0.76</i></b>	
6   RACAP	0.91	0.51	0.74	0.63	0.76	0.66	<b><i>0.83</i></b>

Note: The diagonal (in italics) shows the square root of the average variance extracted for each construct.

Discriminant validity is determined by examining whether the variance shared between any two constructs is less than the average variance extracted (AVE) by the constructs and all measures loaded higher on intended constructs than on other constructs (Hulland, 1999). Within the same model, this suggests that measures of a given construct differ from measures of other constructs. As shown in Table 5.13, the average variances extracted in all the constructs were all at least or greater than 0.50, which is indicative of convergent validity (Fornell & Larcker, 1981).

This overall model and the final list of constructs, however, indicated some evidence of lack of discriminant validity. There were a few high correlations between PACAP/RACAP and MV at 0.70 and 0.74 accordingly, slightly higher than the AVE of MV (0.69). Although these

constructs appear to be correlated highly, they are in fact distinct entities. PACAP and RACAP or ACAP and MV are important measures adapted from the scale proposed by Flatten et al. (2011) and Reid and de Brentani (2010).

Table 5.14 presents a comparison between PACAP/RACAP and MV constructs.

**Table 5.14: Comparison between PACAP/RACAP of ACAP and MV constructs**

Construct	Item	Statement/Question
<b>Potential Absorptive Capacity (PACAP):</b> the firm's ability to acquire and assimilate knowledge from external sources.		
Acquisition of Knowledge (AQ)	<b>In terms of how your company/SBU acquires knowledge from external sources, please tell us to what extent you agree or disagree with each of the following statements:</b>	
	AQ1	The search for relevant information concerning our industry is an every-day business in our company/SBU.
	AQ2	Our management motivates employees to use information sources within our industry.
	AQ3	Our management expects that employees deal with information beyond our industry.
Assimilation of Knowledge (AS)	<b>In terms of how your company/SBU processes the externally acquired knowledge, please tell us to what extent:</b>	
	AS1	In our company/SBU, ideas and concepts are effectively communicated across departments.
	AS2	Our management emphasizes cross-departmental support to solve problems.
	AS3	In our company/SBU, there is a quick information flow e.g. if a business unit obtains important information it communicates this information promptly to all other business units or departments.
	AS4	Our management demands cross-departmental meetings to exchange information on new developments, problems, and achievements.
<b>Realised Absorptive Capacity (RACAP):</b> the firm's ability to transform and exploit knowledge for commercial purpose.		
Transformation of Knowledge (TR)	<b>In terms of how employees within your company/SBU combine their existing knowledge with new knowledge:</b>	
	TR1	Our employees have an exceptional ability to structure and to use collected knowledge.
	TR2	Our employees are used to absorbing new knowledge as well as preparing it for further purposes and to make it available.
	TR3	Our employees successfully link existing knowledge with new insights.
	TR4	Our employees are able to apply new knowledge in their practical work.
Exploitation of Knowledge (EX)	<b>In terms of how your company/SBU exploits new knowledge to develop new products:</b>	
	EX1	Our management supports the development of product prototypes to test a concept or process and make sure things work before starting actual development.
	EX2	Our company/SBU regularly reconsiders technologies and ideas and adapts them according to new knowledge.
	EX3	Our company/SBU has the ability to work more effectively by adopting new technologies.
	EX4	Our company/SBU has the ability to work more effectively by adopting new ideas.



**Table 5.14: Comparison between PACAP/RACAP of ACAP and MV constructs (continued)**

Construct	Item	Statement/Question
<b>Market Vision (MV):</b> A Market Vision is “a clear and specific early-stage mental model or image of a product-market that enables NPD teams to grasp what it is they are developing and for whom”.		
Specific Magnetism (SPMG)	<b>Preamble: Please think about the market vision in the very early stages of developing breakthrough innovations in your company/SBU and indicate the degree to which you agree or disagree with these statements:</b>	
	SPMG1	We have a very specific Market Vision statement that guides each NPD project.
	SPMG2	Our Market Vision provides clear direction to others in the company/SBU regarding what is being developed and for whom.
	SPMG3	Our Market Vision helps make tangible what is to be developed and for whom.
	SPMG4	Our Market Vision clearly highlights the attractiveness of the market opportunity.
	SPMG5	Our Market Vision generates buy-in from other people and groups in the company/SBU.
Form (FO)	<b>Preamble: “When you first start thinking about specific markets would benefit from your breakthrough innovations, you and your NPD team are able to spend an appropriate amount of time thinking and talking about...”</b>	
	FO1	How end-users would ultimately interact with and use the breakthrough innovations.
	FO2	How the breakthrough innovations would fit into an overall system of use for potential customers.
	FO3	How customers might use the breakthrough innovations in their environments.
	FO4	The potentials for standardizing the design of the breakthrough innovations.
Scope (SC)	SC1	What the most profitable target market would be for the breakthrough innovations.
	SC2	What the largest target market would be for the breakthrough innovations.
	SC3	What the most important target market would be for the breakthrough innovations.
Clarity (CL)	<b>Preamble: “After spending time discussing the specific markets for the breakthrough innovations within your NPD team...”</b>	
	CL1	It is generally clear who the target customers would be for the breakthrough innovations.
	CL2	It is generally clear what target customers' needs would be for the breakthrough innovations.
	CL3	It is generally clear how breakthrough innovations would be used by the target customers.

The measures of ACAP and MV reflect different levels of learning capabilities, related tasks and thinking within a firm (company/SBU). As shown in Table 5.14, ACAP measures refer to general organisational routines and processes in a company or SBU quite apart from innovation related activities. At the broad organisational level, the PACAP dimension captures organisational learning through the search for new relevant information within and beyond the industry and across all departments such as R&D, production, marketing and accounting within a firm, and the ability of all employees within these departments to communicate with each other. Further, the RACAP dimension captures how well employees apply new knowledge in their practical work in order to work more effectively towards outcomes such as new product development. This is consistent with other empirical studies that have adopted ACAP construct as a predictor of innovative activity (Cohen & Levinthal, 1990) or innovative output (Liu & White, 1997), and as a firm's ability to create new knowledge for innovation (Kim, 1998; Zahra & George, 2002).

On the other hand, MV is distinct from ACAP in that it refers to the specific innovation-related thinking of an NPD team, in regard to the market vision of the early stages of developing breakthrough innovations. At the NPD program level analysis, MV in this study is a clear and specific early-stage mental model or image of a product-market that enables NPD teams to grasp what it is they are developing and for whom (Reid & de Brentani, 2010). Hence, the constructs of ACAP and MV can be argued, theoretically, as separate dimensions for the development of a structural equation model. The statistical results overall indicated that the final measurement model is sufficiently valid for an interpretation of structural estimates.

## 5.9.2 Structural Model Estimates

In a PLS structural model, variance explained ( $R^2$ ) and t-values of path coefficients were used to assess the structural relationships among variables (Barclay et al., 1995).

Unlike CB-SEM, PLS path modelling and its current version of SmartPLS does not provide a global validation of the model or indicator of fit. A method for calculating a global criterion of goodness-of-fit (GOF) for complete PLS path modelling has been proposed by Tenenhaus et al. (2005). The GOF index represents an operational solution for validating the PLS model globally as it takes into account the quality of the structural and measurement models. The formula for the global GOF index is written as (Tenenhaus et al., 2005, p.173):

$$GOF = \sqrt{\overline{communality} \times \overline{R^2}}$$

$\overline{R^2}$  is the average of all R-square values in the full path model. The geometric mean of communality was determined as follows:

$$\overline{communality} = \frac{1}{P} \sum_{j=1}^J p_j communality_j$$

According to Fornell and Larcker (1981), the communality is equal to AVE in the PLS path modelling. In this regard, the special issue of *MIS Quarterly* on PLS Path Modelling guidelines by Wetzels, Odekerken-Schroder, and Van Oppen (2009) proposed a cut-off value of 0.5 for commonality. Wetzels et al. (2009) proposed “the GoF criteria for small, medium, and large effect sizes of  $R^2$  by substituting the minimum average AVE of 0.50 and the effect sizes for  $R^2$  in the equation defining GoF” (p.187).

For each estimated model, the GoF was therefore computed following the formula and criteria:

$$(GoF = \sqrt{AVE * R^2})$$

$$GoF_{small} = 0.1, GoF_{medium} = 0.25, \text{ and } GoF_{large} = 0.36$$

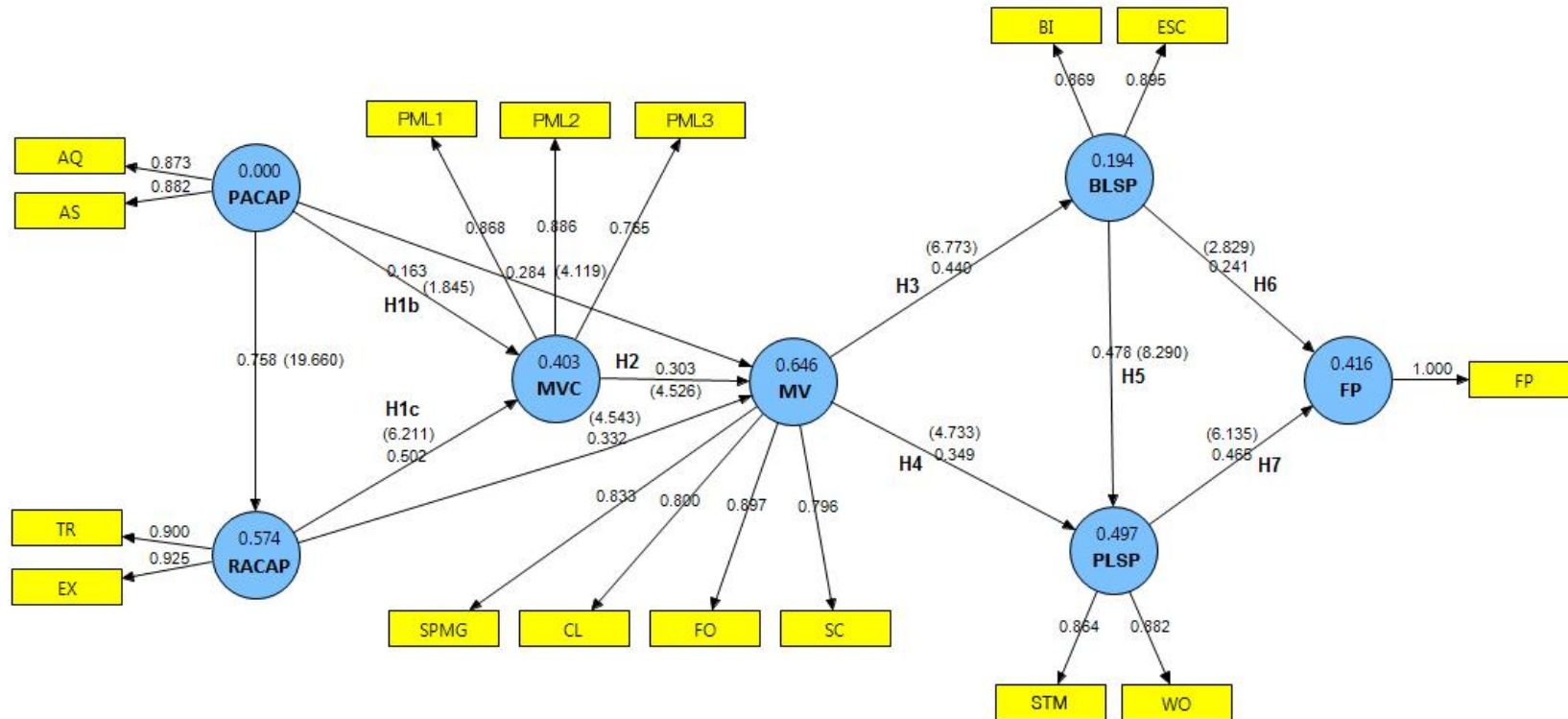
The GoF value assesses how well a statistical model overall fits its set of observations, as well as indicating the explanatory power of the model. The GoF index is bounded between 0 and 1. The GoF criterion is the baseline values that demonstrate small, medium and large effect sizes of  $R^2$  for PLS Path Modelling. An assessment of the use of PLS-SEM in marketing research by Hair et al. (2012b, p.426), however, suggested that this criterion of GoF “does not represent a true global fit measure (even though its name suggests this), and threshold values for an acceptable ‘goodness-of-fit’ can hardly be derived because acceptable R square values depend on the research context and the construct’s role in the model”. Nevertheless, this relatively new method for GoF has been reported in many recent studies as a useful measure to diagnose statistical models using PLS Path Modelling (e.g. Caniëls & Bakens, 2012; Hammedi et al., 2011; Westerlund & Rajala, 2010). Moreover, the GoF is only applicable for PLS-SEM based on reflective hierarchical construct models (reflective outer model’s commonalities) (Hair et al., 2012b), and hence it is suitable to evaluate the structural models in this study.

### **5.9.2.1 Hypothesis Testing**

The hypothesised main effects between potential absorptive capacity (PACAP) and realised absorptive capacity (RACAP), market visioning competence (MVC), market vision (MV), before-launch stage performance (BLSP) and post-launch stage performance (PLSP) and financial performance (FP) were assessed. The PLS model explained 42% of variance for FP, 19% of variance for BLSP and 50% for PLSP. The data also explained 40% of variance in MVC and 65% in MV, and 57% of variance for RACAP by PACAP.

The empirical results of the structural model are depicted in Figure 5.2. Regression coefficients of the PLS analysis, t-values (between parentheses) and R-squares are reported in the figure.

**Figure 5.2: Structural Model (hypothesis testing)**



\*\*\* t-values > 3.29 are significant at the 0.001 level

\*\* t-values > 2.58 are significant at the 0.01 level

\* t-values > 1.96 are significant at the 0.05 level

The results indicate the subsets of ACAP, namely, PACAP and RACAP, have different influences on MVC and MV. Surprisingly, the direct impact of PACAP on MVC was found to be positive but nonsignificant at two-tailed significance level ( $\beta = 0.16$ ;  $t = 1.86$ ), thereby rejecting H1b. PACAP, however, could be said to have a significant impact on MVC at one-tailed significance level as the t-value was greater than 1.65. In addition, RACAP significantly influences MVC ( $\beta = 0.50$ ;  $t = 6.21$ ), lending support to H1c. In addition to the proposed hypotheses, further analysis was done on the model to investigate the degree to which PACAP and RACAP influence MV. Interestingly, PACAP was also found to significantly influence MV ( $\beta = 0.28$ ;  $t = 4.12$ ), while RACAP has slightly more impact on MV than PACAP does ( $\beta = 0.33$ ;  $t = 4.54$ ). Notwithstanding RACAP which relates to a firm's capability to transform and exploit knowledge, appears to be a key construct that significantly and positively affects both MVC and MV.

As hypothesised, MVC has a significant positive impact on MV ( $\beta = 0.30$ ;  $t = 4.53$ ), supporting H2. Further, MV has positive impact on both BLSP and PLSP ( $\beta = 0.44$ ;  $t = 6.77$  and  $\beta = 0.35$ ;  $t = 4.73$ ), providing support to both H3 and H4. H5 expressed that BLSP positively influences PLSP, which was found to be supported by the findings ( $\beta = 0.48$ ;  $t = 8.29$ ). Both BLSP and PLSP influence financial performance, as predicted, ( $\beta = 0.24$ ;  $t = 2.83$  and  $\beta = 0.47$ ;  $t = 6.14$ ), and hence further support was found for H6 and H7. These findings of H1c to H7 also support the earlier regression analysis.

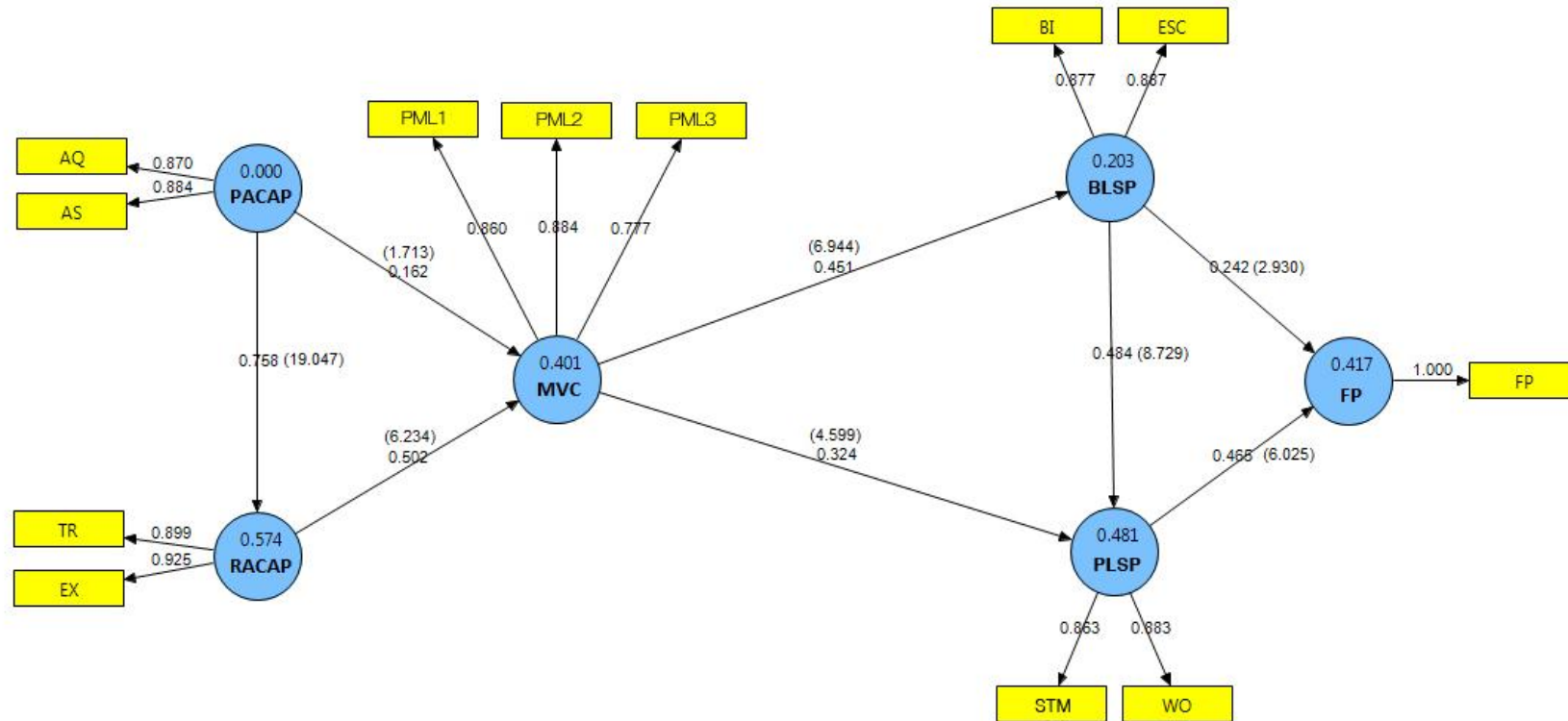
For the complete (main effects) model, a GoF value of 0.59 was obtained, which exceeds the cut-off value of 0.36 for large effect sizes of R square following the defined criteria of Wetzels et al. (2009). This indicates that the model performs well in comparison with the baseline value. The GoF value is also higher than 0.47, the value calculated for the European Consumer Satisfaction Index (ECSI) model estimated by Tenenhaus et al. (2005), and therefore showing a good level of explanatory power for the model.

### 5.9.2.2 Testing Mediated Effects (Fully Mediated Model)

Although no hypotheses were developed specifically for MV as a mediator between MVC and BLSP/PLSP, it was nonetheless modelled in SmartPLS (version 21) (Ringle et al., 2005) to identify what influences existed. Two approaches were incorporated to test the mediation effects. First, the procedure recommended by Shrout and Bolger (2002) was applied, with the bootstrapping approach as suggested by Efron and Tibshirani (1993). In this regard, the significant direct effect of an independent variable (MVC) on dependent variables (BLSP and PLSP) was investigated; a mediating variable (MV) was excluded from the structural model while the rest of the model remained unchanged. Then MV was included and its significance was calculated by bootstrapping the product of  $MVC \rightarrow MV$  and  $MV \rightarrow BLSP/PLSP$ . If the direct effects of MVC on BLSP and PLSP become non-significant when MV is included and its mediation is found to be significant, the conclusion can be drawn that MV is a full mediator. However, if all the effects remained significant, MV is considered a partial mediator.

Figure 5.3 presents the model without market vision (MV) as a mediator variable and Figure 5.4 presents the fully-mediated model. Regression coefficients of the PLS analysis, as well as t-values (between parentheses) and R-squares, are reported in each figure.

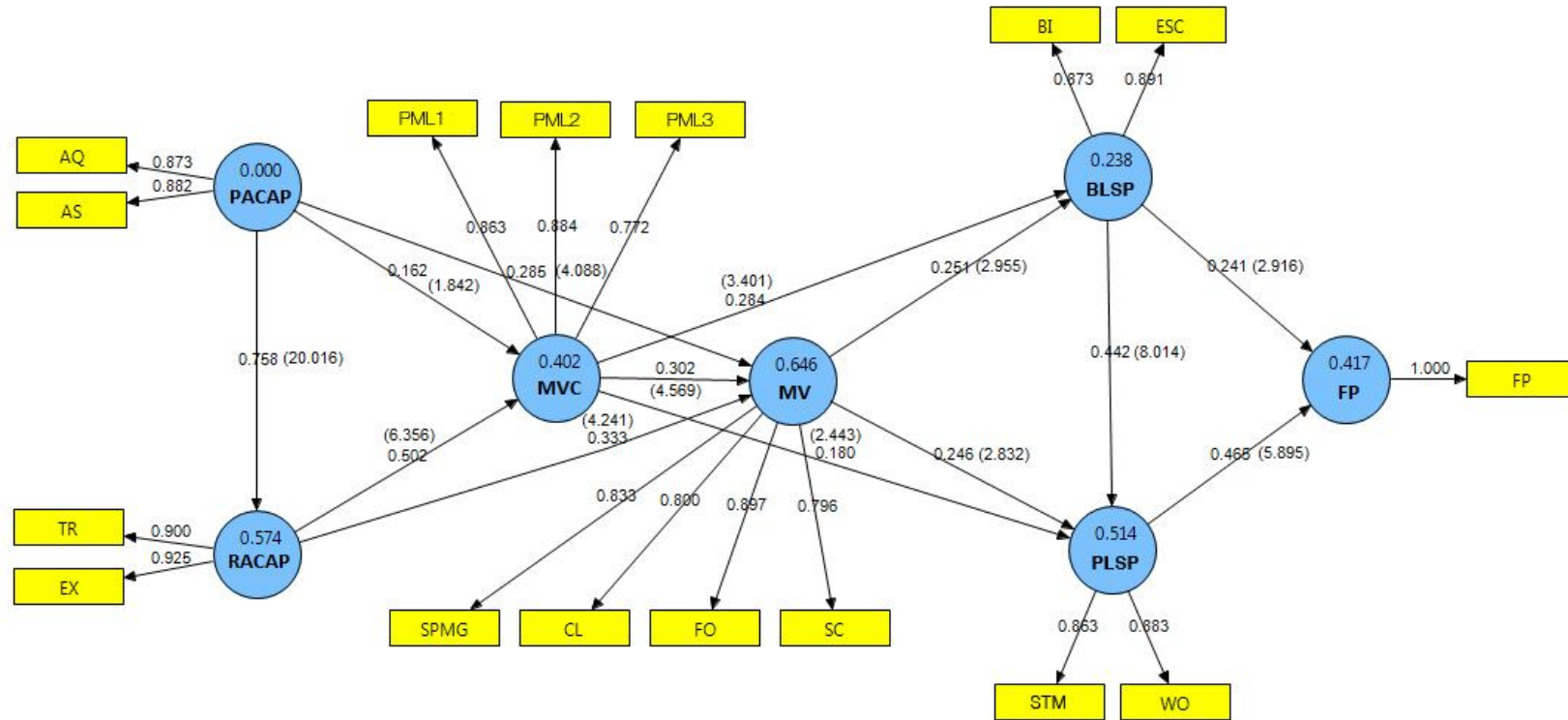
**Figure 5.3: Structural Model Without Market Vision (MV)**



\*\*\* t-values > 3.29 are significant at the 0.001 level  
 \*\* t-values > 2.58 are significant at the 0.01 level  
 \* t-values > 1.96 are significant at the 0.05 level



**Figure 5.4: Fully-Mediated Model (reconfigured model)**



\*\*\* t-values > 3.29 are significant at the 0.001 level  
 \*\* t-values > 2.58 are significant at the 0.01 level  
 \* t-values > 1.96 are significant at the 0.05 level

The results shown in Figure 5.4 indicate that MV only partially mediates the relationship between MVC and BLSP/PLSP outcomes. The direct effects of MVC and MV on BLSP/PLSP outcomes all remained significant (MVC to BLSP/PLSP:  $\beta = 0.28$ ;  $t = 3.40$  and  $\beta = 0.18$ ;  $t = 2.44$ , and MV to BLSP/PLSP:  $\beta = 0.25$ ;  $t = 2.96$  and  $\beta = 0.25$ ;  $t = 2.83$ ). Other results of the mediated model appear to be consistent with the structural model presented in Figure 5.2, which support H1c to H7 and the regression analysis.

The summary of the main hypotheses results and additional findings are shown in Table 5.15 and Table 5.16.

**Table 5.15: Summary of Main Hypotheses Results (Fully-Mediated Model)**

Hypothesis	Relationship	Path Coefficient ( $\beta$ )	(t-value)	Results
H1b	PACAP $\rightarrow$ MVC (+)	0.16	1.84 (n.s.)	Not supported
H1c	RACAP $\rightarrow$ MVC (+)	0.50***	6.36	Supported
H2	MVC $\rightarrow$ MV (+)	0.30***	4.57	Supported
H3	MV $\rightarrow$ BLSP (+)	0.25**	2.96	Supported
H4	MV $\rightarrow$ PLSP (+)	0.25**	2.83	Supported
H5	BLSP $\rightarrow$ PLSP (+)	0.44***	8.02	Supported
H6	BLSP $\rightarrow$ FP (+)	0.24**	2.92	Supported
H7	PLSP $\rightarrow$ FP (+)	0.47***	5.90	Supported

N = 179; Bootstrap with 500 repetitions; n.s. = not significant.

\*\*\* t-values > 3.29 are significant at the 0.001 level

\*\* t-values > 2.58 are significant at the 0.01 level

\* t-values > 1.96 are significant at the 0.05 level

**Table 5.16: Summary of Additional Analysis Results (Fully-Mediated Model)**

Relationship	Path Coefficient ( $\beta$ )	(t-value)
PACAP $\rightarrow$ RACAP	0.76***	20.02
PACAP $\rightarrow$ MV	0.29***	4.09
RACAP $\rightarrow$ MV	0.33***	4.24
MVC $\rightarrow$ BLSP	0.28***	3.40
MVC $\rightarrow$ PLSP	0.18*	2.44

N = 179; Bootstrap with 500 repetitions; n.s. = not significant.

\*\*\* t-values > 3.29 are significant at the 0.001 level

\*\* t-values > 2.58 are significant at the 0.01 level

\* t-values > 1.96 are significant at the 0.05 level

Further, the GoF of the model (with mediated paths from MVC to BLSP and PLSP) was calculated and compared with a competing model, incorporating direct links between constructs. The mediated model shows a substantially better fit with a GoF value of 0.59 compared to the 0.47 of the model without the mediating variable (MV). The explained variance in both R-square of BLSP and PLSP were also higher in the mediated model. Whereas the model without MV (Figure 5.3) illustrates the R<sup>2</sup> of 0.20 and 0.48, the mediated model (Figure 5.4) illustrates the R<sup>2</sup> of 0.24 and 0.51 for BLSP/PLSP outcomes. This shows that the mediated model improves the R-square value and provides a better explanation of performance outcomes at both before-launch stage and post-launch stage.

### 5.9.2.3 Testing Moderating Effects

The proposed moderators were tested on the fully mediated model, which included firm size (NOE), NPD process rigidity (NPDR) and competitive intensity (CI), technological turbulence (TT) and market turbulence (MT) of the external environment (EE). For each of the moderating effects, the methodology suggested by Chin et al. (2003) was applied into the reconfigured (fully-mediated) PLS model. All the indicators of the moderator and corresponding predictor variable were multiplied to calculate the indicators measuring the interaction effect. These sets of indicators were then inserted into the reconfigured PLS model as an independent variable in order to calculate the associated path coefficients.

Consistent with the regression analysis on the moderating effects, the “mean-center indicator values” option was selected for interaction effect term generation before multiplication.

In line with the previous regression analysis using MODPROBE (Hayes & Matthes, 2009), the moderating impact of firm size (NOE) on the relationship between MV and PLSP was fully supported by the findings in the model ( $\beta = 0.17$ ;  $t = 2.23$ ), lending support to H10b. In addition, the moderating impact of NPD process rigidity (NPDR) between MV and PLSP outcome was found to be nonsignificant but positive. This was very similar to the regression result, thereby rejecting H9b. For H9a, a significant positive impact of NPDR was found between MV and BLSP in the regression analysis. The model, however, indicates a nonsignificant positive impact of NPDR.

As part of H8a and H8b, competitive intensity (CI) was the only dimension of the external environment (EE) found in regression analysis that has a significant positive influence on MV to BLSP/PLSP outcomes. In this regard, the result of the model for CI of H8a was not significant but nonetheless indicating some influence close to one-tailed significance level of 1.65 at 1.49. According to the model results for H8b, the hypothesised moderating impacts of EE including CI, market turbulence and technological turbulence (MT and TT) were all found to be negative, as proposed, but however not significant. The results of the model and the regression analysis also reveal similar positive and negative non-significant impacts of MT on MV and BLSP/PLSP outcomes. In addition to these findings, there were some indications of direct relationships of NPDR and CI to PLSP, as well as firm size (NOE) to BLSP; ( $\beta = 0.18$ ;  $t = 2.52$  and  $\beta = -0.16$ ;  $t = 2.28$ ) and ( $\beta = -0.24$ ;  $t = 3.30$ ) accordingly. In this regard, the findings of NPDR and NOE and their possible direct effects on PLSP and BLSP are consistent with the previous regression results.

The summary of the hypothesised moderator results is shown in Table 5.17.

**Table 5.17: Summary of Moderating Effects Results (Fully-Mediated Model)**

Hypothesis	Relationship	Path Coefficient ( $\beta$ )	(t-value)	Results
<b>H8a</b>	MV $\rightarrow$ BLSP moderated by CI, TT, and MT (-)	0.26, -0.14, 0.06	1.49, 0.76, 0.46 (n.s.)	Not supported
<b>H8b</b>	MV $\rightarrow$ PLSP moderated by CI, TT, and MT (-)	-0.06, -0.05, -0.02	0.49, 0.55, 0.23 (n.s.)	Not supported
<b>H9a</b>	MV $\rightarrow$ BLSP moderated by NPDR (-)	0.04	0.29 (n.s.)	Not supported
<b>H9b</b>	MV $\rightarrow$ PLSP moderated by NPDR (-)	0.06	0.53 (n.s.)	Not supported
<b>H10a</b>	MV $\rightarrow$ BLSP moderated by Firm Size (NOE) (+)	-0.07	0.76 (n.s.)	Not supported
<b>H10b</b>	MV $\rightarrow$ PLSP moderated by Firm Size (NOE) (+)	0.17*	2.23	Supported

N = 179; Bootstrap with 500 repetitions; n.s. = not significant.

\*\*\* t-values > 3.29 are significant at the 0.001 level

\*\* t-values > 2.58 are significant at the 0.01 level

\* t-values > 1.96 are significant at the 0.05 level

## **5.10 Overview of Chapter 5 Findings**

This chapter presented the results of regression analyses and structural equation modelling in examining the research propositions and hypotheses in the conceptual model derived from the literature review. The analysis of the structural model indicates a good model fit between the data and the conceptual model. The results from both the regression and structural model analyses have leaned support to the majority of the research hypotheses. A number of findings are identified as follows:

### **i. Absorptive capacity**

Absorptive capacity overall and its subsets of potential and realised absorptive capacities have a significant and positive impact on market visioning competence in the regression analysis. In a more complex setting (structural model), only realised absorptive capacity has a significant and positive impact on market visioning competence. This particularly highlights the importance of the transformation and exploitation of knowledge and its significant impact on the ability of individuals or NPD teams to link new idea or technologies to future market opportunities.

### **ii. Market visioning competence and market vision**

In both regression and structural model analyses, market visioning competence has a significant and positive impact on market vision, that is, the knowledge, insight and foresight of a radically new or really new product.

### **iii. Performance consequence of market vision**

The results indicate that market vision has a significant and positive impact on both before-launch stage performance and post-launch stage performance. This suggests that having a clear and specific market vision can be translated into improved performance in terms of achieving breakthrough integrity, early success with customers, speed-to-market and windows of opportunity. The results also indicate that market vision has a greater impact on post-launch stage performance than on before-launch stage performance.

Form is the dimension of market vision that most influences breakthrough integrity and early success with customers. An NPD team's time spent discussing end-user interactions

with a breakthrough innovation is a key aspect for firms trying to maintain the breakthrough integrity of the product and not to “dumbing down” a highly innovative concept (that better meet the needs of early customers). Scope, however, appears to have an adverse influence on the likelihood of achieving breakthrough integrity in particular. At the front end of innovation, a focus of an NPD team on the most profitable, the most important and/or the largest target market (scope) can impede a breakthrough idea, and thus, losing its innovativeness. To a lesser extent, scope was also found to negatively impact on early success with customers and windows of opportunity. In addition to this, the impact of clarity appears to be significant and positive only on post-launch stage performance. Firms need to be able to deal with the uncertainty and to recognise that clarity is a luxury for breakthrough innovation in terms of speeding up the NPD process and opening windows of opportunity.

#### **iv. Market-driving innovation performance**

The relationships among market-driving innovation performance constructs exist in both regression and structural model analysis. Before-launch stage performance significantly and positively influences post-launch stage performance, and both of these constructs significantly and positively influence financial performance. Specifically, the results also indicate that post-launch stage performance has more impact on financial performance than before-launch stage performance does.

#### **v. Moderation effects**

The results from the path model indicate firm size (number of employee) as the only moderator, and more specifically, on the relationship between market vision and post-launch stage performance. The regression analysis shows that NPD process rigidity and competitive intensity moderate the relationship between market vision and before-launch stage performance. Adding to this, competitive intensity also influences the relationship between market vision and post-launch stage performance. Overall, the findings on the proposed moderating effects suggest that moderators have less effect in a complex setting (structural model).

- vi. Additional analysis on the fully-mediated model** revealed the following results:
- Potential absorptive capacity and realised absorptive capacity have a significant and positive impact on market vision. This may have a significant impact on the interpretation of the findings.
  - Potential absorptive capacity has a significant and positive impact on realised absorptive capacity. This supports their complementary roles as subsets of absorptive capacity.
  - Market visioning competence has a significant and positive impact on both before-launch stage and post-launch stage performance outcomes, suggesting market vision is a partial mediator. The model estimations overall indicate that the best way to account for the outcomes is by considering market vision as a mediating variable.
- vii. Possible direct relationships** in the regression and structural model analyses:
- There was some indication of a direct, positive relationship of NPD process rigidity (formality) to post-launch stage performance. This may suggest that the formality of the NPD process can speed up the process of developing breakthrough innovation into the market and ultimately open a new market or product/technological arena.
  - A direct, negative relationship of firm size to before-launch stage performance was also indicated. The results indicate that large firms may not do as well as small firms in maintaining the highly innovative product concept from the front end of the development process and through to launch (the breakthrough integrity), and may have difficulties in satisfying early customers. Thus, absorptive capacity, market visioning competence and its resultant market vision can be key instruments to successful breakthrough innovation.

The next chapter concludes the thesis with a discussion of key findings and the implications of the research.



# CHAPTER 6: CONCLUSIONS AND IMPLICATIONS

## 6.1 Introduction

The research addresses the main research question:

*To what extent does a firm's absorptive capacity, market visioning competence and its resultant market vision influence the firm's success at developing market-driving innovations?*

The concept of market visioning competence (MVC) and its resultant market vision (MV) (Reid & de Brentani, 2010) have emerged as instrumental in ensuring that market-driving innovations are able to make it out of the front end of innovation through to development and into commercialisation, without losing their innovativeness or breakthrough integrity. The findings in this study are not exact replications of the original work on MVC and MV. This study adds more insight around the importance of MVC/MV concept by:

- Extending the concept from a project level analysis to a program level analysis
- Examining both radical and really new “market-driving” innovations, across different industries and not limited to radically new, high-tech products
- Exploring the importance of the concept in different research context (i.e. using sample from a developing country – Thailand)
- Being the first empirical study to propose absorptive capacity (ACAP) as an important organisational level antecedent to MVC/MV.

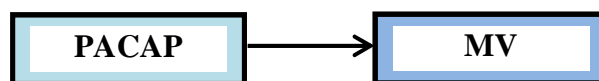
The preceding Chapter 5 presented the results of the empirical findings and the associated discussion around the hypothesised relationships, and culminated in the analysis of the various relationships through the use of partial least square structural equation model (PLS-SEM). All the results were found to support most of the proposed hypotheses. Additional analysis results were also presented.

This final chapter presents the key issues and main conclusions of the study relating to each of the hypotheses and the additional analysis results. The implications of the study, both theoretical and managerial, are discussed. The chapter concludes with an acknowledgement of the limitations of the present study and recommendations for future research.

## 6.2 Absorptive Capacity, Market Visioning Competence and Market Vision

One of the major findings of this study is that absorptive capacity (ACAP) as a dynamic capability significantly influences both market visioning competence (MVC) and market vision (MV) at the front end of market-driving innovation. These results are in line with those of the studies examined in the literature review where ACAP and MVC and the resultant MV are seen as an emerging construct that has one of the greatest impacts on innovation performance, especially at the front end of the new product development effort for market-driving innovation (Chen et al., 2009; Reid & de Brentani, 2010; Sun & Anderson, 2010; Tsai, 2001). Specifically, the results suggest that potential and realised absorptive capacities are complementary, and have distinct impacts on MVC and MV.

### 6.2.1 Potential Absorptive Capacity and Market Vision



The finding suggests that potential absorptive capacity (PACAP) allows firms to discover new sources of knowledge for new product creativity, particularly market-driving ideas (MV). This additional relationship between PACAP and MV was drawn in the structural model, although it was not originally hypothesised. PACAP refers to a firm's capability to *acquire* and *assimilate* knowledge through effective organisational routines and communication. In this respect, PACAP identifies prior related knowledge as a major constituent, reflecting the enrichment of the knowledge base and the diverse array of novel knowledge stored within a firm. Diversity of knowledge may give rise to creativity, allowing the sort of linkages of what are known and novel associations, and the generation of new patterns (pattern generation). Thus, PACAP was found to directly impact the early-stage mental model or image of the product-market of individuals or an NPD team (MV) during the front end of the NPD effort.

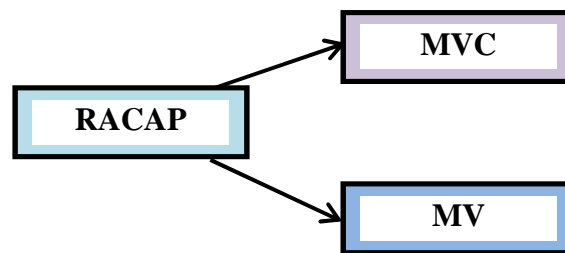
Several recent studies support the general concept of PACAP that diversity of knowledge is a source of new product creativity, particularly for market driving innovation (e.g. Kim, Im & Slater, 2013; O'Connor & Rice, 2013b). Kim et al. (2013), for instance, found that high complexity of knowledge (volume of knowledge and diversity) increases both the novelty and the meaningfulness of a new product, that is, the degree of its originality and uniqueness, as well as its appropriateness and usefulness. A firm's deeply and diversely embedded technological and market information stock can provide great potential for generating "outside-the-box" new product ideas and latent knowledge that enhance the innovative outcome. O'Connor and Rice (2013b) argued that breakthrough innovation with its inherent ambiguity and uncertainty requires more intuitive and divergent thinking and a focus on opportunity and market creation, as opposed to analytical thinking and execution.

Specifically, the knowledge acquisition/assimilation dimensions of PACAP are highlighted in recent studies on market-driving innovation. Ritala and Hurmelinna-Laukkanen (2013) concentrated on PACAP and suggested that having a large knowledge base with a rival can be beneficial for firms acquiring new knowledge for NPD and radical innovation. However, this happens only if the firm's core of knowledge is sufficiently protected to allow safe knowledge exchange. Bao, Chen, and Zhou (2012) suggested that a firm's acquisition, processing and integration of external knowledge, particularly external technical knowledge, increase the chance of radical innovation by fostering a novel integration of diversity and complementary knowledge resources. In addition, a recent study by Ahmad, Mallick, and Schroeder (2013) highlighted the importance of knowledge assimilation that team integration is essential for improved product development, especially for highly innovative products. In a similar vein, Lamore et al. (2013) study on proactive market orientation found evidence that a high degree of collaboration between marketing and R&D departments is required for firms to uncover creative solutions to latent customer needs or future market needs.

Overall, the significant and positive impact of potential absorptive capacity on market vision makes sense, and is consistent with the findings in recent literature. However, a high potential absorptive capacity does not imply that a firm has the capability to transform and exploit the knowledge for profit generation. In line with Zahra and George (2002) conceptualisation of ACAP subsets, the impact of realised absorptive capacity on market

vision was then examined in addition to the proposed relationship between realised absorptive capacity and market visioning competence. The following section presents the conclusion of the findings of these relationships.

### 6.2.2 Realised Absorptive Capacity, Market Visioning Competence and Market Vision



The relationship between realised absorptive capacity (RACAP) and MVC was found in both regression and path model analysis, as hypothesised. The additional relationship between RACAP and MV was also examined and a significant and positive relationship among the constructs was found. This suggests that RACAP is a key organisational capability to success of market-driving innovations.

RACAP is “the primary source for performance improvements” (Zahra & George, 2002, p.191). RACAP refers to a firm’s capability to transform and exploit newly acquired and assimilated knowledge generated in PACAP for the development of new product innovation. In addition, RACAP involves a firm’s capability to refine and improve its existing organisational routines and competencies in order to achieve high efficiency in the NPD process.

The findings indicate that the transformation and exploitation of knowledge, as reflected in RACAP, can foster the entrepreneurial mindset and actions of individuals or NPD team members, and directly influence opportunity recognition in MVC. The transformation of knowledge at the broader organisational level is related to the ability to link existing knowledge with new insights such as emerging technologies and market trends. This may influence pattern recognition of the front end individuals or NPD team members by

matching new insights to patterns previously generated and schemas already stored in memory, and thus enable them to discover solutions to additional or unarticulated needs of the customers (MVC). This transformed knowledge is exploited to generate the new initiatives and knowledge that are essential for creating a market vision of radically new or really new product (MV). Recent research supports the finding that knowledge accumulated at different levels of organisational memory may stimulate creative minds and allow individuals to discover promising market opportunities (Kim et al., 2013). RACAP, therefore, provide a strong foundation for firms to generate new sources of competitive advantage.

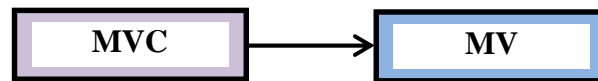
### **6.2.3 Section Conclusion**

In summary, absorptive capacity overall enables firms to capitalise on changing environmental conditions and strategic changes by leveraging organisational resources and capabilities for new product exploration, particularly knowledge inflow into market vision. The findings provide empirical support for one of the fundamental theoretical assumptions of absorptive capacity – that innovation benefit can be derived from new external knowledge, especially when the value of this knowledge is recognised, internalised and exploited for a commercial purpose (Cohen & Levinthal, 1990; Zahra & George, 2002).

The relationships between absorptive capacity, market visioning competence and market vision constructs are important given that they constitute firm's dynamic capabilities. Focusing on these capabilities can increase the chance of market-driving ideas emerging from the front end of innovation and into the development process, while reducing the inherent ambiguity and uncertainty involved. Lacking absorptive capacity, market visioning competence and market vision, firms may fall into competence traps and not recognise the opportunities that new external knowledge offers (e.g. new or novel competitive technology that has the potential to transform a market or an industry). In line with the theoretical argument in the RBV and dynamic capability literature, the outcome of these capabilities contributes to achieving a position of competitive advantage and superior performance through new product development (Harvey et al., 2010; Kostopoulos et al., 2011; Reid & de Brentani, 2010). O'Connor and Rice (2013a, p.16) stated:

Firms have an opportunity to reduce the uncertainties that radical innovation project teams must confront by developing new project management competencies and corporate level organizational structures and processes that can support radical innovation activity. This is a process of learning and accumulation of experience, knowledge, and wisdom. To benefit from the accumulated learning, though, firms must make a long-term commitment to developing this capability.

### 6.3 Market Visioning Competence and Market Vision



Market visioning competence (MVC) was found to be an essential element in creating an effective market vision (MV). The observed strength between the two constructs was not surprising. Whilst not a replication study, the results do somewhat extend the work of Reid and de Brentani (2010). At the NPD project level analysis, Reid and de Brentani (2010) have examined the concept of MVC and MV of radically new, high tech products of firms in developed countries (North America and Europe). The analysis of the MVC/MV linked in this research was conducted at the NPD program level and under market-driving scenarios of both radically new and really new products across different industry contexts and in a developing country. Certain modifications were therefore made to the original MVC/MV items to reflect the program level analysis.

The final MVC items in this research predominantly reflect 'proactive market learning', which captures the discovery of additional or unarticulated needs to incorporate these into solutions in the form of new products. The individuals or NPD team members also use several forecasting and market estimation techniques before making a final market selection. In fact, the process underlying MVC is based on exploratory learning. Thus, evidence has been found that MVC results in a market vision or a clear and specific early-stage mental model or image of a product-market that enables an NPD team to grasp what it is they are developing and for whom. The significance and positive impact of MVC on MV appears support the earlier finding of Reid and de Brentani (2010) and broadens the general knowledge of market visioning and the specific MVC/MV constructs in a different research setting.

In a similar vein, recent research by O'Connor and Rice (2013b) found that market-driving behaviour can be regarded as an opportunity to be engaged in the proactive managerial practice which is essential to new market creation. This helps to explain the observed relationship between proactive market learning (MVC) and MV as an early image of a

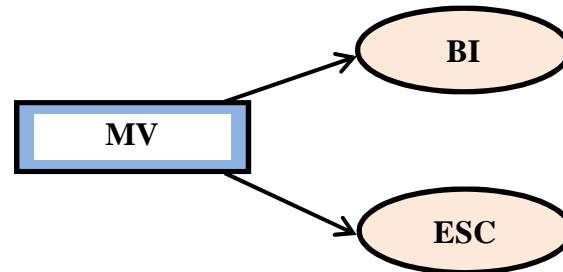
future product-market. Further, a recent study by Menguc, Auh, and Yannopoulos (2013) has appeared to support the importance of market visioning (MVC/MV) as a new market learning approach (in reverse), in their view regarding the voice of customers (VOC) in the case of market-driving innovation. Menguc et al. (2013) findings on high-tech companies suggested a strong harmful effect of too much customer involvement in new product design, especially for radical innovations. Highly innovative products are inherently associated with high market and technical uncertainty. It is difficult therefore to obtain early and reliable input from customers during the front end of the development process. Collaboration with customers may not be suitable or must be well managed in the case of radical innovation. It must be noted, however, that Mengue et al.'s study (2013) did not have separate categories of regular users and lead users in their sample. According to findings in the literature review, lead users can help to explore unarticulated needs and might be a source for market-driving ideas (Lilien et al., 2002; von Hippel, Thomke & Sonnack, 2000).

In addition, a recent PDMA comparative performance assessment by Markham and Lee (2013a) highlighted the need for firms to focus more on exploring the unarticulated needs of customers in order to determine future market needs. Consistent with the finding in this study, this appears to indicate that proactive market learning (MVC) is particularly critical to market vision at the front end of breakthrough innovation. Further, Markham and Lee's study (2013a) showed that assessing the unarticulated (unstated) needs of existing customers and potential customers is done least frequently (41.5%) at the front end of innovation, while assessing the articulated (stated) needs of existing customers is done most frequently (66%) at that stage. This finding on the assessment of articulated needs also indicates why the development of incremental innovation is still practised by the majority of firms, despite the agreement of scholars and business leaders on the importance of breakthrough innovation to a company's long-term growth and renewal.



## 6.4 Performance Consequence of Market Vision

### 6.4.1 Market Vision and Before-Launch Stage Performance



The findings from both regression and path model analysis indicated that MV is considered a significant influence on before-launch stage performance (BLSP) in terms of achieving breakthrough integrity (BI) and early success with customers (ESC).

Importantly, having a clear and specific early stage mental model or image of a product-market (MV), significantly and positively influences the ability to maintain the innovative concept of a radically new or really new product from the front end of innovation through to launch (BI). This is an important finding for the marketing discipline, as breakthrough integrity is a newly formed concept drawn from the literature review undertaken for this research and is emerging as a central focus in recent product innovation studies.

The findings of Markham and Lee (2013b) emphasised the importance of how firms manage the flow of ideas from the front end into more formal development programs. Generally, the front end activities involve the work required prior to an idea's being accepted into the formal development program (Smith & Reinertsen, 1992). However, acceptance into the formal NPD process does not mean that an idea will be developed and then delivered to market. Only a small fraction of ideas generated are further assessed and refined before their actual development and possible launch. Hence, the impact of most of the front end activities will be evident in how successful the front end is at generating and delivering high-quality ideas. The quality of the original idea is evidenced in the movement from the front end to formal development, which can impact on product performance and ultimately the marketplace.

Eling, Griffin, and Langerak (2013) highlighted that a new product concept ready to proceed into development is the outcome of the front end of innovation. Accordingly, this concept should incorporate appropriate degree of novelty and meaningfulness in the eyes of the target customers to ensure new product success. This supports the importance of maintaining the originality and innovativeness of the new product concept or its breakthrough integrity. Importantly, market vision was found to have a significant role in achieving breakthrough integrity. Lynn (1999, p.106) stated that “without a clear objective of knowing what the product should be, who the target market will be and when the product will need to be launched, the vision is unlikely to be shared and accepted”. As such, having a market vision can avoid the confusion and instability among individuals, NPD team members and top management that may reduce the breakthrough integrity of the originally desired, highly innovative product concept of a potential new product.

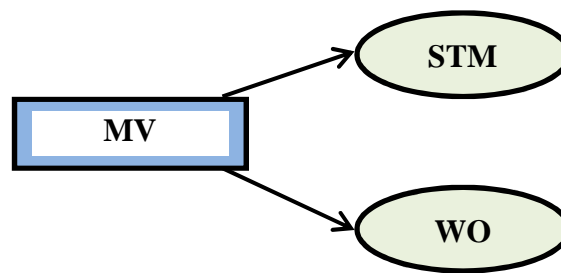
More specifically, the results of the regression analysis have shown that the form (FO) dimension of market vision has the most influence on before-launch stage performance. As FO reflects the thoughts relative to end-user interaction and the real meaning of a future product-market, once it is recognised and valued by individuals and the NPD teams, it can lead to improved early performance in terms of achieving breakthrough integrity. In addition, an effective MV, particularly FO, can result in a more clearly defined new product that brings a different and unexpected value to customers and ultimately leads to improved success with early customers (ESC) (Hekkert & van Dijk, 2011). Whilst the analysis of the relationship between MV and ESC in this research was done at the broader NPD program level of market-driving innovations, the result is consistent with the finding of Reid and de Brentani (2010) regarding the significant and positive impact of MV on early success with customers (ESC). This result has rather extended the current body of knowledge that MV is also significant to early performance in terms of achieving ESC in the case of really new innovation, and is not limited to the high-tech industry or firms in developed countries.

In addition, scope (SC) was found as the only dimension of MV that has a negative direct impact, particularly on before-launch stage performance in terms of achieving breakthrough integrity and early success with customers. This finding is important in suggesting that the more time an NPD team spends on thinking about and discussing the most profitable, the most important and/or the largest target market, the more they are likely to be at risk of

losing breakthrough integrity of a future product-market and may shift the focus away from delivering unique benefits to potential customers. This study adds to the current literature relative to scope in supporting that assessments of market size and market potential should be less of a concern during the front end of market-driving innovation (e.g. Christensen, 1997; O'Connor, 1998).

In fact, the questions about the target market reflected in SC may be more appropriate to a known market condition of an incremental, evolutionary nature (McCarthy et al., 2006; Phillips et al., 2006). In an incremental innovation scenario, early market-related questions can primarily be based on an inward-looking perspective by referring to a question of “how valuable the market is to the firm in terms of size, potential and growth” (O'Connor, 1998, p.162). This seems to relate to SC in the way of asking “what would be the most profitable, largest and most important target market for the breakthrough innovations?” (Reid & de Brentani, 2010). In contrast, the market-related questions for breakthrough innovations merely lean towards an outward-looking perspective by referring to “the degree to which the market will value the offering” (O'Connor, 1998, p.162), which in this case, the right market-related question regarding SC should probably be “who of the target market will value and benefit the most from the breakthrough innovation”. Really new innovation or market breakthrough by definition will “develop” a latent market, that is, one that does not currently exist or which is only just emerging.

## 6.4.2 Market Vision and Post-Launch Stage Performance



The findings from both regression analysis and path model analysis revealed that MV impacts on post-launch stage performance (PLSP) in terms of achieving speed-to-market (STM) and windows of opportunity (WO). Both STM and WO have been recognised as strategically important success measures in the product innovation literature. This finding adds to extant knowledge and develop the understanding of MV and its significant impact on post-launch stage performance, and to some extent, its impact on “early performance” (Reid & de Brentani, 2010).

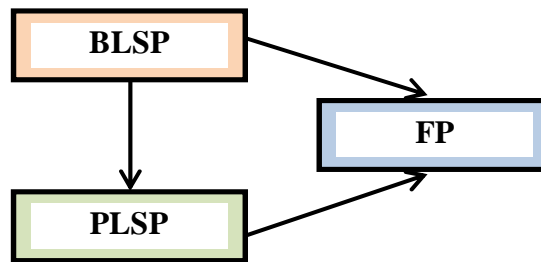
Having a clearly defined MV can reduce reworking the product and avoid changes in direction for an NPD team, thereby influencing the elapsed time from the beginning of idea generation to full commercialisation (Kim & Wilemon, 2002a; Lynn & Akgün, 2001). In general, STM is a reflective view on how quickly the firm was able to get to market with acceptable risk (Tatikonda & Montoya-Weiss, 2001). Several researchers have supported the importance of a clear and specific vision on new product development in terms of speed-to-market (Dyer et al., 1999a, 1999b; Lynn et al., 1999b). Cankurtaran, Langerak, and Griffin (2013), in their meta-analysis of 56 articles published between 1989 and 2009 on new product development speed (denotes the same concept as STM), found that goal or vision effectiveness acts as the only salient antecedent of development speed. This finding is similar to that of Chen et al. (2010) on goal clarity and development speed.

Although the impact of clarity (CL) dimension of MV was not found on before-launch stage performance, it is important for firms to recognise that CL is essential to speed up the NPD cycle relative to market-entry timing. Firms need to be able to deal with the inherent ambiguity associated with the front end of market-driving innovation, and as a result, a market vision may become more apparent as the project progresses. Markham and Lee (2013a) PDMA comparative performance assessment study supported the importance of this

finding and highlighted that “it is important to understand why goal clarity and relationship to SBU strategy actually decreased in 2012 when they are so strongly related to performance” (p. 421).

Moreover, the result suggests that the MV of a future product-market can drive firms to take advantage of pioneering windows of opportunity (WO). Discovering a product’s true meaning through effective MV leads to a clearly defined new product that is likely to fulfil customers’ latent or unarticulated needs which they may be unable to explicate to the firm (Slater & Narver, 2000), thereby driving the firm into new product, technological or market arenas (Hills & Sarin, 2003; Kleinschmidt et al., 2007). This finding is consistent with the study by Kleinschmidt et al. (2007), who found a significant positive impact of homework activities (clearly defined new product definition) on windows of opportunity. Overall findings in this section add to the current literature in supporting the importance of goal/vision (MV) on speed-to-market and windows of opportunity, particularly in the case of market-driving innovation.

## 6.5 Market-Driving Innovation Performance



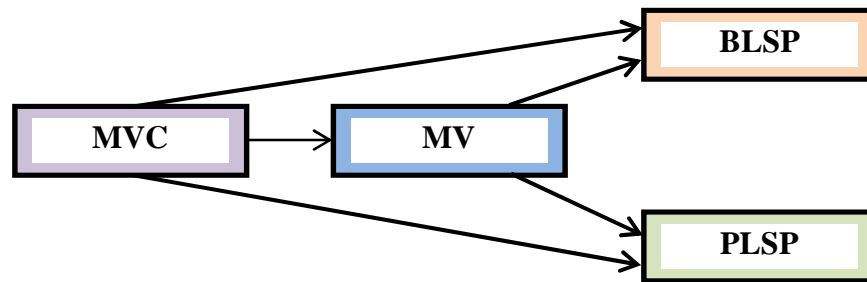
For the purpose of this study, the concept of market-driving innovation performance (MDIP) was formed based on the review of the product innovation literature as a construct that specifically captures the before-launch stage performance (BLSP), post-launch stage performance (PLSP) and financial performance (FP) of a market-driving innovation.

In line with RBV and the empirical results in NPD research, the impacts of before-launch stage performance on post-launch stage performance and financial performance were found to be significant and positive. Several studies have supported the significant impact of the front end activities and the outcome of an early product definition on the NPD process and innovation in terms of achieving speed-to-market, high product quality and product profitability (e.g. McNally et al., 2011; Tassarolo, 2007) and overall financial performance (e.g. Cooper, 1996; Griffin & Page, 1996). The outcome of the front end activities in product innovation studies appears to be consistent with the outcome of before-launch stage performance, that is, an early and clear product definition provided by effective market vision (Cooper, 1996; Kleinschmidt et al., 2007). A recent study by Markham (2013) also support these findings by stating that the front end performance has a significant impact on overall new product success, time-to-market and market penetration as well as financial performance.

This study adds to the current body of knowledge on how the front end performance impacts on performance outcomes of the later stages of the NPD process and the final success of market-driving innovation in particular. The results help to explain how the ability to maintain breakthrough integrity and satisfy early customers at the front end of market-driving innovation can speed up the NPD process and allow firms to open up windows of opportunities (PLSP) and ultimately achieve positive financial outcomes (FP).

In addition to these findings, post-launch stage performance (STM/WO) was found to have greater impact on financial performance than before-launch stage performance (BI/ESC) did. This appears to make sense because the ability to move breakthrough innovations quickly through to full commercialisation (STM) allows a firm to begin to obtain its financial returns and benefits from the resources invested in developing such products. The aspects of windows of opportunity (WO), which captured in market-driving innovation (entering into a new market or new product/technological domains), have also been regarded as a key to achieve long-term product advantage and superior financial performance (e.g. de Brentani et al., 2010; Henard & Szymanski, 2001; Kleinschmidt et al., 2007). This result further adds to the overall understanding of the importance of market-driving innovation and the influence of strategic performance outcomes on financial performance.

## 6.6 The Mediating Role of Market Vision



Additional relationships were considered in the fully-mediated path analysis model to examine the relationships between market visioning competence (MVC) and before-launch stage performance (BLSP) and between MVC and post-launch stage performance (PLSP). The findings indicate a significant and positive impact of MVC on BLSP/PLSP in terms of achieving breakthrough integrity, early success with customers, speed-to-market and windows of opportunity. These findings also suggest that MV is a partial mediator.

The findings of MVC/MV and its relationship with BLSP and PLSP add to the current body of knowledge on understanding the process of “visioning” or “market visioning” (O'Connor, 1998; Rangan & Bartus, 1995), and to some extent, extending the study of Reid and de Brentani (2010). At the NPD project level, the original MVC construct developed by Reid and de Brentani (2010) captured idea driving, networking, proactive market orientation and market learning tools dimensions. Their study has also indicated that MVC has an influence on the ability of a firm to attract capital in terms of gaining the attention of financiers or AAC but not on the ability to achieve early success with customers (ESC) (Reid & de Brentani, 2010). However, the analysis of MVC construct in this study was conducted at the NPD program level where the original MVC items were modified accordingly. This study has also considered the influences of MVC on other performance dimensions apart from AAC. The findings of MVC in this study demonstrate that excelling in ‘proactive market learning’ (PML) competencies is important because they help to discover additional needs of customers and identify several potential future markets for a given idea or technology, thereby influencing the ability of a firm to achieve breakthrough integrity (BI), speed-to-market (STM) and windows of opportunity (WO). This can excite individuals or NPD teams to take on the original idea/technology through to the development and speed up the NPD

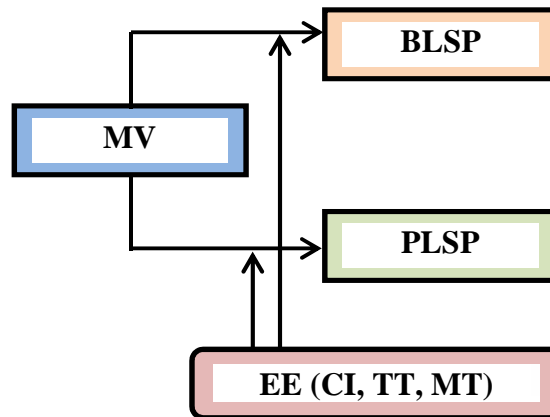


process in order to get to the market quickly and take advantage of the pioneering opportunities.

Adding to this, it must be noted that the influence of MVC on ESC was found in this study. This is in contrast to the finding of Reid and de Brentani (2010) previously stated; MV was considered a full mediator of the relationship between MVC and ESC. The finding of the influence of MVC on ESC in this study was, nonetheless, expected given that the MVC construct and the related questions posted in the questionnaire of this study were revised to capture NPD program level capabilities and influences rather than following the work of Reid and de Brentani (2010) on MVC project level analysis. One might expect some differences in the results when examining a construct at a different level of analysis and particularly in the way that NPD program level capabilities (i.e. MVC) might directly influence program level measures of performance (i.e., program level BLSP and PLSP outcomes). Despite these findings, the overall model results indicated that the best way to account for before-launch stage and post-launch stage performance outcomes is by considering market vision as a mediating variable.

## 6.7 Moderation Effects

### 6.7.1 External Environment



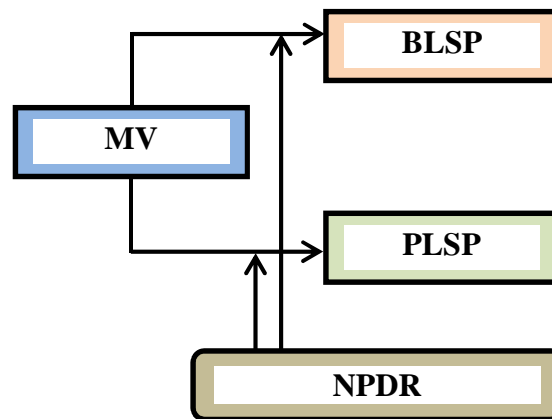
The external environment (EE) was identified in the literature as an appropriate moderator of the effectiveness of different strategic choices or orientations in new product development (e.g. Jaworski & Kohli, 1993; Zhang & Duan, 2010). The construct captures three external environmental factors: (1) competitive intensity (CI), (2) technological turbulence (TT) and (3) market turbulence (MT). Accordingly, it was proposed that these factors would negatively influence the relationships between market vision (MV) and before-launch stage performance (BLSP) and between MV and post-launch stage performance (PLSP).

In the regression analysis, competitive intensity was the only moderator found to significantly and positively influence the relationships between MV and BLSP and between MV and PLSP. This result may highlight that the value of a clearly defined MV in attaining performance outcomes – high intensity may be navigated if a clear MV is in place. In a more complex setting, the results of the path model however suggest that none of the external moderating factors (CI, TT and MT) influence the proposed relationships between MV and BLSP/PLSP. These findings indicate that MV is an important determinant of both before-launch stage and post-launch stage performance, regardless of the market turbulence or technological turbulence and the competitive intensity of the environment in which it operates. The findings of the path model are consistent with the study by Reid and de Brentani (2010) that MV is critical to the early performance of market-driving innovations.

One possible reason for the nonsignificant result of CI, TT and MT might also be that a firm's innovative efforts, particularly on market-driving innovations, should not be disrupted by immediate changes in market demand or technologies or by competitive situations. The nonsignificant influence of competitive intensity is in line with previous empirical investigations on the moderating influence of the external environment on market orientation. Jaworski and Kohli (1993) and Slater and Narver (1994) found no empirical evidence of competitive intensity as a moderating influence on market orientation. Recent research by Lamore et al. (2013) supported the insignificant influence of competitive intensity on the relationship between proactive market orientation and marketing-R&D integration. Their study explained that "market conditions with a high level of competitive intensity are not necessarily an atmosphere conducive to fostering resource- and time-consuming endeavors into discovering future customer needs" (p. 709).

From this result, which is in line with prior research, it may be concluded in this study that the external competitive environment does not have a significant moderating influence on the relationship between market vision and before-launch stage performance and between market vision and post-launch stage performance of market-driving innovation.

## 6.7.2 NPD Process Rigidity



Several authors have argued that there is a possible harmful effect of having a highly formalised, market-driven stage-gate type of process at the front end of breakthrough innovation (Leifer et al., 2000; Song & Montoya-Weiss, 1998; Veryzer, 1998a). The formality of the NPD process may impose too much rigidity and thus limit the creativity necessary to generate breakthrough ideas (Bonner et al., 2002; Sethi & Iqbal, 2008). In this context, previous research has further highlighted that having flexibility in the NPD process may be more effective than a formalised process in conditions of high uncertainty, that is, for breakthrough innovations (e.g. Brown & Eisenhardt, 1995; Eisenhardt & Martin, 2000; Lynn et al., 1996). The present study adopted a NPD process rigidity (NPDR) measure in response to this contention and posited that the degree of highly formalised or market-driven NPD process would negatively influence the relationship between market vision (MV) and before-launch stage performance (BLSP), as well as that between market vision and post-launch stage performance (PLSP).

An unexpected significant positive impact of NPDR was found on the relationship between MV and BLSP in the regression analysis, but was not supported in the path model. As some items of the NPDR were based on the “NPD process formality” scale developed by (Kleinschmidt et al., 2007), this may have framed the respondents’ thoughts about a formal NPD process. One possible explanation for the significant and positive influence of NPDR might be that the management of market-driving innovation requires a means of mitigating the associated high risk, uncertainty and longevity. The nonsignificant influence of NPDR

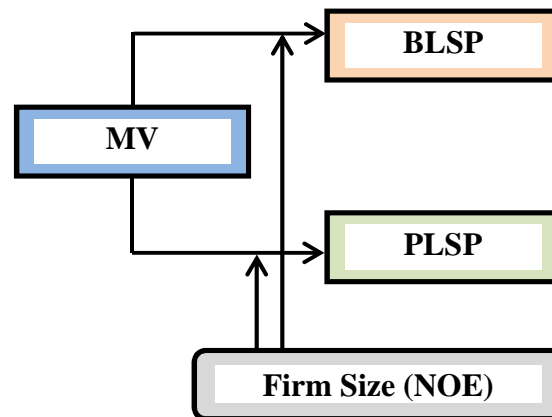
in the path model, nonetheless, suggests MV as an important determinant of before-launch stage performance. This may involve a balanced effect of NPDR, which would underlie its nonsignificant influence. On one hand, having a formal process can significantly influence front end success. On the other hand, a formal process may hamper a number of potential ideas moving from the front end into formal NPD (Markham, 2013). Despite the opportunity provided through a formal NPD process, it may have a negative influence in terms of translating MV into before-launch stage performance.

Interestingly, the positive finding relative to NPDR from the regression analysis is in line with recent studies supporting the importance of having a formal process to manage market-driving innovations, particularly at the front end of the development process (e.g. Holahan et al., 2014; Schultz, Salomo, de Brentani & Kleinschmidt, 2013). Huchzermeier and Loch (2001) claimed that project management flexibility should be lower in a high uncertainty environment (radical innovation) than in a low uncertainty environment (incremental innovation). Radical innovation projects require more formality in the NPD process and project management. Holahan et al. (2014) indicated that radical projects are often managed through more formal methods as opposed to informal entrepreneurial adventures, and are less flexible than incremental projects. Other researchers including Schultz et al. (2013) have suggested that a highly formal control system (stage and gate types of processes) operates effectively at achieving positive decision making clarity when an NPD program leans towards the radical end of the innovativeness spectrum.

In the complex environments of developing radical innovations, a formal control system can direct specific process activities to ensure overall vision, new entrepreneurial learning, creativeness and the actions needed to support the radical aspects of the NPD projects. Thus, this approach can lead to improved process activities, particularly the up-front homework (Schultz et al., 2013) (the before-launch stage performance, in this study). Markham and Lee (2013a) PDMA comparative performance assessment study highlighted the trend towards using more formal processes at the front of innovation by firms that are significantly involved in innovative projects, and stated that “at the same time as companies are eschewing formal processes in the formal development programs, they seem to be adding process to the front end” (p.427).

From the regression result, which is in line with emerging research, it may tentatively be concluded that NPD process formality has a role to play in terms of influencing the relationship between market vision and the before-launch stage performance of market-driving innovation. A formal NPD process may be useful as long as it can cope with the high risk and uncertainty associated with breakthrough products. If this holds true, it may add to the recent arguments and the trend to move attention to the formal front end process, particularly for market-driving innovations.

### 6.7.3 Firm Size (Number of Employees)



The debate on firm size and its influence on NPD and breakthrough innovation success has been ongoing for several decades and is yet to be settled (Burgelman & Sayles, 1986; Chandy & Tellis, 2000; Dougherty & Heller, 1994; Kanter, 1988). There is more anecdotal evidence that small firms might be responsive to changes and more innovative in generating breakthrough ideas through a quick information flow and decision making (Stringer, 2000). Large firm are often more bureaucratic and slow and perhaps less flexible (i.e., the traps of familiarity and maturity) and this could stifle more radical projects (McDade, Oliva & Pirsch, 2002). Despite certain drawbacks of large firm size, this may not imply that large firms cannot overcome the disadvantages and develop breakthrough innovations. The common failure of large firms to innovate may be due to lack of organisational ability and lack of motivation (Ahuja & Morris Lampert, 2001). An organisation can resolve such competency traps by experimenting with novel, emerging and pioneering technologies; which requires considerable resources to be successful.

A large firm size can be highly beneficial in the case of market-driving innovation. They have greater access to slack resources (“deep pockets”) such as human resources, market learning systems as well as financial resources to support the development of a risky project (Reid & de Brentani, 2012). It was, therefore, posited that a large firm size would positively moderate the relationship between market vision (MV) and before-launch stage performance (BLSP), and the relationship between MV and post-launch stage performance (PLSP). Firm size was measured categorically using number of employees (NOE).

The findings from both the model and regression results indicate that being a large firm has a significant and positive influence on the relationship between MV and PLSP. This result appears to make sense. Empirical studies have suggested that once a breakthrough idea progresses over the stages of the development process, they require more resources in the forms of human resources (reviewers, decision makers, sales support), broad network and distribution channels and financial resources. This is due to the associated high/unexpected costs, risk and uncertainties in developing such product idea and bringing it to the market (e.g. O'Connor & Rice, 2013b; Schmidt et al., 2009). In this respect, several studies support the significant and positive impact of large firms and their slack resource on breakthrough innovation. As evidenced in the benchmarking study by Griffin and Page (1996), a large firm can support extensive marketing expenditure, which was found to have a positive impact on innovation success. Ahuja and Morris Lampert (2001) stated that “cash-rich corporations can far more easily afford certain kinds of speculative and experimental ventures” (p. 541). Adding to this, large firms often have a better reputation than small firms. As such, the innovations developed by large firms are perceived by customers to be less risky (Chandy & Tellis, 2000; Sorescu et al., 2003).

The results of recent research on large firm size and slack resources and their influence on market-driving innovation are also emerging in the product innovation and management literature. Troilo, De Luca, and Atuahene-Gima (2013) indicated that higher levels of slack resources particularly external knowledge are positively correlated to radical innovation because they can reduce the associated uncertainty and ambiguity in the development process. Rubera and Kirca (2012) meta-analysis review highlighted that large firms have a broad network and preferential access to distribution channels than small firms and this allows easy access to the required resources and opening up of new markets to reach consumers more quickly, thus, increasing the innovation adoption rate. Andries and Faems (2013) also indicated that large firms have greater knowledge and expert resources such as specialised patent departments and patent attorneys to undertake patenting and licensing of breakthrough innovation than small firms. This allows them to commercial radically new or really new product and related new knowledge without being hindered by imitators.

From this result, which is in line with the emerging research, it may be concluded in this study that the effectiveness of market vision on the post-launch stage performance of



market-driving innovation is greater for large firms (with slack resources) in terms of improved speed-to-market and broader windows of opportunity. Despite the anecdotal evidence regarding the benefits of small firm size, this study adds to the current body of knowledge on the positive influence of large firm size on market-driving innovation.

In addition to these findings, a possible direct negative effect of firm size on the before-launch stage performance was found in the path model. This may be explained by the large body of evidence that large firms are unable to manage the front end exploration well (O'Connor & Rice, 2013b). A further possible reason for the insignificant influence of large firm size on market vision and before-launch stage performance may be that market vision is not largely influenced by firm size. Market vision remains an important determinant of before-launch stage performance in terms of achieving breakthrough integrity and early success with customers, regardless of whether a firm has only few employees or hundreds.

## 6.8 The Implications of the Study

### 6.8.1 Theoretical Implications

A number of theoretical implications have arisen from this research. The contribution to the literature is mainly fourfold:

- (1) Advancing knowledge about the **front end of innovation** in relation to **market vision and associated competencies** and, through **absorptive capacity**, specifically adding to theory development.

Core of the major contribution of the thesis is the advancement of knowledge about the front end of the development process, particularly for market-driving innovation. This study builds on and extends, in particular, the work of Reid and de Brentani (2010) on market visioning competence (MVC) and its resultant market vision (MV). The constructs have emerged from the product innovation and management literature to deal particularly with the high uncertainty and ambiguity associated with the front end of market-driving innovation.

Whilst this research is not a replication of Reid and de Brentani (2012), evidence has been found that MVC and its resultant MV are significantly instrumental in ensuring that market-driving innovations are able to emerge into the development process, whilst retaining their originality and innovativeness (breakthrough integrity). The analyses for this research has been done at the program level, as opposed to the project level (Reid & de Brentani, 2010), and thus the impacts of MVC/MV were extended to encompass the performance of several projects. Because the focus was beyond a single product, analysis was able to determine the degree to which firms had the ability to produce ongoing market-driving innovations, especially if they were leaders in their field. This study also captures both radical and really new innovation as market-driving innovation. The research was conducted across different industries, and was therefore not limited to radically new, high-tech products (Reid & de Brentani, 2010). Overall, the findings in this study on MVC and MV broaden an overall understanding of the emerging market learning approach, that is, the process of “visioning” or “market visioning” and its significance to the front end of market-driving innovation. It also adds to the current body of knowledge on the specific MVC and MV (Reid & de

Brentani, 2010) that helps to explain the importance of this concept in different research settings.

Importantly, this study specifically adds to the theory on development of MVC/MV through absorptive capacity (ACAP). The concept of ACAP has emerged from the management literature as an organisational dynamic learning capability and a predictor of innovative activity and performance. This study brings the concept of ACAP, primarily based on the work of Zahra and George (2002), into the field of NPD and product innovation. A review by Shafique (2013) on innovation-related publications in top journals over a 21-year period supports this cross-field research and argues that innovation research is becoming increasingly compartmentalised within management disciplines.

Moreover, prior research has often examined absorptive capacity as single indicator or unidimensional measure. Cohen and Levinthal (1990) original work on absorptive capacity, however, suggested the importance of multidimensionality. In this respect, the present study treats absorptive capacity as a multidimensional construct and operationalises it on the basis of the recent scale developed by Flatten et al. (2011) to further extend the empirical research. In addition, the concept of absorptive capacity has often been applied in the context of incremental innovation, as opposed to radical innovation (Lane et al., 2006). Thus, this study extends the current body of knowledge on absorptive capacity and breakthrough innovation, especially at the front end of the development process.

This study is the first empirical study to model the role of absorptive capacity and its potential and realised subsets as precursors to both market visioning competence and market vision at the front end of market-driving innovation. This adds to the knowledge of innovation in terms of visioning for market-driving innovation (an individual's tacit knowledge) and the organisational influence as part of the dynamic knowledge creating process. A recent research by Markham and Lee (2013b) also highlighted that the front end of innovation and related activities is dependent on a firm's ability to acquire, transform and absorb new knowledge. This further indicates the importance of absorptive capacity as an emerging construct at the front end of innovation.

By positioning absorptive capacity as a dynamic capability, this study demonstrates the value of higher level process capabilities that serve as a mechanism to explain how firms

can attain breakthrough product innovation, subsequent success and benefits, and competitive advantage over time. Specifically, this study supports the theoretical assumption of the absorptive capacity concept that is often applied in highly dynamic environments and in the high-tech industry of developed countries. Thailand, as a developing country, also faces a dynamic environment with competition from its rapidly industrialising neighbours and from international competitors targeting its markets and key customer. Thus, developing breakthrough innovation through an organisational dynamic learning capability is also an important challenge for firms in developing countries.

In respect to the critical focus of this thesis on the front end of market-driving innovation, several recent researchers have highlighted that the area is still under-researched (e.g. de Brentani & Reid, 2012; Markham, 2013; O'Connor & Rice, 2013a; Reid & de Brentani, 2012; Slater, Mohr & Sengupta, 2013; Stevens, 2014). The development of market-driving innovation at the front end of innovation involves the degree of originality, novelty and meaningfulness. Further, managing the flow of market-driving innovations (i.e. ideas, concepts) from the front end into a formal development process has shown as a critical issue to new product success. This study has captured this emerging area of research and linked with the importance of absorptive capacity and market visioning, resulting in the formation of a foundation for further studies to replicate and extend this work. It is hoped that the study will stimulate scholars in the field of innovation to identify capabilities, competence (tools, skills) and managerial practices that drive markets, so that firms can leverage new ideas and exploit these into market-driving innovations.

(2) Bridging the gap in the traditional market orientation to NPD through the **resource-based view and dynamic capability** theory and the notion of “**market driving**”.

The traditional market orientation and the concept of “market-driven” have been dominant in the strategic marketing literature (Jaworski et al., 2000). However, research on market-driven orientation has appeared to offer little explanation on the behaviour of market-driving firms and their development of radical or really new innovations. A recent study by Büschgens, Bausch, and Balkin (2013) highlighted that “up to now, few studies have examined the link between organisational culture and radical innovation” (p.771). Market

orientation underlies the organisational norms, values and culture that inherently form specific learning and decision-making behaviour, activities, resources and capabilities (Slater & Narver, 1995). The need to move the focus of research away from the traditional market orientation is essential to market-driving innovation (Hills & Sarin, 2003; Kumar et al., 2000). This study bridges this research gap and provides evidence that a market-driving orientation is conducive to market-driving innovation.

Cast in the resource-based view (RBV) of the firm and dynamic capabilities literature, this study uncovers the rich array of factors which underlie a firm's internal resources and capabilities, particularly the intangible skills and knowledge related to market-driving that serve as sources of competitive advantage to achieve and enhance firm performance through NPD. The paradigm of the traditional RBV alone, as asserted by most researchers, does not sufficiently capture today's highly competitive and dynamic marketplace (due to either pace or ambiguity). This is especially true for an investigation of market-driving innovation in the context of dynamic capability (Eisenhardt & Martin, 2000; O'Connor, 2008; Teece et al., 1997). Accordingly, the present study adds to the theoretical argument of RBV and dynamic capability literature as a robust approach to the analysis of sustainable competitive advantage, particularly for market-driving innovation.

(3) Improving the understanding of **NPD performance-related market-driving innovation** relative to before-launch stage, post-launch stage and financial performance outcomes, and more specifically adding to theory development through the newly formed breakthrough integrity measure.

An extensive literature review has suggested a lack of quantitative studies have been conducted to capture NPD performance outcomes from the front end through to final success, especially for market-driving innovation. On one hand, recent research by Markham (2013) found little empirical evidence of the impact of front end activities on front end performance. The majority of research on the front end has been presented as conceptual, without specifying or testing the effects of the front end activities. On the other hand, O'Connor and Rice (2013b) claimed that less attention has been paid to the

commercialisation success stage of market-driving innovation, that is, how well a product performs in creating a successful market, a new business or a new revenue model.

This study underscores the importance of a coherent framework to examine the performance outcomes of market-driving innovation by adopting a multidimensional measure as referred to as “market-driving innovation performance” (MDIP). The program level MDIP measure was adopted and integrated primarily from the scales developed by other researchers in product innovation and management literature, while a few new items had to be developed specifically for the purpose of this study, particularly the new measurement scale for “breakthrough integrity” since this concept has only just begun to emerge from the literature.

MDIP captures the outcome measures in the product, process, customer, firm and financial related aspects of market-driving innovation from the front end through to its final success. Specifically, the MDIP dimensions are breakthrough integrity, early success with customers, speed-to-market, windows of opportunity and financial performance that as a whole comprise market-driving innovation performance. These dimensions were categorised by different time horizons into before-launch stage, post-launch stage and financial performance. In addition, the relationships among these specific performance outcomes were drawn in the conceptual model and tested for their associations. This provides a new explanation of the relationships, with a view to understanding how to facilitate greater performance outcomes of market-driving innovation.

(4) Broadening the scope of the pertinent research on **market-driving innovations by using and testing data from a developing country**, which includes both large sized and small-to-medium sized firms developing market-driving innovations.

This study makes a contribution by its context of the developing country of Thailand. By virtue of the sample composition of the present research, this contribution is about broadening the notion of research of market-driving innovation in developing countries by testing models in Thailand and using the data that includes both large sized and small-to-medium sized firms developing radically new and/or really new products. This sample also comes from a cross section of industries and this moves the analysis and implications

beyond developed countries such as the USA, the UK or Europe. Further it shifts the focus of using only large mature firms developing radically new, high-tech products in Silicon Valley or those on the Fortune 500 list – all of which are so pervasive in the product innovation and management literature.

Respectively, using Thailand does make a contribution in that the issues faced by firms in developing countries are similar in effect to those in developed countries trying to bring about market-driving innovations (both radically new and really new products) to service local and global markets. Firms regardless of the country conditions often face similar strategic, operational and process issues in developing new products, particularly breakthrough market driving ones. In addition, only a few empirical studies on innovation have been found that have used Thai firms (e.g. Chaveerug & Ussahawanitchakit, 2008; Dhamvithee, Shankar, Jangchud & Wuttijumnong, 2005; Suwannaporn & Speece, 2010; Wattanasupachoke, 2012). This indicates a dearth of research on innovation in Thailand, particularly in relation to market-driving innovation.

(5) Addressing the **debates on the influence of firm size** on the development of market-driving innovation.

Significant and positive influences of large firm size were found on the relationship between market vision and post-launch stage performance. The findings from the regression analysis and path models are in line with other recent research supporting the significance of a large firm as an influencer (e.g. Troilo et al. (2013). The review of the evidence addressed the debate regarding firm size and the common perception of the negative influence of large size on the development of market-driving innovations. Large firms are getting better at market-driving innovation, and through their slack resources, allow them to move forward a potential new product to the market quickly to open up a new market or product/technological arena. This led to the conclusion that a large size is likely to be beneficial to a firm but only if it is not too bureaucratic and has the ability to accept the risk associated with market-driving innovation.

## **6.8.2 Managerial Implications**

### **6.8.2.1 Implications for Business**

This study has significant implications for managers, entrepreneurs and NPD team members related to how they can best manage and facilitate the development of market-driving innovation, especially at the front end of the NPD process.

#### ***For Firms to Become “Market Driving”***

In today’s highly dynamic and competitive business environment, firms should face the challenges and be engaged in market-driving innovative activities rather than being market-driven in order to survive. Having visionary leaders and employees with multifunctional skills and entrepreneurial characteristics can encourage the development of a market-driving culture in firms or strategic business units. Large firms should recognise the advantage of having greater access to the resources of finance, people and knowledge than small start-up firms. Notwithstanding the impetus and opportunity provided through these resources, large firms should also be encouraged to participate in broad communication networks and to spread the cost of bringing new products to market through economies of scale. This may speed up the new product development process and open windows of opportunity for firms engaging in market-driving innovations.

#### ***Visioning for Market-Driving Innovation and Breakthrough Possibilities!***

The findings of this study, based on a cross-section of firms in Thailand, broaden the RBV research agenda to place more emphasis on the roles of managers in visioning for market-driving innovation. Managers should resist the temptation to fall back on “me-too” products or market-driven innovations even though undertaking market-driving innovation tends to increase the levels of uncertainty and complexity in the development process. This is a competitive necessity for firms to achieve sustainable competitive advantage. To be involved in a project associated with high risk and uncertainty does not necessarily result in poor performance. A competitive advantage can often be gained by undertaking more difficult and complex tasks than the competitors do.



Managers should not be too concerned about technical solutions to develop market-driving innovation but should devote more attention to key nontechnical resources and competencies early in the process. The ability of individuals and NPD team members to bring in and use external information from various sources creates the diversity of knowledge essential to the generation of new product ideas. They should be involved in exploratory learning by means of discovering additional or unarticulated needs of customers, and experimenting with new ideas and incorporating them into solutions that contribute to successful market-driving innovation. Forecasting and market estimation techniques can also be useful before making a final market selection.

A good understanding of the dimensions of each of the market visioning competence and market vision constructs can be an enabler for managers to identify breakthrough possibilities. This understanding helps managers to recognise and understand the real meaning of the future product-market they are developing, and to have the courage to follow their intuition when making the front end decisions related to market-driving innovation. The right questions must be asked among the NPD team members when they first start thinking about the development of a market-driving innovation, particularly the question of who of the target market will value and benefit the most from the breakthrough innovation. Further, the individuals and NPD team must have a clear and specific market vision when moving towards the later stages of the development process.

### ***Organisational Dynamic Learning Capabilities***

Market-driving innovation often demands a reconfiguration and different management of a firm's resources and capabilities. Firms must devise ways to mobilise and leverage resources in order to develop new or novel capabilities to facilitate opportunity identification leading to market-driving innovation. In the RBV research and dynamic capabilities agenda, it is clear that the management of key resources and capabilities is critical and should take a central place in market visioning (MVC/MV).

The market visioning competence (of individuals or an NPD team) must be formulated and sustained through organisational routines and processes that promote exploratory learning.

Knowledge management and information processing are at the core of market visioning at the front end of market-driving innovation. Management must recognise that a firm's ability to acquire and assimilate knowledge is a proxy for market vision. New information from the environment regarding markets, technology, competitors and resources is the source of radically new or really new product ideas. More importantly, a firm's capability to combine non-redundant or new information with in-house knowledge to transform it influences the process of market visioning or employees' vision of a future market opportunity and its exploitation into a successful market-driving innovation.

### ***Maintaining Breakthrough Integrity from the Front End through to Launch***

The real challenge for firms is to maintain the highly innovative concept of a potential new product, or breakthrough integrity from the front end stage through to the final product launch. Highly innovative, market-driving ideas are revolutionary, risky and disruptive. Accordingly, the more innovative ideas (that might create new markets) are often squelched by managers or led astray by customers' expressed preferences at the outset, or otherwise face a number of stops and starts, deaths and revivals before moving through to launch.

Correspondingly, the quality of execution of early NPD activities (market visioning) is instrumental in achieving breakthrough integrity and early success with customers, particularly at the front end of market-driving innovation. These early NPD activities and performance also have significant impacts on the levels of speed in bringing market-driving innovations to market and in opening up new opportunities for firms and ultimately achieving sales and profitability. Thus, managers and employees must have the market vision to generate and allow market-driving ideas to have a fair chance of success.

In addition to these managerial guidelines, if the result related to NPD process formality holds true, managers must change the way they think about the development of market-driving innovation. A formal process may allow a market vision to be translated into improved breakthrough integrity and early success with customers. As opposed to providing a flexible process, managers should provide some forms of structured NPD process such as process tools and decision criteria to mitigate the high risk and uncertainties associated with market-driving innovation.

### **6.8.2.2 Implications for Public Policy Makers**

This study utilised a sample of Thailand Top Innovative Companies extracted from the list of National Innovation Award winners (National Innovation Agency, 2011, 2012). The list was generated by the National Innovation Agency (NIA), which operates under the umbrella of the Ministry of Science and Technology in Thailand. The role of NIA is to foster innovation development in Thailand by enhancing and promoting a national innovation culture, productivity and international competitiveness, as well as to coordinate industrial clusters at the policy and operational levels. Through a broad-based and systematic approach, their goal is to transform Thailand into an innovation-driven economy (National Innovation Agency, 2010a).

Accordingly, this study can propose modes of facilitating and improving the development of market-driving innovation for practitioners and policy makers, particularly those in Thailand, as well as those in other countries and locations. The policies can be formulated in terms of stimulating a firm's absorptive capacity and related knowledge and information resources, i.e., promoting the importance of external linkages between producers, suppliers, clients and research organisations, and improving the technological knowledge and skills of employees and the mobility of scientists to exploit locally available materials and resources. This can be an effective means of building cross-industry networks for exchanging and exploiting external innovation and knowledge that can lead to an increased development of market-driving innovations at the national level. Over time it may also produce the necessary economic resources to support future knowledge inflows and innovation activities, and add value to the local community and the grass-roots economy.

Absorptive capacity as a dynamic capability can advance the traditional array of policy interventions directly by facilitating the market-driving innovation performance of both developed countries and developing countries such as Thailand. The importance of a firm's absorptive capacity is related to the country's absorptive capacity (Mowery & Oxley, 1995). To develop a policy that fosters knowledge management and information processing through a firm's absorptive capacity may turn out to be "very effective in making the country more receptive to international knowledge flows" (Escribano, Fosfuri & Tribó, 2009, p.104). In particular, it is essential for developing countries to develop a worldwide network due to the inadequacies in some extent factors such as technological knowledge,

infrastructure and high value added components, which often require support from developed countries, in order to encourage market-driving innovations (Intarakumnerd et al., 2002).

### **6.8.3 Limitations and Future Research**

Five main limitations that restrict the generalisability of the findings of this research are explained in detail in this section. The first limitation is that the research focuses on one specific country, Thailand, and thus, country-based limitations apply, and it focuses on Thai firms across industries, which might have certain idiosyncrasies and face unique environmental contingencies that affect their NPD efforts related to market-driving innovations. Thailand as a developing country, for instance, may often appear to play a role of technological catching-up (Klochikhin & Shapira, 2012). This may limit the generalisability of the findings to other countries, specific industries or businesses. Future research could investigate the research question and the conceptual model by using firms in other countries (e.g. developed countries), using firms which operate in an international context or using alternative industries, to examine whether the findings hold in other contexts. In addition, future research could explore specific issues confronting firms in Thailand or other developing countries such as Vietnam and Cambodia, particularly by looking at how the infrastructure of a developing country helps or hinder the ability of innovative firms such as the ones in this research to develop new and breakthrough products and to see how the results may differ from the extant literature. For researchers considering this focus, new literature, hypotheses or propositions will need to be developed and to discuss the results more in this context; a longitudinal focus via tracking or case studies can be a useful method to provide greater insights in this case.

Second, the present study has captured both radical and really new innovations as “market-driving innovations”. Further research should examine the level of effects of absorptive capacity and its subsets, as mediated by market visioning (MVC/MV), on the market-driving innovation performance for a specific type of product innovation. For instance, it would be interesting to see whether higher levels of absorptive capacity and market visioning competence/market vision are required for firms to develop radical innovations

than to develop really new or incremental innovations. Future studies should explore how high performing firms (those producing a high number of product innovations, particularly radical innovations, or those that perform well at before-launch stage and post-launch stage performance and financial performance) manage their absorptive capacity, market visioning competence/market vision compared to lower performing firms.

Third, supposing that the effects of absorptive capacity antecedents on market visioning competence/market vision may differ as a function of a moderator, future research should explore and identify moderators of the first paths in the model. The same set of moderators at different paths and/or other possible moderators could be considered in future analyses. Reid and de Brentani (2012) began to explore some moderating effects (such as origin relatedness, incumbency and resource availability) on the relationship between market visioning competence and market vision. In this regard, a new set of moderators may also be used to assess such relationship based on the model of the present study. Testing moderated mediation effects may further advance the understanding of market visioning competence and market vision, with absorptive capacity as an antecedent, and the performance consequences.

Fourth, direct paths were found from market visioning competence to before-launch stage performance and post-launch stage performance outcomes that cannot be fully explained by market vision. Market vision could, in fact, be an important mediator leading to before-launch stage performance and post-launch stage performance. Further research should investigate how market vision influences specific aspects of the performance outcomes at these stages. Using mixed method research that includes in-depth interviews and case studies can offer a more comprehensive explanation of the role of market vision.

Fifth and finally, the use of cross-sectional data may create difficulties in inferring causal links from the results. The dynamic effect of absorptive capacity as higher organisational level capabilities on market visioning competence and market vision at NPD program level may change over time. A change may be due to external pressures or to changes in strategic decisions (due, for example, to venture capital pressures to pursue short-term product market ideas in preference to longer-term ones). With recent research in marketing, a longitudinal study, although time-consuming, would enable an assessment of the causal

effects in the relationships underpinning the conceptual framework. This would provide further insight into changes in the nature and dynamic effect of the influence of absorptive capacity on the course of market visioning competence, the originally intended market vision and the performance of market-driving innovation over time. In particular, it might clarify the high correlation detected between absorptive capacity and market visioning competence. As the constructs are emerging concepts and in fact are conceptually distinct entities, a longitudinal study would help to explain, in the notion of market driving, how a higher-order absorptive capacity (organisational level sensing) influences market visioning competence (NPD program level sensing). Such a study could also lead to a better understanding of the long-term effects of establishing knowledge and the other external or internal factors that may influence the relationships.

Notwithstanding the five main limitations and the recommendations for future research directions, there are also other considerations for future research in this area. The questionnaire developed for this research has asked respondents for the number of product innovations of different types that their firms had introduced over three-year period. This was in the knowledge that firms targeted were highly innovative and had commercialised products of the types under investigation (that is, radical breakthrough, technological breakthrough and/or market breakthrough new products). The questionnaire instructions therefore focus respondents on these types of breakthrough innovations that have been developed rather than other types. Future research could, however, seek to capture activity from a wider date (e.g. five-year period) because market-driving innovations often take some time to get to market. Moreover, investigators should consider asking about products in the innovation pipeline as there may be further market-driving innovations currently under development that can be used as reference points in answering questions. The importance of a market driving innovation to the firm or the size of the particular introductions can also be considered in the future research. Future research could pose questions regarding how specifically important market-driving innovation in general is to the firm relative to all the product innovation activities undertaken, including incremental innovation. Similarly a question could be asked as to the value (\$) and/or ROI contributed to the firm by market-driving innovations relative to the other forms of product innovation.

The above section outlined the limitations of the research, but these limitations do not detract from the significance of the findings. Instead, the limitations provide platforms for future research. While the use of path models provides an indication of the relations between tested variables, a good model fit of the final model is not necessarily a valid reflection of real-world behaviour. The accepted model, on the basis of the empirical data, provides the best mix of theoretical and logical justifications. Thus, the results are relative, rather than absolute, by virtue of the competing models strategy performed in this research (Hair et al., 2010). Above all, the strengths of the research remain and add to the body of knowledge on the front end of market-driving innovation.

## 6.9 Conclusion and Personal Reflection

In conclusion, this study has conducted the first empirical examinations of the effects of absorptive capacity on market visioning competence and its resultant market vision, and on the specific performance outcomes of market-driving innovation. The resultant better understanding of these dynamic capabilities associated with market-driving innovation can help researchers, managers and employees to manage this intrinsically complex, risky but high potential NPD scenario. This may help firms to avoid getting into “the current-customer trap” and leading them to achieve superior innovation performance and sustainable competitive advantage.

Through this worthwhile journey to the PhD, I truly believe that the important ability underlying all successes is to vision – to follow instinct, gut-feel or intuition. In the case of market-driving innovation, this simply means that one needs to have a market vision. I hope that the results of this study will encourage any individual involved in NPD, not only in Thailand but also in other countries, to seize control of tomorrow’s market. A greatly designed market-driving innovation can make history, revolutionising an industry and enhancing both customer value and firm value, allowing more and/or faster growth in the broad economy.

As Steve Jobs (1984) put it in one of his well-known quotes:

*We’re gambling on our vision, and we would rather do that than make ‘me, too’ products. Let some other companies do that. For us, it’s always the next dream*

Apple product event for the first Macintosh computer, Steve Jobs, 1984



## REFERENCES

- Aage, T. (2003a). *Absorptive capabilities in industrial districts: The role of knowledge creation and learning and boundary spanning mechanisms*, DRUID, Copenhagen.
- Aage, T. (2003b). *Absorptive capacity of industrial districts*, DRUID, Copenhagen.
- Aaker, D. A. (1988). *Strategic Market Management (2nd Edition)*. New York: John Wiley & Sons, Inc.
- Aaker, D. A., Kumar, V., & Day, G. S. (2001). *Marketing Research (7th Edition)* John Wiley&Sons Inc. New York.
- Accenture Research. (2009, Nov 10). Companies Make Innovation a Priority for Growth in Aftermath of Downturn But Management Shortcomings Hinder Results, Accenture Research Finds. Retrieved 10 November, 2012, from [http://newsroom.accenture.com/article\\_display.cfm?article\\_id=4901](http://newsroom.accenture.com/article_display.cfm?article_id=4901)
- Acedo, F. J., Barroso, C., & Galan, J. L. (2006). The resource-based theory: dissemination and main trends. *Strategic Management Journal*, 27(7), 621-636.
- Acur, N., Kandemir, D., de Weerd-Nederhof, P. C., & Song, X. M. (2010). Exploring the impact of technological competence development on speed and NPD program performance. *Journal of Product Innovation Management*, 27, 915-929.
- Adler, J. H. (1965). *Absorptive capacity: The concept and its determinants*. Brookings Institution: Washington.
- Ahmad, S., Mallick, D. N., & Schroeder, R. G. (2013). New Product Development: Impact of Project Characteristics and Development Practices on Performance. *Journal of Product Innovation Management*, 30(2), 331-348.
- Ahuja, G., & Morris Lampert, C. (2001). Entrepreneurship in the large corporation: a longitudinal study of how established firms create breakthrough inventions. *Strategic Management Journal*, 22(6-7), 521-543.
- Albaum, G. (1997). The Likert scale revisited: An alternate version. *Journal of the Market Research Society*, 39(2), 331-348.
- Albers, S. (2009). PLS and Success Factor Studies in Marketing. In Esposito Vinzi, V., Chin, W. W., Henseler, J., & Wang, H. (Eds.), *Handbook of Partial Least Squares. Concepts, Methods, and Applications in Marketing and Related Areas*: Springer Handbooks of Computational Statistics.
- Allinson, W. C., Chell, E., & Hayes, J. (2000). Intuition and Entrepreneurial Behaviour. *European Journal of work and Organizational Psychology*, 9(1), 31-43.
- Alves, J., Marques, M. J., Saur, I., & Marques, P. (2007). Creativity and Innovation through multidisciplinary and multisectoral cooperation. *Creativity and Innovation Management*, 16(1), 27-34.
- American Productivity & Quality Center. (2003). *Improving New Product Development Performance and Practices*. Houston (TX): APQC ([www.apqc.org/pubs/NPD2003](http://www.apqc.org/pubs/NPD2003)).
- Amit, R., & Schoemaker, P. J. H. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, 14(1), 33-46.
- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological bulletin*, 103(3), 411-423.
- Anderson, J. C., Gerbing, D. W., & Hunter, J. E. (1987). On the Assessment of Unidimensional Measurement: Internal and External Consistency, and Overall Consistency Criteria. *Journal of Marketing Research*, 24(4), 432-437.
- Andrew, J., Manget, J., Michael, D. C., Taylor, A., & Zablith, H. (2010). *Innovation 2010. A Return to prominence - and the Emergence of a New World Order*. Retrieved 15 July, 2011, from <http://www.bcg.com/documents/file42620.pdf>

- Andrews, D., Nonnecke, B., & Preece, J. (2003). Electronic survey methodology: A case study in reaching hard-to-involve Internet users. *International Journal of Human-Computer Interaction, 16*(2), 185-210.
- Andries, P., & Faems, D. (2013). Patenting Activities and Firm Performance: Does Firm Size Matter? *Journal of Product Innovation Management, 30*(6), 1089-1098.
- Andriopoulos, C., & Lewis, M. W. (2009). Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation. *Organization Science, 20*(4), 696-717.
- Arbuckle, J. L., & Wothke, W. (1999). *AMOS 4.0 user's guide*. Chicago: SPSS.
- Armstrong, J. S., & Overton, T. S. (1977). Estimating Nonresponse Bias in Mail Surveys. *Journal of Marketing Research, 14*(3), 396-402.
- Atuahene-Gima, K. (2005). Resolving the Capability-Rigidity Paradox in New Product Innovation. *Journal of Marketing, 69*, 61-83.
- Atuahene-Gima, K., & Ko, A. (2001). An Empirical Investigation of the Effect of Market Orientation and Entrepreneurship. *Organizational Science, 12*(1), 54-74.
- Atuahene-Gima, K., Slater, S. F., & Olson, E. M. (2005). The Contingent Value of Responsive and Proactive Market Orientations for New Product Program Performance\*. *Journal of Product Innovation Management, 22*(6), 464-482.
- Audretsch, D. B., & Acs, Z. J. (1991). Innovation and Size at the Firm Level. *Southern Economic Journal, 57*(3), 739-744.
- Autio, E., Sapienza, H. J., & Almeida, J. G. (2000). Effects of age at entry, knowledge intensity, and imitability on international growth. *Academy of Management Journal, 43*(5), 909-924.
- Backman, M., Borjesson, S., & Setterberg, S. (2007). Working with concepts in the fuzzy front end: exploring the context for innovation for different types of concepts at Volvo Cars. *R&D Management, 37*(1), 17-28.
- Baer, M., Oldham, G. R., & Cummings, A. (2003). Rewarding creativity: when does it really matter? *The Leadership Quarterly, 14*(4-5), 569-586.
- Bagozzi, R. P. (1979). The role of measurement in theory construction and hypothesis testing: toward a holistic model. In O. C. Ferrell, S. W. Brown, C. W. Lamb (Eds.), *Conceptual and theoretical developments in marketing* (pp. 15-32). Chicago: American Marketing Association.
- Bagozzi, R. P. (1980). *Causal Models in Marketing*. New York: John Wiley.
- Bagozzi, R. P. (1981). Attitudes, intentions, and behavior: A test of some key hypotheses. *Journal of personality and social psychology, 41*(4), 607.
- Bagozzi, R. P. (1984). A Prospectus for Theory Construction in Marketing. *Journal of Marketing, 48*(1), 11-29.
- Bagozzi, R. P., & Baumgartner, H. (1994). The evaluation of structural equation models and hypothesis testing. In R. P. Bagozzi (Ed.), *Principles of marketing research* (pp. 386-422). Cambridge: Blackwell.
- Bagozzi, R. P., & Phillips, L. W. (1982). Representing and Testing Organizational Theories: A Holistic Construal. *Administrative Science Quarterly, 27*(3), 459-489.
- Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the academy of marketing science, 16*(1), 74-94.
- Bagozzi, R. P., Yi, Y., & Singh, S. (1991). On the use of structural equation models in experimental designs: Two extensions. *International Journal of Research in Marketing, 8*(2), 125-140.

- Bakar, L. J. A., & Ahmad, H. (2010). Assessing the relationship between firm resources and product innovation performance: A resource-based view. *Business Process Management Journal*, 16(3), 420-435.
- Baker, W. E., & Sinkula, J. M. (1999). Learning Orientation, Market Orientation and Innovation: Integration and Extending Models of Organizational Performance. *Journal of Market Focused Management*, 4, 295-308.
- Baker, W. E., & Sinkula, J. M. (2002). Market Orientation, Learning Orientation and Product Innovation: Delving into the Organization's Black Box. *Journal of Market-Focused Management*, 5(1), 5-23.
- Bao, Y., Chen, X., & Zhou, K. Z. (2012). External learning, market dynamics, and radical innovation: Evidence from China's high-tech firms. *Journal of Business Research*, 65(8), 1226-1233.
- Barclay, D., Higgins, C., & Thompson, R. (1995). The partial least squares (PLS) approach to causal modeling: Personal computer adoption and use as an illustration. *Technology studies*, 2(2), 285-309.
- Barczak, G., Griffin, A., & Kahn, K. B. (2009). PERSPECTIVE: Trends and Drivers of Success in NPD Practices: Results of the 2003 PDMA Best Practices Study\*. *Journal of Product Innovation Management*, 26(1), 3-23.
- Barczak, G., & Kahn, K. B. (2012). Identifying new product development best practice. *Business Horizons*, 55(3), 293-305.
- Barney, J. B. (1986). Strategic factor markets: Expectations, luck, and business strategy. *Management Science*, 32(10), 1231-1241.
- Barney, J. B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99-120.
- Baron, R. A. (1998). Cognitive mechanisms in entrepreneurship: Why and when entrepreneurs think differently than other people. *Journal of Business Venturing*, 13(4), 275-294.
- Bartl, M., Füller, J., Mühlbacher, H., & Ernst, H. (2012). A Manager's Perspective on Virtual Customer Integration for New Product Development. *Journal of Product Innovation Management*, 29(6), 1031-1046.
- Bass, F. M. (1969). A new-product growth model for consumer durables. *Management Science*, 1, 215-227.
- Baumgartner, H., & Homburg, C. (1996). Applications of structural equation modeling in marketing and consumer research: A review. *International Journal of Research in Marketing*, 13(2), 139-161.
- Belderbos, R., Carree, M., Diederer, B., Lokshin, B., & Veugelers, R. (2004). Heterogeneity in R&D cooperation strategies. *International Journal of Industrial Organization*, 22(8-9), 1237-1263.
- Bell, S. S., Holbrook, M. B., & Solomon, M. R. (1991). Combining esthetic and social value to explain preferences for product styles with the incorporation of personality and ensemble effects. *Journal of Social Behavior & Personality*.
- Ben, L. K., & Cruz, A. P. (2009). *Intuition: an often overlooked component in organizational decision-making*, 16(1). Paper presented at the ASBBS Annual Conference: Las Vegas.
- Benner, M. J., & Tushman, M. L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review*, 28(2), 238-256.
- Berchicci, L., & Tucci, C. L. (2010). There Is More to Market Learning than Gathering Good Information: The Role of Shared Team Values in Radical Product Definition\*. *Journal of Product Innovation Management*, 27(7), 972-990.

- Bertels, H. M. J., Kleinschmidt, E. J., & Koen, P. (2011). Communities of Practice versus Organizational Climate: Which One Matters More to Dispersed Collaboration in the Front End of Innovation?\*. *Journal of Product Innovation Management*, 28(5), 757-772.
- Bertrand, O., & Mol, M. J. (2013). The antecedents and innovation effects of domestic and offshore R&D outsourcing: The contingent impact of cognitive distance and absorptive capacity. *Strategic Management Journal*, 34(6), 751-760.
- Bessant, J., Birkinshaw, J., & Delbridge, R. (2004). Innovation as Unusual. *Business Strategy Review*, 15(3), 32-35.
- Bessant, J., Von Stamm, B., Moeslein, K. M., & Neyer, A. K. (2010). Backing outsiders: selection strategies for discontinuous innovation. *R&D Management*, 40(4), 345-356.
- Beverland, M., Ewing, M. T., & Matanda, M. J. (2006). Driving-market or Market-driven? A Case Study Analysis of the New Product Development Practices of Chinese Business-to-Business Firms. *Industrial Marketing Management*, 35, 383-393.
- Bhaskar, R. (1989). *Reclaiming reality: A critical introduction to contemporary philosophy*. London: Verso.
- Biazzo, S. (2009). Flexibility, Structuration, and Simultaneity in New Product Development. *Journal of Product Innovation Management*, 26(3), 336-353.
- Bisman, J. E. (Writer). (2002). The critical realist paradigm as an approach to research in accounting, *In poster presentation at the Accounting Association of Australian and New Zealand Annual Conference, Perth, Australia, July*.
- BITEC. (2012). TechnoMart InnoMart 2012 Year's Biggest technology and innovation Event Kicks off! Retrieved 25 October, 2012, from <http://www.bitec.co.th/index.php/113000219/content/detail/en>
- Bogers, M., Afuah, A., & Bastian, B. (2010). Users as Innovators: A Review, Critique and Future Research Directions. *Journal of Management*, February, 1-19.
- Bohrstedt, G. W. (1970). Reliability and validity assessment in attitude measurement. In G. F. Summers (Ed.), *Attitude measurement* (pp. 80-99). London: Rand McNally.
- Bollen, K., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological bulletin*, 110(2), 305.
- Bonner, J. M., Ruekert, R. W., & Walker, O. C. (2002). Upper management control of new product development projects and project performance. *Journal of Product Innovation Management*, 19(3), 233-245.
- Boomsma, A., & Hoogland, J. J. (2001). The Robustness of LISREL Modeling Revisited. In R. Cudeck, K. G. Joreskog & S. H. du Toit (Eds.), *Structural Equation Modeling: Present and Future* (pp. 139-168). Chicago: Scientific Software International.
- Bower, J. L. (1970). *Managing the resource allocation process: A study of corporate planning and investment*. Boston, MA: Harvard Business School Press.
- Brace, I. (2004). *Questionnaire design: how to plan, structure, and write survey material for effective market research* (Vol. 1). London: Kogan Page.
- Brem, A., & Voigt, K.-I. (2009). Integration of market pull and technology push in the corporate front end and innovation management—Insights from the German software industry. *Technovation*, 29(5), 351-367.
- Brimble, P. (2006). Specific Approaches to University-Industry Links of Selected Companies in Thailand and Their Relative Effectiveness. In S. Yusuf & K. Nabeshima (Eds.), *How Universities Promote Economic Growth* (pp. 265-273): World Bank
- Broring, S., Cloutier, L. M., & Leker, J. (2006). The front end of innovation in an era of industry convergence: evidence from nutraceuticals and functional foods. *R&D Management*, 36(5), 487-498.

- Brown, S. L., & Eisenhardt, K. M. (1995). Product Development: Past Research, Present Findings, and Future Directions. *The Academy of Management Review*, 20(2), 343-378.
- Brown, S. L., & Eisenhardt, K. M. (1997). The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*, 42(1), 1-34.
- Burgelman, R. A., & Sayles, L. R. (1986). *Inside corporate innovation: Strategy, structure and managerial skills*. New York: The Free Press.
- Burns, A. C., & Bush, R. F. (2008). Marketing Research & SPSS 13.0 Student CD Pkg. Value Package (includes Qualtrics Access).
- Burns, A. C., & Bush, R. F. (2009). *Marketing Research: Global Edition (6th Edition)*. One Lake Street, Upper Saddle River, New Jersey: Pearson Education Inc., Prentice Hall.
- Büschgens, T., Bausch, A., & Balkin, D. B. (2013). Organizational Culture and Innovation: A Meta-Analytic Review. *Journal of Product Innovation Management*, 30(4), 763-781.
- Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming (2nd Edition)*. New York, NY: Routledge.
- Calantone, R. J., Chan, K., & Cui, A. S. (2006). Decomposing Product Innovativeness and Its Effects on New Product Success. *Journal of Product Innovation Management*, 23(5), 408-421.
- Calantone, R. J., Garcia, R., & Droge, C. (2003). The Effects of Environmental Turbulence on New Product Development Strategy Planning. *Journal of Product Innovation Management*, 20(2), 90-103.
- Calantone, R. J., Schmidt, J. B., & di Benedetto, A. (1997). New Product Activities and Performance: The Moderating Role of Environmental Hostility. *Journal of Product Innovation Management*, 14(3), 179-189.
- Callahan, J., & Lasry, E. (2004). The Importance of Customer Input in the Development of Very New Products. *R&D Management*, 34(2), 107-120.
- Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2), 81-105.
- Caniëls, M. C. J., & Bakens, R. J. J. M. (2012). The effects of Project Management Information Systems on decision making in a multi project environment. *International Journal of Project Management*, 30(2), 162-175.
- Cankurtaran, P., Langerak, F., & Griffin, A. (2013). Consequences of New Product Development Speed: A Meta-Analysis. *Journal of Product Innovation Management*, 30(3), 465-486.
- Cantner, U., & Pyka, A. (1998). Absorbing technological spillovers: simulations in an evolutionary framework. *Industrial and Corporate Change*, 7(2), 369-397.
- Carmines, E. G., & Zeller, R. A. (1979). *Reliability and Validity Assessment*. Beverly Hills, CA: Sage.
- Carrillat, F. A., Jaramillo, F., & Locander, W. B. (2004). Market-Driving Organizations: A Framework. *Academy of Marketing Science Review*, 2004(5), 1-14.
- Cavusgil, S. T., & Zou, S. (1994). Marketing Strategy-Performance Relationship: An Investigation of the Empirical Link in Export Market Ventures. *Journal of Marketing*, 58(1), 1-21.
- Chan, V., Musso, C., & Shankar, V. (2008). McKinsey global survey results: Assessing innovation metrics. Retrieved 16 November, 2010, from [https://www.mckinseyquarterly.com/McKinsey\\_Global\\_Survey\\_Results\\_Assessing\\_innovation\\_metrics\\_2243](https://www.mckinseyquarterly.com/McKinsey_Global_Survey_Results_Assessing_innovation_metrics_2243)

- Chandy, R. K., & Tellis, G. J. (1998). Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize. *Journal of Marketing Research*(November), 474-487.
- Chandy, R. K., & Tellis, G. J. (2000). The Incumbent's Curse? Incumbency, Size, and Radical Product Innovation. *The Journal of Marketing*, 64, 1-17.
- Charnsripinyo, C. (2008). *Measuring the Internet (User) Growth in Thailand*. Paper presented at the AINTEC2008, Pullman Bangkok King Power, Bangkok, Thailand.
- Chaveerug, A., & Ussahawanitchakit, P. (2008). Learning Orientation, Innovation Capability, and Organizational Performance in Thai Audit Firms: Moderating Effects of Organization Climate and Uncertainty Environment. *Review of Business Research*, 8(2), 92-102.
- Chen, J., Damanpour, F., & Reilly, R. R. (2010). Understanding antecedents of new product development speed: A meta-analysis. *Journal of Operations Management*, 28(1), 17-33.
- Chen, J., Guo, Y., & Zhu, H. (2012). Can me-too products prevail? Performance of new product development and sources of idea generation in China – an emerging market. *R&D Management*, 42(3), 273-288.
- Chen, J., Reilly, R. R., & Lynn, G. S. (2005). The impacts of speed-to-market on new product success: the moderating effects of uncertainty. *Engineering Management Journal*, 52(2), 199-212.
- Chen, Y.-S., Lin, M.-J. J., & Chang, C.-H. (2009). The positive effects of relationship learning and absorptive capacity on innovation performance and competitive advantage in industrial markets. *Industrial Marketing Management*, 38, 152-158.
- Chesbrough, H. W., & Appleyard, M. M. (2007). Open innovation and strategy. *California Management Review*, 50(1), 57-76.
- Chin, W. W. (1998). *The Partial Least Squares Approach for Structural Equation Modelling*. In G.A. Marcoulides (Ed), *Modern Methods for Business Research* (pp. 295-336): Lawrence Erlbaum, Philadelphia.
- Chin, W. W. (2010). Bootstrap Cross-Validation Indices for PLS Path Model Assessment. In V. Esposito Vinzi, W. W. Chin, J. Henseler & H. Wang (Eds.), *Handbook of Partial Least Squares* (pp. 83-97): Springer Berlin Heidelberg.
- Chin, W. W., Marcolin, B., & Newsted, P. (2003). A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/Adoption Study. *Information Systems Research*, 14(2), 189-217.
- Chin, W. W., & Newsted, P. R. (1999). *Structural equation modeling analysis with small samples using partial least squares*. In: Hoyle, R.H. (Ed.), *Statistical Strategies for Small Sample Research*: SAGE, Thousand Oaks, CA, 307-341.
- Chiva, R., & Alegre, J. (2009). Investment in Design and Firm Performance: The Mediating Role of Design Management\*. *Journal of Product Innovation Management*, 26(4), 424-440.
- Cho, D. S., Kim, D. J., & Rhee, D. K. (1998). Latecomer Strategies: Evidence from the Semiconductor Industry in Japan and Korea. *Organization Science*, 9(4), 489-505.
- Cho, H.-J., & Pucik, V. (2005). Relationship between innovativeness, quality, growth, profitability, and market value. *Strategic Management Journal*, 26(6), 555-575.
- Christensen, C. M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Boston, Mass.: Harvard Business School Press.
- Christensen, C. M., & Bower, J. L. (1996). Customer Power, Strategic Investment, and the Failure of Leading Firms. *Strategic Management Journal*, 17(3), 197-218.

- Christensen, C. M., & Overdorf, M. (2000). Meeting the Challenge of Disruptive Change. *Harvard Business Review*, 78(2), 66-77.
- Churchill, G. A. (1979). A Paradigm for Developing Better Measures of Marketing Constructs. *Journal of Marketing Research*, 16(1), 64-73.
- Churchill, G. A. (1991). *Marketing research methodological foundations* (5th Edition) Chicago, Dryden.
- Churchill, G. A. (1995). *Marketing research: Methodology foundation* (6th Edition). Chicago, IL: Dryden Press.
- Churchill, G. A. (1999). *Marketing Research: Methodological foundation* (7th Edition). USA, Dryden Press.
- Churchill, G. A., & Iacobucci, D. (2005). *Marketing Research: Methodological Foundations* (9th Edition): Mason, Ohio: Thomson South-Western.
- Clark, K. B., & Fujimoto, T. (1990). The Power of Product Integrity. *Harvard Business Review*, 68(6), 107-116.
- Clark, K. B., & Fujimoto, T. (1991). *Product Development Performance: Strategy, Organization, and Management in the World Auto Industry*. Boston: Harvard Business School Press.
- Cobanoglu, C., Warde, B., & Moreo, P. J. (2001). A comparison of mail, fax and web-based survey methods. *International journal of market research*, 43(4), 441-452.
- Cohen, W. M. (1995). Empirical Studies of Innovative Activity, in Stoneman, P (ed.): *Handbook of the Economics of Innovation and Technological Change*. Oxford: Blackwell.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128-152.
- Collins, J. C., & Porras, J. I. (1991). Organizational vision and visionary organizations *California Management Review*, 34(1), 30-52.
- Collis, D. J., & Montgomery, C. A. (1995). Competing on Resources: How do you create and sustain a profitable strategy? *Harvard Business Review*, 73(4), 118-128.
- Conner, K. (1991). A Historical Comparison of Resource-Based Theory and Five Schools of Thought Within Industrial Organization Economics: Do We Have a New Theory of the Firm? *Journal of Management*, 17(1), 121-154.
- Connole, H., Smith, R. J., & Wiseman, R. (1995). *Research methodology 1: Issues and methods in research. Study guide*: Deakin University.
- Cooper, R. G. (1984). New product strategies: What distinguishes the top performers? *Journal of Product Innovation Management*, 2, 151-164.
- Cooper, R. G. (1988). Predevelopment activities determine new product success. *Industrial Marketing Management*, 17(3), 237-247.
- Cooper, R. G. (1990a). New products - What distinguishes the winners. *Research - Technology Management*, 33(6), 27-31.
- Cooper, R. G. (1990b). Stage-gate systems: a new tool for managing new products. *Business Horizons*, 33(3), 44-54.
- Cooper, R. G. (1993). *Winning at New Products: Accelerating the Process from Idea to Launch* (2nd Edition): Addison-Wesley, Reading, MA.
- Cooper, R. G. (1994). New Products: The Factors that Drive Success. *International Marketing Review*, 11(1), 60-76.
- Cooper, R. G. (1996). Overhauling the new product process. *Industrial Marketing Management*, 25(6), 465-482.
- Cooper, R. G. (1997). Fixing the fuzzy front end of the new product process: building the business case. *CMA magazine*, 71(8), 21-23.

- Cooper, R. G. (1998). Benchmarking new product performance: Results of the best practices study. *European Management Journal*, 16(1), 1-17.
- Cooper, R. G. (1999). The Invisible Success Factors in Product Innovation. *Journal of Product Innovation Management*, 16(2), 115-133.
- Cooper, R. G. (2001). *Winning at New Products, Accelerating the Process from Idea to Launch (3rd Edition)*. Cambridge: Perseus Publishing.
- Cooper, R. G. (2008). Perspective: The Stage-Gate® Idea-to Launch Process—Update, What's New, and NexGen Systems\*. *Journal of Product Innovation Management*, 25, 213-232.
- Cooper, R. G. (2011). Perspective: The Innovation Dilemma: How to Innovate When the Market Is Mature. *Journal of Product Innovation Management*, 28(1), 2-27.
- Cooper, R. G., & de Brentani, U. (1991). New industrial financial services: What distinguishes the winners. *Journal of Product Innovation Management*, 8(2), 75-90.
- Cooper, R. G., & Edgett, S. J. (2006). Stage-Gate and the Critical Success Factors for New Product Development. Retrieved 05 May 2009, from BPTrends; Product Development Institute
- Cooper, R. G., & Edgett, S. J. (2007). *Generating Breakthrough New Product Ideas: Feeding the Innovation Funnel*. Ancaster, Ontario, Canada: Product Development Institute.
- Cooper, R. G., & Edgett, S. J. (2008). Maximizing Productivity in Product Innovation. *Research Technology Management*, 51(2), 47-58.
- Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2001). *Portfolio Management for New Products, 3rd Edition*: Perseus Books, Reading.
- Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2002a). Optimizing the Stage-Gate Process: What Best Practice Companies are Doing - Part One. *Research Technology Management*, 45(5), 1-14.
- Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2002b). Optimizing the Stage-Gate Process: What Best Practice Companies are Doing - Part Two. *Research Technology Management*, 45(5), 1-11.
- Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2002c). Portfolio management: fundamental to new product success. In Belliveau, P., Griffin, A., and Somermeyer, S. (Eds.), *The PDMA Toolbook for New Product Development* (pp. 331-364): John Wiley & Sons, Inc., New York.
- Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2003). Best practices in product innovation: What distinguishes top performers. *Product Development Institute, Inc.*
- Cooper, R. G., & Kleinschmidt, E. J. (1986). An Investigation into the New Product Process: Steps, Deficiencies, and Impact. *Journal of Product Innovation Management*, 3, 71-85.
- Cooper, R. G., & Kleinschmidt, E. J. (1987a). New products: What separates winners from losers? *Journal of Product Innovation Management*, 4(3), 169-184.
- Cooper, R. G., & Kleinschmidt, E. J. (1987b). Success factors in product innovation. *Industrial Marketing Management*, 16(3), 215-223.
- Cooper, R. G., & Kleinschmidt, E. J. (1987c). What makes a new product a winner: Success factors at the project level. *R&D Management*, 17(3), 175-189.
- Cooper, R. G., & Kleinschmidt, E. J. (1993). Major new products: What distinguishes the winners in the chemical industry? *Journal of Product Innovation Management*, 10(2), 90-111.
- Cooper, R. G., & Kleinschmidt, E. J. (1994a). Determinants of timeliness in product development. *Journal of Product Innovation Management*, 11(5), 381-396.



- Cooper, R. G., & Kleinschmidt, E. J. (1994b). Screening new products for potential winners. *IEEE Transactions on Engineering Management Journal*, 22(4), 24-30.
- Cooper, R. G., & Kleinschmidt, E. J. (1995a). Benchmarking the Firm's Critical Success Factors in New Product Development. *Journal of Product Innovation Management*, 12, 374-391.
- Cooper, R. G., & Kleinschmidt, E. J. (1995b). New Product performance: keys to success, profitability and cycle time reduction. *Journal of Marketing Management*, 11, 315-337.
- Cooper, R. G., & Kleinschmidt, E. J. (1995c). Performance typologies of new product projects. *Industrial Marketing Management*, 24(5), 439-456.
- Cooper, R. G., & Kleinschmidt, E. J. (1996). Winning businesses in product development: the critical success factors. *Research Technology Management*, 39(4), 18-29.
- Cooper, R. G., & Kleinschmidt, E. J. (2000). New Product Performance: What Distinguishes the Star Products. *Australian Journal of Management (University of New South Wales)*, 25(1), 17.
- Cooper, R. G., & Kleinschmidt, E. J. (2010). Success Factors for New Product Development *Wiley International Encyclopedia of Marketing: John Wiley & Sons, Ltd.*
- Cordero, R. (1990). The measurement of innovation performance in the firm: An overview. *Research Policy*, 19(2), 185-192.
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of applied psychology*, 78(1), 98-104.
- Couper, M. P. (2008). *Designing effective Web surveys*. New York: Cambridge University Press.
- Cousins, P. D., Lawson, B., Petersen, K. J., & Handfield, R. B. (2011). Breakthrough Scanning, Supplier Knowledge Exchange, and New Product Development Performance. *Journal of Product Innovation Management*, 28(6), 930-942.
- Craig, A., & Hart, S. (1992). Where to Now in New Product Development Research? *European Journal of Marketing*, 26(11), 2-49.
- Crawford, M. C. (1980). Defining the charter for product innovation. *Sloan management review*, 22(1), 3-12.
- Crawford, M. C. (1992). The hidden costs of accelerated product development. *Journal of Product Innovation Management*, 9(3), 188-199.
- Crawford, M. C. (1994). *New Product Management, (4th Edition)*. Boston: Richard D. Irwin, Inc.
- Crawford, M. C., & di Benedetto, A. (2000). *New Products Management*. Boston: McGraw-Hill.
- Crawford, M. C., & di Benedetto, A. (2003). *New Products Management, (7th Edition)*. New York: McGraw Hill/ Irwin.
- Creswell, J. W. (1994). *Research design: Sage publications Thousand Oaks, CA.*
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.
- Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological bulletin*, 52(4), 281-302.
- Cunha, M. P. E. (2007). Entrepreneurship as decision making: rational, intuitive and improvisational approaches. *Journal of Enterprising Culture*, 15(1), 1-20.
- D'Aveni, R. A. (1994). HyperCompetition. Managing the Dynamics of Strategic Maneuvering (pp. 83-93). New York: The Free Press.

- D'Aveni, R. A., Canger, J. M., & Doyle, J. J. (1995). Coping with Hypercompetition: Utilizing the New 7S's Framework [and Executive Commentary]. *The Academy of Management Executive*, 9(3), 45-60.
- Da Silva, N., & Davis, A. R. (2011). Absorptive capacity at the individual level: linking creativity to innovation in academia. *The review of higher education* 34(3), 355-379.
- Daghfous, A. (2004). Absorptive capacity and the implementation of knowledge-intensive best practices. *SAM Advanced Management Journal*, 69(2), 21-27.
- Damanpour, F. (1991). Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators. *The Academy of Management Journal*, 34(3), 555-591.
- Dane, E., & Pratt, M. G. (2007). Exploring intuition and its role in managerial decision making. *Academy of Management Review*, 32(1), 33-54.
- Danneels, E. (2002). The dynamics of product innovation and firm competences. *Strategic Management Journal*, 23(12), 1095-1121.
- Danneels, E., & Kleinschmidt, E. J. (2001). Product innovativeness from the firm's perspective: its dimensions and their relation with project selection and performance. *Journal of Product Innovation Management*, 18(6), 357-373.
- Davenport, T. H. (1993). *Process innovation: reengineering work through information technology*. Boston, MA: Ernst & Young Center for Information & Strategy, Harvard Business School Press.
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319-340.
- Dawes, J. (2008). Do data characteristics change according to the number of scale points used? An experiment using 5 point, 7 point and 10 point scales. *International Journal of Market Research*, 51(1).
- Day, G. S. (1993). *The Capabilities of Market-Driven Organizations*. Cambridge, MA: Marketing Science Institute Report.
- Day, G. S. (1994). *The Capabilities of Market-Driven Organizations*. *the Journal of Marketing*, 58(4), 37-52.
- Day, G. S. (1998). What Does it Mean to be Market-Driven? *Business Strategy Review*, 9(1), 1-14.
- Dayan, M., & Elbanna, S. (2011). Antecedents of Team Intuition and Its Impact on the Success of New Product Development Projects. *Journal of Product Innovation Management*, 28(1), 159-174.
- de Brentani, U. (1989). Success and failure in new industrial services. *Journal of Product Innovation Management*, 6(4), 239-258.
- de Brentani, U. (2001). Innovative versus incremental new business services: Different keys for achieving success. *Journal of Product Innovation Management*, 18, 169-187.
- de Brentani, U., & Kleinschmidt, E. J. (2004). Corporate Culture and Commitment: Impact on Performance of International New Product Development Programs. *Journal of Product Innovation Management*, 21(5), 309-333.
- de Brentani, U., Kleinschmidt, E. J., & Salomo, S. (2010). Success in Global New Product Development: Impact of Strategy and the Behavioral Environment of the Firm. *Journal of Product Innovation Management*, 27(2), 143-160.
- de Brentani, U., & Reid, S. E. (2012). The Fuzzy Front-End of Discontinuous Innovation: Insights for Research and Management. *Journal of Product Innovation Management*, 29(1), 70-87.
- De Clercq, D., Thongpapanl, N., & Dimov, D. (2011). A Closer Look at Cross-Functional Collaboration and Product Innovativeness: Contingency Effects of Structural and Relational Context. *Journal of Product Innovation Management*, 28(5), 680-697.

- de Vaus, D. A. (1985). *Surveys in Social research*: London: UCL Press Ltd.
- de Vaus, D. A. (1995). *Surveys in Social research* (4th Edition). Sydney, Allen and Unwin.
- De Vellis, R. F. (1991). *Scale development: Theory and applications*. Newbury Park, CA: Sage.
- Deighton, J. A., Rizley, R., & Keane, S. (2012). Research Priorities of the Marketing Science Institute. *Marketing Science* 31(6), 873-877.
- Denzin, N. K., & Lincoln, Y. S. (1994). *Handbook of qualitative research*, Thousands Oaks: Sage Publications.
- Department of Commerce. (2013). *Doing Business in Thailand, 2013 Country Commercial Guide for U.S. Companies*. from U.S. & FOREIGN COMMERCIAL SERVICE AND U.S. DEPARTMENT OF STATE
- Deshpandé, R., Farley, J. U., & Webster, F. E., Jr. (1993). Corporate Culture, Customer Orientation, and Innovativeness in Japanese Firms: A Quadrad Analysis. *Journal of Marketing*, 57(1), 23-37.
- Deszca, G., Munro, H., & Noori, H. (1999). Developing Breakthrough Products: Challenges and Options for Market Assessment. *Journal of Operations Management*, 17, 613-630.
- Dhamvithee, P., Shankar, B., Jangchud, A., & Wuttijumnong, P. (2005). New product development in Thai agro-industry: explaining the rates of innovation and success in innovation. *International Food and Agribusiness Management Review*, 8(3), 1-20.
- di Benedetto, A., DeSarbo, W. S., & Song, X. M. (2008). Strategic capabilities and radical innovation: An empirical study in three countries. *Engineering Management, IEEE Transactions on*, 55(3), 420-433.
- Diamantopoulos, A., Riefler, P., & Roth, K. P. (2008). Advancing formative measurement models. *Journal of Business Research*, 61(12), 1203-1218.
- Diamantopoulos, A., & Siguaw, J. A. (2006). Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration. *British Journal of Management*, 17(4), 263-282.
- Diamantopoulos, A., & Winklhofer, H. M. (2001). Index Construction with Formative Indicators: An Alternative to Scale Development. *Journal of Marketing Research*, 38(2), 269-277.
- Diefenbach, M. A., Weinstein, N. D., & O'Reilly, J. (1993). Scales for assessing perceptions of health hazard susceptibility. *Health Education Research*, 8(2), 181-192.
- Dillman, D. A. (1998). Mail and other self-administered surveys in the 21st century: The beginning of a new era. *The Gallup Research Journal*, 2(1), 121-140.
- Dillman, D. A. (2000a). *Mail and internet surveys: The tailored design method* (Vol. 2). New York: John Wiley & Sons.
- Dillman, D. A. (2000b). *Mail and Internet surveys: The tailored design method*. New York: John Wiley & Sons, Inc.
- Dillon, W. R., Madden, T. J., & Firtle, N. H. (1990). *Marketing research in a market environment*. Boston, MA: Irwin.
- Dixon, R., & Turner, R. (2007). *Electronic vs. conventional surveys*. In R. A. Reynolds, R. Woods, & J. D. Baker (Eds.). *Handbook of research on electronic surveys and measurements*, pp. 104-111: Hershey, PA: Idea Group Reference.
- Dodgson, M., Gann, D., & Salter, A. (2005). *Think, Play, Do: Technology and Organization in the Emerging Innovation Process*: Oxford: Oxford University Press.
- Dougherty, D. (1995). Managing your core incompetencies for corporate venturing. *Entrepreneurship Theory and Practice*, 19, 113-136.

- Dougherty, D., & Heller, T. (1994). The Illegitimacy of Successful Product Innovation in Established Firms. *Organization Science*, 5(2), 200-218.
- Douglas, S. P., & Craig, C. S. (2007). Collaborative and Iterative Translation: An Alternative Approach to Back Translation. *Journal of International Marketing*, 15(1), 30-43.
- Doyle, P. (1994). Setting business objectives and measuring performance. *European Management Journal*, 12(2), 123-132.
- Dröge, C., Calantone, R. J., & Harmancioglu, N. (2008). New Product Success: Is It Really Controllable by Managers in Highly Turbulent Environments? *Journal of Product Innovation Management*, 25(3), 272-286.
- Dröge, C., Jayaram, J., & Vickery, S. K. (2000). The Ability to Minimize the Timing of New Product Development and Introduction: An Examination of Antecedent Factors in the North American Automobile Supplier Industry. *Journal of Product Innovation Management*, 17(1), 24-40.
- Dunford, B. B., Snell, S. A., & Wright, P. M. (2003). Human Resources and The Resource Based View of the Firm, School of Industrial and Labour Relations. *Center for Advanced of Human Resource Studies, Cornell University, Ithaca, NY*, 1-35.
- Dwyer, L., & Mellor, R. (1991a). New product process activities and project outcomes. *R&D Management*, 21(1), 31-42.
- Dwyer, L., & Mellor, R. (1991b). Organizational environment, new product process activities, and project outcomes. *Journal of Product Innovation Management*, 8(1), 39-48.
- Dyer, B., Gupta, A. K., & Wilemon, D. (1999a). How to be a first-to-market company. *Chemtech*, 29(6), 56-61.
- Dyer, B., Gupta, A. K., & Wilemon, D. (1999b). What first-to-market companies do differently. *Research-Technology Management*, 42(2), 15-21.
- Echambadi, R., & Hess, J. D. (2007). Mean-Centering Does Not Alleviate Collinearity Problems in Moderated Multiple Regression Models. *Marketing Science*, 26(3), 438-445.
- Edwards, J. R. (2001). Multidimensional constructs in organizational behavior research: An integrative analytical framework. *Organizational Research Methods*, 4(2), 144-192.
- Efron, B., & Tibshirani, R. J. (1993). *An introduction to the bootstrap*. New York: Chapman & Hall.
- Eisenberg, I. (2011). Lead-user research for breakthrough innovation. *Research-Technology Management*, 54(1), 50-58.
- Eisenhardt, K. M. (1999). Strategy as strategic decision making. *Sloan management review*, 40(3), 65-72.
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, 21, 1105-1121.
- Eling, K., Griffin, A., & Langerak, F. (2013). Using Intuition in Fuzzy Front-End Decision-Making: A Conceptual Framework. *Journal of Product Innovation Management*, 31(5), 1-17.
- Emory, C. W., & Cooper, D. R. (1991). *Business Research Methods*: Homewood, IL: Irwin.
- Escribano, A., Fosfuri, A., & Tribo, J. (2005). *Managing knowledge spillovers: the impact of absorptive capacity on innovation performance*, [http://www.fep.up.pt/conferences/earie2005/cd\\_rom/session%20v/v.m/escriban.pdf](http://www.fep.up.pt/conferences/earie2005/cd_rom/session%20v/v.m/escriban.pdf).
- Escribano, A., Fosfuri, A., & Tribó, J. A. (2009). Managing external knowledge flows: The moderating role of absorptive capacity. *Research Policy*, 38(1), 96-105.
- Ettlie, J. E., Bridges, W. P., & O'Keefe, R. D. (1984). Organization Strategy and Structural Differences for Radical Versus Incremental Innovation. *Management Science*, 30(6), 682-695.

- Ettlie, J. E., & Elsenbach, J. M. (2007). Modified Stage-Gate Regimes in New Product Development. *Journal of Product Innovation Management*, 24, 20-33.
- Evered, R., & Louis, M. R. (1991). Research perspectives. In N. Craig Smith & P. Dainty (Eds.), *The Management Research Book*. London: Routledge.
- Fang, E. (2008). Customer participation and the trade-off between new product innovativeness and speed to market. *Journal of Marketing*, 72(4), 90-104.
- Field, A. (2009). *Discovering Statistics Using SPSS, (3rd Edition)*. London, England: Sage Publications, Ltd.
- Fisher, R. J., Maltz, E., & Jaworski, B. J. (1997). Enhancing Communication between Marketing and Engineering: The Moderating Role of Relative Functional Identification. *Journal of Marketing*, 61(3), 54-70.
- Fiske, D. W. (1982). Convergent-Discriminant Validation in Measurements and Research Strategies. In Brinberg, D. & Kidder, L. H. (Eds.), *Forms of Validity in Research*, pp. 77-92. San Francisco, CA: Jossey-Bass.
- Flatten, T. C., Engelen, A., Zahra, S. A., & Brettel, M. (2011). A measure of absorptive capacity: scale development and validation. *European Management Journal*, 29, 98-116.
- Fleming, C. M., & Bowden, M. (2009). Web-based surveys as an alternative to traditional mail methods. *Journal of Environmental Management*, 90(1), 284-292.
- Fornell, C., & Bookstein, F. L. (1982). A comparative analysis of two structural equation models: LISREL and PLS applied to market data. In C. Fornell (Ed.), *A second generation of multivariate analysis (pp. 289-323)*. New York, Praeger.
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39-50.
- Foss, N. J., & Knudsen, T. (2003). The Resource-Based Tangle: Towards a Sustainable Explanation of Competitive Advantage. *Managerial and Decision Economics*, 24(4), 291-307.
- Fourt, L. A., & Woodlock, J. W. (1960). Early Prediction of Market Success for New Grocery Products. *Journal of Marketing*, 25(2), 31-38.
- Freeman, C. (1994). The Economics of Technical Change. *Cambridge Journal of Economics*, 18, 463-514.
- Garcia, R., & Calantone, R. J. (2002). A Critical Look at Technological Innovation Typology and Innovativeness Terminology: A Literature Review. *Journal of Product Innovation Management*, 19(2), 110-132.
- Garcia, R., Calantone, R. J., & Levine, R. (2003). The Role of Knowledge in Resource Allocation to Exploration versus Exploitation in Technologically Oriented Organizations\*. *Decision Sciences*, 34(2), 323-349.
- Garson, G. D. (2009). Structural equation modeling. *Statnotes: Topics in multivariate analysis*.
- Gatignon, H., & Xuereb, J.-M. (1997). Strategic Orientation of the Firm and New Product Performance. *Journal of Marketing Research*, 34(1), 77-90.
- Gellman Research Associates. (1982). The relationship between industrial concentration, firm size, and technological innovation, prepared for the Office of Advocacy, U.S. Small Business Administration under award no. SBA-2633-OA-79.
- Gendall, P., & Healey, B. (2008). Alternatives to prepaid monetary incentives in mail surveys. *International Journal of Public Opinion Research*, 20(4), 517-527.
- Gilbert, C. (2005). Unbundling the Structure of Inertia: Resource Versus Routine Rigidity. *Academy of Management Journal*, 48(5), 741-763.

- Giuliani, E., & Bell, M. (2005). The micro-determinants of meso-level learning and innovation: evidence from a Chilean wine cluster. *Research Policy*, 34(1), 47-68.
- Global Entrepreneurship Monitor. (2011). GEM Thailand - 2011 National Report. (Bangkok, Thailand).
- Globerman, S. (1975). Technological diffusion in the Canadian carpet industry. *Research Policy*, 4(2), 190-206.
- Goffin, K., & Koners, U. (2011). Tacit knowledge, lessons learnt, and new product development. *Journal of Product Innovation Management*, 28(2), 300-318.
- Goktan, A. B., & Miles, G. (2011). Innovation speed and radicalness: are they inversely related? *Management Decision*, 49(4), 533-547.
- Götz, O., Liehr-Gobbers, K., & Krafft, M. (2010). Evaluation of Structural Equation Models Using the Partial Least Squares (PLS) Approach. In: Vinzi, V E, Chin, W W, Henseler, Jet al (Eds) handbook of Partial Least Squares: Concepts, Methods and Applications, pp 691–711. Springer, Heidelberg.
- Government Public Relations Department. (2009). His Majesty King Bhumibol Adulyadej Presented with WIPO's Global Leaders Award. *THE MONARCHY*. Retrieved 16 June, 2010, from [http://thailand.prd.go.th/view\\_news.php?id=4042&a=1](http://thailand.prd.go.th/view_news.php?id=4042&a=1)
- Grant, R. M. (1991). The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation *California Management Review*, 33(3), 114-135.
- Green, P. E., Tull, D. S., & Albaum, G. (1988). Research for marketing decisions: Englewood Cliffs, NJ: Prentice Hall.
- Green, S. G., Gavin, M. B., & Aiman-Smith, L. (1995). Assessing a multidimensional measure of radical technological innovation. *Engineering Management, IEEE Transactions on*, 42(3), 203-214.
- Greenleaf, E. A. (1992). Improving rating scale measures by detecting and correcting bias components in some response styles. *Journal of Marketing Research*, 29(2), 176-188.
- Grewal, R., Cote, J. A., & Baumgartner, H. (2004). Multicollinearity and Measurement Error in Structural Equation Models: Implications for Theory Testing. *Marketing Science*, 23(4), 519-529.
- Griffin, A. (1993). Metrics for measuring product development cycle time. *Journal of Product Innovation Management*, 10(2), 112-125.
- Griffin, A. (1997a). Modeling and measuring product development cycle time across industries *Journal of Engineering and Technology Management*, 14, 1-24.
- Griffin, A. (1997b). PDMA Research on New Product Development Practices: Updating Trends and Benchmarking Best Practices. *Journal of Product Innovation Management*, 14, 429-458.
- Griffin, A., & Hauser, J. R. (1993). The Voice of the Customer. *Marketing Science*, 12(1), 1-27.
- Griffin, A., & Page, A. L. (1993). An Interim Report on Measuring Product Development Success and Failure. *Journal of Product Innovation Management*, 10(4), 291-308.
- Griffin, A., & Page, A. L. (1996). PDMA Success Measurement Project: Recommended Measures for Product Development Success and Failure. *Journal of Product Innovation Management*, 13(6), 478-496.
- Gronum, S., Verreynne, M.-L., & Kastle, T. (2012). The Role of Networks in Small and Medium-Sized Enterprise Innovation and Firm Performance. *Journal of Small Business Management*, 50(2), 257-282.
- Grunfeld, L. (2004). The multiple faces of R&D: Absorptive capacity effects and different sources of spillovers. *Norwegian Institute of International Affairs, Oslo*.

- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of qualitative research*, 2, 105-117.
- Guo, L. (2008). PERSPECTIVE: An Analysis of 22 Years of Research in JPIM\*. *Journal of Product Innovation Management*, 25(3), 249-260.
- Gupta, A. K., & Govindarajan, V. (2000). Knowledge flows within multinational corporations. *Strategic Management Journal*, 21(4), 473-496.
- Gupta, A. K., & Wilemon, D. (1990). Accelerating Development of Technology-Based New Products. *California Management Review*, 32(2), 24-44.
- Haenlein, M., & Kaplan, A. (2004). A Beginner's Guide to Partial Least Squares Analysis. *Understanding Statistics*, 3(4), 283-297.
- Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate Data Analysis with Readings (4th Edition)*. Englewood Cliffs, NJ: Prentice-Hall.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis (7 Edition)*: Prentice Hall.
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate Data Analysis (6th Edition)*: Upper Saddle River: Pearson.
- Hair, J. F., Lukas, B., Miller, K., Bush, R., & Ortinau, D. (2012a). *Marketing Research*. Australia: McGraw Hill
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *The Journal of Marketing Theory and Practice*, 19(2), 139-151.
- Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012b). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414-433.
- Hamel, G., & Prahalad, C. K. (1994a). *Competing for the Future*: Boston: MA, Harvard Business School Press.
- Hamel, G., & Prahalad, C. K. (1994b). Seeing the future first. *Fortune*, 130(September 5), 64-70.
- Hamel, G., & Prahalad, C. K. (2005). Strategic intent. *Harvard Business Review*, 83(7), 148-161.
- Hammedi, W., van Riel, A. C. R., & Sasovova, Z. (2011). Antecedents and Consequences of Reflexivity in New Product Idea Screening\*. *Journal of Product Innovation Management*, 28(5), 662-679.
- Han, J. K., Kim, N., & Srivastava, R. K. (1998). Market Orientation and Organizational Performance: Is Innovation a Missing Link? *Journal of Marketing*, 62, 30-45.
- Harmancioglu, N., Dröge, C., & Calantone, R. J. (2009). Theoretical lenses and domain definitions in innovation research. *European Journal of Marketing*, Vol. 43(1/2), 229 - 263.
- Hart, S., Hultink, E. J., Tzokas, N., & Commandeur, H. R. (2003). Industrial companies' evaluation criteria in new product development gates. *Journal of Product Innovation Management*, 20(1), 22-36.
- Harter, D. E., Krishnan, M. S., & Slaughter, S. A. (2000). Effects of Process Maturity on Quality, Cycle Time, and Effort in Software Product Development. *Management Science*, 46(4), 451-466.
- Harvey, G., Skelcher, C., Spencer, E., Jas, P., & Walshe, K. (2010). Absorptive Capacity in a non-market environment. *Public management review*, 12(1), 77-97.
- Hassenzahl, M. (2001). The Effect of Perceived Hedonic Quality on Product Appealingness. *International Journal of Human-Computer Interaction*, 13(4), 481-499.
- Hauser, J. R., Tellis, G. J., & Griffin, A. (2006). Research on Innovation: A Review and Agenda for Marketing Science. *Marketing Science*, 25(6), 687-717.

- Hayes, A. F. (2005). *Statistical methods for communication science*. NJ, Erlbaum: Mahwah.
- Hayes, A. F., & Matthes, J. (2009). Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behavior Research Methods*, 41(3), 924-936.
- Haynes, S. N., Richard, D. C. S., & Kubany, E. S. (1995). Content Validity in Psychological Assessment: A Functional Approach to Concepts and Methods. *American Psychological Association*, 7(3), 238-247.
- Healy, M., & Perry, C. (2000). Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm. *Qualitative Market Research: An International Journal*, 3(3), 118-126.
- Heeler, R. M., & Ray, M. L. (1972). Measure Validation in Marketing. *Journal of Marketing Research*, 9(4), 361-370.
- Heidt, T. V. D. (2008). Developing and testing a model of cooperative interorganisational relationships (IORs) in product innovation in an Australian manufacturing context: a multi-stakeholder perspective. *Southern Cross University, Lismore*.
- Hekkert, P., & van Dijk, M. B. (2011). *Vision in design: A guidebook for innovators*. Amsterdam: BIS publishers.
- Henard, D. H., & Szymanski, D. M. (2001). Why Some New Products Are More Successful Than Others. *Journal of Marketing Research*, 38(3), 362-375.
- Henseler, J., & Chin, W. W. (2010). A Comparison of Approaches for the Analysis of Interaction Effects between Latent Variables Using Partial Least Squares Path Modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 17(1), 82-109.
- Henseler, J., & Fassott, G. (2010). Testing Moderating Effects in PLS Path Models: An Illustration of Available Procedures. In V. Esposito Vinzi, W. W. Chin, J. Henseler & H. Wang (Eds.), *Handbook of Partial Least Squares: Concepts, Methods and Applications* (Vol. 2, pp. 713-735). Berlin Heidelberg: Springer Berlin Heidelberg.
- Henseler, J., Ringle, C. M., & Sinkovics, R. (2009). The use of partial least squares path modeling in international marketing. *Advances in International Marketing*(20), 277-319.
- Herrmann, A., Tomczak, T., & Befurt, R. (2006). Determinants of radical product innovations. *European Journal of Innovation Management*, 9(1), 20-43.
- Hildebrandt, F. (1998). Identification of a gene for nephronophthisis. *Nephrology Dialysis Transplantation*, 13(6), 1334-1336.
- Hill, C. W. L., & Rothaermel, F. T. (2003). The Performance of Incumbent firms in the face of Radical Technological Innovation. *Academy of Management Review*, 28(2), 257-274.
- Hill, N., & Alexander, J. (2006). *The Handbook of Customer Satisfaction and Loyalty Measurement*: Hampshire: Gower.
- Hills, S. B., & Sarin, S. (2003). From Market Driven to Market Driving: An Alternate Paradigm for Marketing in High Technology Industries. *Journal of Marketing Theory and Practice*, 11(3), 13-24.
- Hise, R. T., O'Neal, L., Parasuraman, A., & McNeal, J. U. (1990). Marketing/R&D interaction in new product development: Implications for new product success rates. *Journal of Product Innovation Management*, 7(2), 142-155.
- Hofstetter, R., Miller, K. M., Krohmer, H., & Zhang, Z. J. (2013). How Do Consumer Characteristics Affect the Bias in Measuring Willingness to Pay for Innovative Products? *Journal of Product Innovation Management*, 30(5), 1042-1053.
- Holahan, P. J., Sullivan, Z. Z., & Markham, S. K. (2014). Product Development as Core Competence: How Formal Product Development Practices Differ for Radical, More



- Innovative, and Incremental Product Innovations. *Journal of Product Innovation Management*, 31(2), 329-345.
- Holland, J., & Gentry, J. W. (1999). Ethnic consumer reaction to targeted marketing: A theory of intercultural accommodation. *Journal of Advertising*, 28(1), 65-77.
- Homburg, C., & Giering, A. (1996). Conceptualization and operationalization of complex constructs. *Marketing ZFP*, 18(1), 5-24.
- Hoskisson, R. E., Eden, L., Lau, C. M., & Wright, M. (2000). Strategy in emerging economies. *Academy of management journal*, 43(3), 249-267.
- Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 159-176): Thousand Oaks, CA: Sage.
- Huchzermeier, A., & Loch, C. H. (2001). Project Management Under Risk: Using the Real Options Approach to Evaluate Flexibility in R&D. *Management Science*, 47(1), 85-101.
- Hughes, G. D., & Chafin, D. C. (1996). Turning New Product Development into a Continuous Learning Process. *Journal of Product Innovation Management*, 13(2), 89-104.
- Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: a review of four recent studies. *Strategic Management Journal*, 20(2), 195-204.
- Hulland, J., Chow, Y. H., & Lam, S. (1996). Use of causal models in marketing research: A review. *International Journal of Research in Marketing*, 13(2), 181-197.
- Hultink, E. J., Griffin, A., Hart, S., & Robben, H. S. J. (1997). Industrial New Product Launch Strategies and Product Development Performance. *Journal of Product Innovation Management*, 14(4), 243-257.
- Hunt, S. D. (1991). *Modern Marketing Theory: Critical Issues in the Philosophy of Marketing Science and Research*. Cincinnati (Ohio): South-Western Publishing Co.
- Hunt, S. D. (1997). Competing through relationships: Grounding relationship marketing in resource-advantage theory. *Journal of Marketing Management*, 13(5), 431-445.
- Hurley, R. F., & Hult, G. T. M. (1998). Innovation, Market Orientation, and Organizational Learning: An Integration and Empirical Examination. *Journal of Marketing*, 62(3), 42-54.
- Hussey, J., & Hussey, R. (1997). *Business Research: A Practical Guide for Undergraduate and Postgraduate Students*. London: Macmillan Press
- Hyung-Jin Park, M., Lim, J. W., & Birnbaum-More, P. H. (2009). The Effect of Multiknowledge Individuals on Performance in Cross-Functional New Product Development Teams\*. *Journal of Product Innovation Management*, 26(1), 86-96.
- Iansiti, M. (1995). Shooting the rapids: managing product development in turbulent environments. *California Management Review*, 38, 37-58.
- Ilieva, J., Baron, S., & Healey, N. M. (2002). Online surveys in marketing research: pros and cons. *International Journal of Market Research*, 44(3), 361-376.
- Intarakumnerd, P., Chairatana, P., & Tangchitpiboon, T. (2002). National innovation system in less successful developing countries: the case of Thailand. *Research Policy*, 31(8-9), 1445-1457.
- ITU. (2005). Core ICT Indicators, Partnership on Measuring ICT for Development. UN-ESCWA, Beirut.
- Jansen, J. J., Van Den Bosch, F. A., & Volberda, H. W. (2005). Managing potential and realized absorptive capacity: how do organizational antecedents matter? *Academy of Management Journal*, 48(6), 999-1015.
- Jaruzelski, B., & Dehoff, K. (2009). Profits down, spending steady: the global innovation 1000. *Strategy business*, 57(Winter).

- Jarvis, C. B., MacKenzie, S. B., & Podsakoff, P. M. (2003). A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research. *Journal of Consumer Research*, 30(2), 199-218.
- Jaworski, B. J., & Kohli, A. K. (1993). Market Orientation: Antecedents and Consequences. *The Journal of Marketing*, 57(3), 53-70.
- Jaworski, B. J., Kohli, A. K., & Sahay, A. (2000). Market-driven Versus Driving Markets. *Journal of the Academy Marketing Science*, 28(1), 45-54.
- Jelinek, M., & Schoonhoven, C. B. (1993). *The innovation marathon: Lessons from high technology firms*: San Francisco: Jossey-Bass.
- Johne, F. A., & Snelson, P. A. (1988). Success factors in product innovation: A selective review of the literature. *Journal of Product Innovation Management*, 5(2), 114-128.
- Johnson, S. C., & Jones, C. (1957). How to organize for new products. *Harvard Business Review*, 35(3), 49-62.
- Jolly, V. K. (1997). *Commercializing New Technologies: Getting from Mind to Market*. Boston, MA: Harvard Business School Press.
- Jones, O., & Craven, M. (2001). Absorptive Capacity and New Organisational Capabilities: A TCS Case Study. *Manchester Metropolitan University Business School, Working Paper Series No. 01/02, Manchester*.
- Kahn, K. B. (2001). Market orientation, interdepartmental integration, and product development performance. *Journal of Product Innovation Management*, 18(5), 314-323.
- Kahn, K. B., Barczak, G., Nicholas, J., Ledwith, A., & Perks, H. (2012). An Examination of New Product Development Best Practice. *Journal of Product Innovation Management*, 29(2), 180-192.
- Kahn, K. B., Castellion, G., & Griffin, A. (2005). *The PDMA handbook of new product development (2nd Edition)*. Hoboken: John Wiley & Sons, Inc.
- Kamien, M. I., & Zang, I. (2000). Meet me halfway: research joint ventures and absorptive capacity. *International Journal of Industrial Organization*, 18(2), 995-1012.
- Kanter, R. M. (1988). When a thousand flowers bloom. *Research in Organizational Behaviour*, 10, 169-211.
- Kapelko, M. (2006). Evaluating efficiency in the framework of resource-based view of the firm: evidence from Polish and Spanish textile and clothing industry. *Bellaterra*, 1, 1-56.
- Kaplan, B., & Maxwell, J. A. (1994). *Qualitative Research Methods for Evaluating Computer Information Systems*. In J. G. Anderson, C. E. Aydin, and S. J. Jay (Eds.), *Evaluating Health Care Information Systems, Methods and Applications*, pp. 45-68: Thousand Oaks, California: Sage Publications.
- Katz, G. M. (2001). The "One Right Way" to gather the voice of the customer. *PDMA Visions Magazine*, 25(4), 1-6.
- Kelley, D. (2009). Adaptation and Organizational Connectedness in Corporate Radical Innovation Programs\*. *Journal of Product Innovation Management*, 26(5), 487-501.
- Kerin, R. A., Varadarajan, P. R., & Peterson, R. A. (1992). First-Mover Advantage: A Synthesis, Conceptual Framework, and Research Propositions. *Journal of Marketing*, 56(4), 33-52.
- Kessler, E. H., & Bierly, P. E. (2002). Is faster really better? An empirical test of the implications of innovation speed. *Engineering Management, IEEE Transactions on*, 49(1), 2-12.

- Kessler, E. H., & Chakrabarti, A. K. (1996). Innovation Speed: A Conceptual Model of Context, Antecedents, and Outcomes. *The Academy of Management Review*, 21(4), 1143-1191.
- Kessler, E. H., & Chakrabarti, A. K. (1999). Speeding Up the Pace of New Product Development. *Journal of Product Innovation Management*, 16(3), 231-247.
- Khatri, N., & Ng, H. A. (2000). The role of intuition in strategic decision making. *Human Relations*, 53(1), 57-86.
- Khurana, A., & Rosenthal, S. R. (1997). Integrating the Fuzzy Front End of New Product Development. *Sloan management review*, Winter, 103-120.
- Khurana, A., & Rosenthal, S. R. (1998). Towards Holistic 'Front Ends' in New Product Development. *Journal of Product Innovation Management*, 15(1), 57-74.
- Kim, J., & Wilemon, D. (2002a). Focusing the fuzzy front-end in new product development. *R&D Management*, 32(4), 269-279.
- Kim, J., & Wilemon, D. (2002b). Strategic issues in managing innovation's fuzzy front-end. *European Journal of Innovation Management*, 5(1), 27-39.
- Kim, J., & Wilemon, D. (2010). Accelerating the fuzzy front-end of NPD projects: methods and management. *International Journal of Engineering Management and Economics*, 1(1), 80-101.
- Kim, L. (1997). The dynamics of Samsung's technological learning in semiconductors. *California Management Review*, 39(3), 86-101.
- Kim, L. (1998). Crisis Construction and Organizational Learning: Capability Building in Catching-up at Hyundai Motor. *Organization Science*, 9(4), 506-521.
- Kim, N., & Atuahene-Gima, K. (2010). Using Exploratory and Exploitative Market Learning for New Product Development. *Journal of Product Innovation Management*, 27, 519-536.
- Kim, N., Im, S., & Slater, S. F. (2013). Impact of Knowledge Type and Strategic Orientation on New Product Creativity and Advantage in High-Technology Firms. *Journal of Product Innovation Management*, 30(1), 136-153.
- Kirzner, I. M. (1997). Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach. *Journal of Economic Literature*, 35(1), 60-85.
- Kleef, E. V., van Trijp, H. C. M., & Luning, P. (2005). Consumer Research in the Early Stages of New Product Development: A Critical Review of Methods and Techniques. *Food Quality and Preference*, 16, 181-201.
- Kleinschmidt, E. J., & Cooper, R. G. (1991). The impact of product innovativeness on performance. *Journal of Product Innovation Management*, 8(4), 240-251.
- Kleinschmidt, E. J., de Brentani, U., & Salomo, S. (2007). Performance of Global new product development programs: A resource-based view. *Journal of Product Innovation Management*, 24, 419-441.
- Kleinschmidt, E. J., de Brentani, U., & Salomo, S. (2010). Information Processing and Firm-Internal Environment Contingencies: Performance Impact on Global New Product Development. *Creativity and Innovation Management*, 19(3), 200-218.
- Kline, R. B. (2005). *Principles and practice of structural equation modeling*. New York, NY: Guilford Press.
- Klochikhin, E. A., & Shapira, P. (2012). Engineering Small Worlds in a Big Society: Assessing the Early Impacts of Nanotechnology in China. *Review of Policy Research*, 29(6), 752-775.
- Kneller, R., & Stevens, P. A. (2002). Absorptive Capacity and Frontier Technology: Evidence from OECD Manufacturing Industries. *Oxford Bulletin of Economics & Statistics*, 68(1), 1-21.

- Knight, G. A., & Cavusgil, S. T. (2004). Innovation, Organizational Capabilities, and the Born-Global Firm. *Journal of International Business Studies*, 35(2), 124-141.
- Knudsen, M. P., Dalum, B., & Villumsen, G. (2001). *Two faces of absorptive capacity creation: Access and utilisation of knowledge*, DRUID, Aalborg.
- Koberg, C. S., Detienne, D. R., & Heppard, K. A. (2003). An empirical test of environmental, organizational, and process factors affecting incremental and radical innovation. *The Journal of High Technology Management Research*, 14(1), 21-45.
- Koen, P. (2005). Chapter 6: The Fuzzy Front End for incremental, platform, and breakthrough products. In K. B. Kahn, G. Castellion & A. Griffin (Eds.), *The PDMA Handbook of New Product Development (2nd Edition., pp. 81-91)*. Hoboken: John Wiley & Sons. Inc.
- Koen, P., Ajamian, G., Boyce, S., Clamen, A., Fisher, E., Fountoulakis, S., . . . Seibert, R. (2002). Fuzzy-Front End: Effective Methods, Tools and Techniques. In P. Belliveau & S. Sorermeier (Eds.), *PDMA Toolbook for New Product Development* (pp. 2-35). New York: John Wiley and Sons.
- Koen, P., Ajamian, G., Burkart, R., Clamen, A. D., J., D'Amore, R., Elkins, C., . . . Wagner, K. (2001). Providing clarity and a common language to the "Fuzzy Front End". *Research Technology Management*, March-April, 44(2), 46-55.
- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3), 383-397.
- Kohli, A. K., & Jaworski, B. J. (1990). Market Orientation: The Construct, Research Propositions, and Managerial Implications. *Journal of Marketing*, 54(2), 1-18.
- Kortmann, S. (2014). The Mediating Role of Strategic Orientations on the Relationship between Ambidexterity-Oriented Decisions and Innovative Ambidexterity. *Journal of Product Innovation Management*.
- Koslow, S., Shamdasani, P. N., & Touchstone, E. E. (1994). Exploring Language Effects in Ethnic Advertising: A Sociolinguistic Perspective. *Journal of Consumer Research*, 20(4), 575-585.
- Kostoff, R. N., & Schaller, R. R. (2000). Science and Technology Roadmaps. *IEEE Transactions on Engineering Management*, 48(2), 132-143.
- Kostopoulos, K., Papalexandris, A., Papachroni, M., & Loannou, G. (2011). Absorptive capacity, innovation, and financial performance. *Journal of Business Research*, 64(12), 1335-1343.
- Kotler, P., & Keller, K. L. (2005). *Marketing Management, (13th Edition)*. Upper Saddle River, NJ: Pearson Education Inc.
- Kotler, P., & Keller, K. L. (2009). *Marketing Management (13th Edition)*. Upper Saddle River: NJ: Prentice Hall.
- Kromrey, J., & Foster-Johnson, L. (1998). Mean Centering in Moderated Multiple Regression: Much Ado about Nothing. *Educational and Psychological Measurement*, 58(1), 42-67.
- Kuhn, T. (1962). *The structure of scientific revolutions*. Chicago, IL: University of Chicago Press.
- Kumar, N. (1997). The Revolution in Retailing: from Market Driven to Market Driving. *Long Range Planning*, 30(6), 830-835.
- Kumar, N., Scheer, L., & Kotler, P. (2000). From Market Driven to Market Driving. *European Management Journal*, 18(2), 129-142.
- Kumar, N., Stern, L. W., & Anderson, J. C. (1993). Conducting interorganizational research using key informants. *The Academy of Management Journal*, 36(6), 1633-1651.

- Lamore, P. R., Berkowitz, D., & Farrington, P. A. (2013). Proactive/Responsive Market Orientation and Marketing—Research and Development Integration. *Journal of Product Innovation Management*, 30(4), 695-711.
- Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: a critical review and rejuvenation of the construct. *Academy of Management Review*, 31(4), 833-863.
- Lane, P. J., & Lubatkin, M. (1998). Relative absorptive capacity and interorganizational learning. *Strategic Management Journal*, 19(5), 461-477.
- Lane, P. J., Salk, J. E., & Lyles, M. A. (2001). Absorptive capacity, learning, and performance in international joint ventures. *Strategic Management Journal*, 22(12), 1139-1161.
- Langerak, F., & Hultink, E. J. (2005). The impact of new product development acceleration approaches on speed and profitability: lessons for pioneers and fast followers. *Engineering Management, IEEE Transactions on*, 52(1), 30-42.
- Langerak, F., Hultink, E. J., & Robben, H. S. J. (2004). The Impact of Market Orientation, Product Advantage, and Launch Proficiency on New Product Performance and Organizational Performance. *Journal of Product Innovation Management*, 21(2), 79-94.
- Lawless, M. W., & Anderson, P. C. (1996). Generational Technological Change: Effects of Innovation and Local Rivalry on Performance. *The Academy of Management Journal*, 39(5), 1185-1217.
- Leach, L. M. (2013). *Eliminate Item Non-Response: The Effect of Forcing Respondents to Answer in Web Surveys*. Paper presented at the The American Association for Public Opinion Research (AAPOR) 68th Annual Conference Boston, Massachusetts.
- Leifer, R. (1998). An information processing approach for facilitating the fuzzy front end of breakthrough innovations. *IEMC*, 130-135.
- Leifer, R., McDermott, C. M., O'Connor, G. C., Peters, L. S., Rice, M. P., & Veryzer, R. W. (2000). *Radical Innovation: How Mature Companies Can Outsmart Upstarts*. Boston, MA: Harvard Business School Press.
- Leifer, R., O'Connor, G. C., & Rice, M. P. (2001). Implementing Radical Innovation in Mature Firms: the Role of Hubs. *Academy of Management Executive*, 15(3), 102-113.
- Leonard-Barton, D. (1992). Core Capabilities and Core Rigidities: A Paradox in Managing New Product Development. *Strategic Management Journal*, 13, 111-125.
- Leonard-Barton, D. (1995). *Wellsprings of Knowledge*. Boston: Harvard Business School Press.
- Leonard-Barton, D., & Doyle, J. L. (1996). Commercializing technology: Imaginative understanding of user needs. In R. Rosenbloom & W. Spencer (Eds.), *Engines of Innovation: U.S. Industrial Research at the End of an Era* (pp. 177-207). Boston: Harvard Business School Press.
- Lettle, C., Herstatt, C., & Gemuenden, H. G. (2006). Users' contributions to radical innovation: evidence from four cases in the field of medical equipment technology. *R&D Management*, 36(3), 251-272.
- Lev, S., Fiegenbaum, A., & Shoham, A. (2009). Managing absorptive capacity stocks to improve performance: Empirical evidence from the turbulent environment of Israeli hospitals. *European Management Journal*, 27, 13-25.
- Levinthal, D. A. (1994). *Surviving Schumpeterian: An evolutionary perspective*. New York: Oxford University Press.
- Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, 14(Special Issue), 95-112.

- Levitt, T. (1965). Exploit the product life cycle. *Harvard Business Review*, 43(November-December), 81-94.
- Li, C. R., Lin, C. J., & Chu, C. P. (2008). The nature of market orientation and the ambidexterity of innovations. *Management Decision*, 46(7), 1002-1026.
- Li, H., & Atuahene-Gima, K. (2001). Product Innovation Strategy and The Performance of New Technology Ventures in China. *Academy of Management Journal*, 44(6), 1123-1134.
- Li, T., & Calantone, R. J. (1998). The Impact of Market Knowledge Competence on New Product Advantage: Conceptualization and Empirical Examination. *Journal of Marketing*, 62(4), 13-29.
- Lichtenthaler, U., & Lichtenthaler, E. (2009). A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity. *Journal of Management Studies*, 46(8), 1315-1338.
- Lieberman, M. B., & Montgomery, D. B. (1998). First-mover (dis)advantages: Retrospective and link with the resource-based view. *Strategic Management Journal*, 19, 1111-1125.
- Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 140(55).
- Lilien, G. L., Morrison, P. D., Searls, K., Sonnack, M., & von Hippel, E. (2002). Performance Assessment of the Lead User Idea-Generation Process for New Product Development. *Management Science*, 48(8), 1042-1059.
- Lindgren, L. M., & O'Connor, G. C. (2011). The Role of Future-Market Focus in the Early Stages of NPD across Varying Levels of Innovativeness. *Journal of Product Innovation Management*, 28(5), 787-800.
- Liu, X., & White, R. S. (1997). The relative contributions of foreign technology and domestic inputs to innovation in Chinese manufacturing industries. *Technovation*, 17(3), 119-125.
- Lorcken, B., Pirie, P., Virnig, K. A., Hinkle, R. L., & Salmon, C. T. (1987). The use of 0-10 scales in telephone surveys. *Journal of the Market Research Society*, 29(3), 353-362.
- Luck, D. J., & Rubin, R. S. (1987). *Marketing Research (7th Edition)*. NJ: Englewood Cliffs: Prentice Hall.
- Luecke, R., & Katz, R. (2003). *Managing creativity and innovation*. Boston, MA: Harvard Business School Press.
- Lukas, B. A., & Ferrell, O. C. (2000). The Effect of Market Orientation on Product Innovation. *Journal of the Academy Marketing Science*, 28(2), 239-247.
- Lynn, G. S. (1999). An exploratory study of project vision: its components and impact on innovation success. *International Journal of Innovation Management*, 3(1), 91-109.
- Lynn, G. S., Abel, K. D., Valentine, W. S., & Wright, R. C. (1999a). Key Factors in Increasing Speed to market and Improving New Product Success Rates. *Industrial Marketing Management*, 28, 319-326.
- Lynn, G. S., & Akgün, A. E. (1998). Innovation strategies under uncertainty: a contingency approach for new product development. *Engineering Management Journal*, 10(3), 11-18.
- Lynn, G. S., & Akgün, A. E. (2001). Project visioning: Its components and impact on new product success. *Journal of Product Innovation Management*, 18, 374-387.
- Lynn, G. S., Akgün, A. E., & Keskin, H. (2003). Accelerated learning in new product development teams. *European Journal of Innovation Management*, 6(4), 201-212.
- Lynn, G. S., & Green, C. (1998). Market Forecasting for High-Tech Vs Low-Tech Industrial Products. *Engineering Management Journal*, 10, 15-18.

- Lynn, G. S., Morone, J. G., & Paulson, A. S. (1996). Marketing and Discontinuous Innovation: The Probe and Learn Process. *California Management Review*, 38(3), 8-37.
- Lynn, G. S., Reilly, R. R., & Akgün, A. E. (2000). Knowledge management in new product teams: practices and outcomes. *Engineering Management, IEEE Transactions on*, 47(2), 221-231.
- Lynn, G. S., Skov, R. B., & Abel, K. D. (1999b). Practices that Support Team Learning and Their Impact on Speed to Market and New Product Success. *Journal of Product Innovation Management*, 16(5), 439-454.
- MacCormack, A., Crandall, W., Henderson, P., & Toft, P. (2012). Do You Need a New Product-Development Strategy? Aligning Process With Context. *Research-Technology Management*, 55(1), 34-43.
- MacKenzie, S. B., & Podsakoff, P. M. (2012). Common method bias in marketing: causes, mechanisms, and procedural remedies. *Journal of Retailing*, 88(4), 542-555.
- Mahajan, V., & Wind, Y. (1990). Innovation Diffusion Models of New Product Acceptance. *A Reexamination*.
- Mahoney, J. T., & Pandian, J. R. (1992). The resource-based view within the conversation of strategic management. *Strategic Management Journal*, 13(5), 363-380.
- Maidique, M. A., & Zirger, B. J. (1984). A study of success and failure in product innovation: the case of the US electronics industry. *IEEE Transactions in Engineering Management*, 31(4), 192-203.
- Malhotra, N. K. (2007). *Marketing research: An applied approach*. New Jersey: Pearson Education, Inc.
- Malhotra, N. K. (2009a). *Basic marketing research: A decision-making approach (3rd Edition)*. New Jersey: Pearson Education, Inc.
- Malhotra, N. K. (2009b). *Marketing Research: An Applied Orientation (6th Edition)*, SPSS: Prentice Hall.
- Malhotra, N. K. (2010). *Marketing research: An applied orientation*: Prentice Hall.
- Malhotra, N. K., Hall, J., Shaw, M., & Oppenheim, P. P. (2004). *Essentials of marketing research: an applied orientation*. Frenchs Forest, NSW, Australia: Pearson-Prentice Hall.
- Malhotra, N. K., Kim, S. S., & Patil, A. (2006). Common Method Variance in Is Research: A Comparison of Alternative Approaches and a Reanalysis of past Research. *Management Science*, 52(12), 1865-1883.
- Malhotra, N. K., Peterson, M., & Kleiser, S. B. (1999). Marketing Research: A state-of-the-art review and directions for the twenty-first century. *Journal of the Academy Marketing Science*, 27(2), 160-183.
- Mancusi, M. L. (2004). International Spillovers and Absorptive Capacity: A cross-country, cross-sector analysis based on European patents and citations. *The Toyota Centre*.
- Mangematin, V., & Nesta, L. (1999). What kind of knowledge can a firm absorb? *International Journal of Technology Management*, 18(3), 149-172.
- Manicas, P. T., & Secord, P. F. (1983). Implications for psychology of the new philosophy of science. *American Psychologist*, 38(4), 399-413.
- Manion, M. T., & Cherion, J. (2009). Impact of Strategic Type on Success Measures for Product Development Projects\*. *Journal of Product Innovation Management*, 26(1), 71-85.
- Mansfield, E. (1961). Technical Change and the Rate of Imitation. *Econometrica*, 29(4), 741-766.

- Maqsood, T., Finegan, A., & Walker, D. (2004). Biases and Heuristics in judgement and decision making: the dark side of tacit knowledge. *Science and Information Technology, 1*, 295-301.
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization science, 2*(1), 71-87.
- Markham, S. K. (1998). A Longitudinal Examination of How Champions Influence Others to Support Their Projects. *Journal of Product Innovation Management, 15*(6), 490-504.
- Markham, S. K. (2013). The Impact of Front-End Innovation Activities on Product Performance. *Journal of Product Innovation Management, 30*, 77-92.
- Markham, S. K., & Griffin, A. (1998). The Breakfast of Champions: Associations Between Champions and Product Development Environments, Practices and Performance. *Journal of Product Innovation Management, 15*(5), 436-454.
- Markham, S. K., & Lee, H. (2013a). Product Development and Management Association's 2012 Comparative Performance Assessment Study. *Journal of Product Innovation Management, 30*(3), 408-429.
- Markham, S. K., & Lee, H. (2013b). Use of an Innovation Board to Integrate the Front End of Innovation with Formal NDP Processes: A Longitudinal Study. *Research-Technology Management, 56*(4), 37-44.
- Markham, S. K., Ward, S. J., Aiman-Smith, L., & Kingon, A. I. (2010). The Valley of Death as Context for Role Theory in Product Innovation. *Journal of Product Innovation Management, 27*(3), 402-417.
- Martin, J. (1995). Ignore Your Customer. *Fortune, 131*(8), 123-126.
- Martinsuo, M., & Poskela, J. (2011). Use of Evaluation Criteria and Innovation Performance in the Front End of Innovation\*. *Journal of Product Innovation Management, 28*(6), 896-914.
- Mascitelli, R. (2000). From Experience: Harnessing Tacit Knowledge to Achieve Breakthrough Innovation. *Journal of Product Innovation Management, 17*, 179-193.
- May, T. (1993). *Social research: Issues, methods, and process*. Buckingham, England: Open University Press
- McCarthy, I. P., Tsinopoulos, C., Allen, P., & Rose-Anderssen, C. (2006). New Product Development as a Complex Adaptive Systems of Decisions. *Journal of Product Innovation Management, 23*, 437-456.
- McDade, S. R., Oliva, T. A., & Pirsch, J. A. (2002). The organizational adoption of high-technology products "for use": Effects of size, preferences, and radicalness of impact. *Industrial Marketing Management, 31*(5), 441-456.
- McDermott, C. M. (1999). Managing Radical Product Development in Large Manufacturing Firms: A Longitudinal Study. *Journal of Operations Management, 17*, 631-644.
- McDermott, C. M., & O'Connor, G. C. (2002). Managing radical innovation: an overview of emergent strategy issues. *Journal of Product Innovation Management, 19*, 424-438.
- McMillan, G. S., Muari, A., & Halmilton, R. D. (2003). The impact of publishing and patenting activities on new product development and firm performance. The case of the US pharmaceutical industry. *International Journal of Innovation Management, 7*(2), 213-223.
- McNally, R. C., Akdeniz, M. B., & Calantone, R. J. (2011). New Product Development Processes and New Product Profitability: Exploring the Mediating Role of Speed to Market and Product Quality. *Journal of Product Innovation Management, 28*(1), 63-77.



- McNally, R. C., & Schmidt, J. B. (2011). From the Special Issue Editors: An Introduction to the Special Issue on Decision Making in New Product Development and Innovation. *Journal of Product Innovation Management*, 28(5), 619-622.
- Meade, N., & Islam, T. (1998). Technological Forecasting—Model Selection, Model Stability, and Combining Models. *Management Science*, 44(8), 1115-1130.
- Mehta, R., & Suvadas, E. (1995). Comparing response rates and response content in mail versus electronic mail surveys. *Journal of the Market Research Society*, 37(4), 429-439.
- Menguc, B., Auh, S., & Yannopoulos, P. (2013). Customer and Supplier Involvement in Design: The Moderating Role of Incremental and Radical Innovation Capability. *Journal of Product Innovation Management*, 31(2), 1-16.
- Millson, M. R., Raj, S. P., & Wilemon, D. (1992). A survey of major approaches for accelerating new product development. *Journal of Product Innovation Management*, 9(1), 53-69.
- Mishra, S., Kim, D., & Lee, D. H. (1996). Factors Affecting New Product Success: Cross-Country Comparisons. *Journal of Product Innovation Management*, 13(6), 530-550.
- Mohr, J. J. (2001). *Marketing of High Technology Products and Innovations*. New York: Prentice Hall.
- Mohr, J. J., Sengupta, S., & Slater, S. F. (2005). *Marketing High Technology Products and Innovations*. Englewood Cliffs, NJ: Prentice-Hall.
- Montgomery, C. A. (1995). *Resource-based and Evolutionary Theories of the Firm: Towards a Synthesis*. Boston: Kluwer Academic Publishers.
- Montoya-Weiss, M. M., & Calantone, R. (1994). Determinants of new product performance: A review and meta-analysis. *Journal of Product Innovation Management*, 11(5), 397-417.
- Montoya-Weiss, M. M., & O'Driscoll, T. M. (2000). From Experience: Applying Performance Support Technology in the Fuzzy Front End. *Journal of Product Innovation Management*, 17(2), 143-161.
- Moore, G. (1991). *Crossing the Chasm*. New York: Harper Collins Business.
- Morgan, D. L. (2007). Paradigms lost and pragmatism regained methodological implications of combining qualitative and quantitative methods. *Journal of mixed methods research*, 1(1), 48-76.
- Moriarty, R. T., & Kosnik, T. J. (1989). High-tech marketing: concepts, continuity, and change. *Sloan management review*, 30(4), 7-17.
- Morone, J. G. (1993). *Winning in High Tech Markets*, Boston MA. *Harvard Business School Press*.
- Morse, J. M. (2003). Principles of mixed methods and multimethod research design. *Handbook of mixed methods in social and behavioral research*, 189-208.
- Mowery, D. C., & Oxley, J. E. (1995). Inward technology transfer and competitiveness: the role of national innovation systems. *Cambridge Journal of Economics*, 19, 67-93.
- Mowery, D. C., Oxley, J. E., & Silverman, B. S. (1996). Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal*, 17, 77-91.
- MSI. (2006). MSI Research Priorities 2006-2008. Retrieved 08 September, 2012, from [http://www.msi.org/pdf/MSI\\_RP06-08.pdf](http://www.msi.org/pdf/MSI_RP06-08.pdf)
- MSI. (2008). MSI Research Priorities 2008-2010. Retrieved 16 August, 2013, from [http://www.msi.org/pdf/MSI\\_RP08-10.pdf](http://www.msi.org/pdf/MSI_RP08-10.pdf)
- MSI. (2014). MSI Research Priorities 2014-2016. Retrieved 9 September, 2014, from [http://www.msi.org/uploads/files/MSI\\_RP14-16.pdf](http://www.msi.org/uploads/files/MSI_RP14-16.pdf)

- Mullins, J. W., & Sutherland, D. J. (1998). New Product Development in Rapidly Changing Markets: An Exploratory Study. *Journal of Product Innovation Management*, 15, 224-236.
- Murphy, S. A., & Kumar, V. (1997). The front end of new product development: a Canadian survey. *R&D Management*, 27(1), 5-15.
- Myers, S., & Marquis, D. G. (1969). *Successful industrial innovations*: National Science Foundation.
- Narvekar, R. S., & Jain, K. (2006). A new framework to understand the technological innovation process. *Journal of Intellectual Capital*, 7(2), 174-186.
- Narver, J. C., & Slater, S. F. (1990). The Effect of a Market Orientation on Business Profitability. *Journal of Marketing*, 54(4), 20-35.
- Narver, J. C., Slater, S. F., & MacLachlan, D. L. (2000). Total market orientation, business performance, and innovation. Cambridge, MA: Marketing Science Institute.
- Narver, J. C., Slater, S. F., & MacLachlan, D. L. (2004). Responsive and Proactive Market Orientation and New-Product Success. *Journal of Product Innovation Management*, 21, 334-347.
- National Innovation Agency. (2006). National Innovation Awards. Retrieved 26 December, 2012, from [http://www.nia.or.th/niaward/index\\_eng.html](http://www.nia.or.th/niaward/index_eng.html)
- National Innovation Agency. (2010a). Background of the National Innovation Agency, Thailand. Retrieved 17 June, 2013, from [http://www.nia.or.th/en/index.php?page=aboutus\\_background](http://www.nia.or.th/en/index.php?page=aboutus_background)
- National Innovation Agency. (2010b). NIA Strategy. Retrieved 17 April, 2012, from [http://www.nia.or.th/en/index.php?page=strategy\\_strategy](http://www.nia.or.th/en/index.php?page=strategy_strategy)
- National Innovation Agency. (2011). *เปิดโลกนวัตกรรมไทย (เล่ม4) 200 ธุรกิจนวัตกรรมสู่เศรษฐกิจสร้างสรรค์ของคนไทย* (Vol. 4): Ministry of Science and Technology, Thailand.
- National Innovation Agency. (2012). *Thailand Top Innovation Companies 2012: ideas, design, new technologies, creativity*: Jointly published by Green World Publication, Bangkok Thailand, and Marshall Cavendish Business Information, Singapore.
- Neuman, W. L. (2000). *Social research methods: Qualitative and quantitative approaches*. Boston: MA: Allyn and Bacon.
- Newey, L. R., & Shulman, A. D. (2004). Systemic absorptive capacity: creating early-to-market returns through R&D alliances. *R&D Management*, 34(5), 495-504.
- Noori, H., Munro, H., Deszca, G., & McWilliams, B. (1999). Developing the "right" breakthrough product/service: an umbrella methodology-Part A. *International Journal of Technology Management*, 17(5), 544-562.
- Norton, J., & Bass, F. (1989). A diffusion-theory model of adoption and substitution for successive generations of high technology products. In W. Henry, M. Menasco & H. Tkada (Eds.), *New Product Development and Testing*. Massachusetts: Lexington Books.
- Norusis, M. J. (1993). *SPSS for Windows: Professional statistics, release 6.0*. Chicago: SPSS Inc.
- Nunnally, J. C. (1967). *Psychometric Methods*: New York: McGraw Hill.
- Nunnally, J. C. (1978). *Psychometric theory (2nd Edition)*: New York: McGraw-Hill.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory (3rd Edition)*. New York: McGraw-Hill.
- O'Connor, G. C. (1998). Market Learning and Radical Innovation: A Cross Case Comparison of Eight Radical Innovation Projects. *Journal of Product Innovation Management*, 15, 151-166.

- O'Connor, G. C. (2008). Major Innovation as a Dynamic Capability: A Systems Approach. *Journal of Product Innovation Management*, 25, 313-330.
- O'Connor, G. C. (2010). Radical Innovation *Wiley International Encyclopedia of Marketing*: John Wiley & Sons, Ltd.
- O'Connor, G. C., & Ayers, A. D. (2005). Building A Radical Innovation Competency. *Research Technology Management, January-February*, 23-31.
- O'Connor, G. C., & DeMartino, R. (2006). Organizing for Radical Innovation: An Exploratory Study of the Structural Aspects of RI Management Systems in Large Established Firms. *Journal of Product Innovation Management*, 23, 475-497.
- O'Connor, G. C., & McDermott, C. M. (2004). The human side of radical innovation. *Journal of Engineering and Technology Management*, 21, 11-30.
- O'Connor, G. C., Ravichandran, T., & Robeson, D. (2008). Risk management through learning: Management practices for radical innovation success. *Journal of High Technology Management Research*, 19, 70-82.
- O'Connor, G. C., & Rice, M. P. (2001). Opportunity Recognition and Breakthrough Innovation in Large Established Firms. *California Management Review*, 43(2), 95-116.
- O'Connor, G. C., & Rice, M. P. (2013a). A Comprehensive Model of Uncertainty Associated with Radical Innovation. *Journal of Product Innovation Management*, 30(S1), 2-18.
- O'Connor, G. C., & Rice, M. P. (2013b). New Market Creation for Breakthrough Innovations: Enabling and Constraining Mechanisms. *Journal of Product Innovation Management*, 30(2), 209-227.
- O'Connor, G. C., & Veryzer, R. W. (2001). The Nature of Market Visioning for Technology-based Radical Innovation. *Journal of Product Innovation Management*, 18, 231-246.
- O'Regan, N., & Ghobadian, A. (2004). The Importance of Capabilities for Strategic Direction and Performance. *Management Decision*, 42(2), 292-313.
- OECD. (2011). *OECD Studies on SMEs and Entrepreneurship, Thailand: Key Issues and Policies*: OECD Publishing.
- Oliveira, M. G., & Rozenfeld, H. (2010). Integrating technology roadmapping and portfolio management at the front-end of new product development. *Technological Forecasting and Social Change*, 77(8), 1339-1354.
- Olson, E. M., & Slater, S. F. (2002). The balanced scorecard, competitive strategy, and performance. *Business Horizons*, 45(3), 11-16.
- Olson, E. M., Walker, O. C., Jr., & Ruekert, R. W. (1995). Organizing for Effective New Product Development: The Moderating Role of Product Innovativeness. *Journal of Marketing*, 59(1), 48-62.
- Olson, E. M., Walker, O. C., Ruekerf, R. W., & Bonnerd, J. M. (2001). Patterns of cooperation during new product development among marketing, operations and R&D: Implications for project performance. *Journal of Product Innovation Management*, 18(4), 258-271.
- Oltra, M. J., & Flor, M. (2003). The Impact of Technological Opportunities and Innovative Capabilities on Firms' Output Innovation. *Creativity and Innovation Management*, 12(3), 137-144.
- Oppenheim, A. N. (1992). *Questionnaire design, interviewing and attitude measurement*. New York: NY: Pinter.
- Ottum, B. D., & Moore, W. L. (1997). The Role of Market Information in New Product Success/Failure. *Journal of Product Innovation Management*, 14(4), 258-273.

- Page, A. L. (1993). Assessing new product development practices and performance: Establishing crucial norms. *Journal of Product Innovation Management*, 10(4), 273-290.
- Pakaworawuth, C. (2007). His Majesty the King's Intellectual Property as a Tool of Development. Retrieved 16 June 2013, from [http://thailand.prd.go.th/thailand\\_illustrated/content.php?s\\_id=311](http://thailand.prd.go.th/thailand_illustrated/content.php?s_id=311)
- Paladino, A. (2007). Investigating the Drivers of Innovation and New Product Success: A Comparison of Strategic Orientations. *Journal of Product Innovation Management*, 24, 534-553.
- Pallant, J. (2005). SPSS survival manual. Berkshire, UK: Open University Press.
- Palumbo, F. A., & Teich, I. (2004). Market segmentation based on level of acculturation. *Marketing Intelligence & Planning*, 22(4), 472-484.
- Parasuraman, A., Grewal, D., & Krishnan, R. (2004). *Marketing research*: Boston, MA: Houghton Mifflin.
- Parry, M. E., & Song, X. M. (1994). Identifying new product successes in China. *Journal of Product Innovation Management*, 11(1), 15-30.
- Patzelt, H., Lechner, C., & Klaukien, A. (2011). Networks and the Decision to Persist with Underperforming R&D Projects. *Journal of Product Innovation Management*, 28(5), 801-815.
- Pawar, K. S., & Riedel, J. C. K. H. (1994). Achieving integration through managing concurrent engineering. *International Journal of production economics*, 34(3), 329-345.
- Penrose, E. (1959). The theory of the growth of the firm. *Wiley, New York*.
- Perry, C., Alizadeh, Y., & Riege, A. (1997, 21-23 September). *Qualitative Methods in Entrepreneurship Research*. Paper presented at the the Annual Conference of the Small Enterprise Association of Australia and New Zealand, Coffs Harbour.
- Peter, J. P. (1979). Reliability: A Review of Psychometric Basics and Recent Marketing Practices. *Journal of Marketing Research*, 16(1), 6-17.
- Peter, J. P. (1981). Construct Validity: A Review of Basic Issues and Marketing Practices. *Journal of Marketing Research*, 18(2), 133-145.
- Peter, J. P., & Churchill, G. A. (1986). Relationships among Research Design Choices and Psychometric Properties of Rating Scales: A Meta-Analysis. *Journal of Marketing Research*, 23(1), 1-10.
- Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), 179-191.
- Peteraf, M. A., & Barney, J. B. (2003). Unraveling the Resource-Based Tangle. *Managerial and Decision Economics*, 24(4), 309-323.
- Peterson, R. A. (1994). A Meta-Analysis of Cronbach's Coefficient Alpha. *Journal of Consumer Research*, 21(2), 381-391.
- Phillips, W., Noke, H., Bessant, J., & Lamming, R. (2006). Beyond The Steady State: Managing Discontinuous Product and Process Innovation. *International Journal of Innovation Management*, 10(2), 175-196.
- Ping, R. A. (2004). On assuring valid measures for theoretical models using survey data. *Journal of Business Research*, 57(2), 125-141.
- Pisano, G. (1994). Knowledge, Integration, and the Locus of Learning: An Empirical Analysis of Process Development. *Strategic Management Journal*, 15, 85-100.
- Pittiglio, C., Rabin, R., Todd, P., & McGrath, M. (1995). Product Development Leadership for Technology-based Companies: Measurement and Management—A Prelude to Action. *Pittiglio, Rabin, Todd & McGrath: Weston, MA*.

- Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual review of psychology*, 63, 539-569.
- Podsakoff, P. M., Todor, W. D., Grover, R. A., & Huber, V. L. (1984). Situational moderators of leader reward and punishment behaviors: Fact or fiction? *Organizational Behavior and Human Performance*, 34(1), 21-63.
- Polanyi, M. (1966). *The Tacit Dimension*. Gloucester: Peter Smith.
- Porter, A. L. (1994). Technology opportunities analysis: Integrating technology monitoring, forecasting, and assessment with strategic planning. *SRA Journal*, 26(2), 21-31.
- Porter, M. E. (1980). *Competitive strategies*. The Free Press, New York.
- Porter, M. E. (1985). *Competitive Advantage*. The Free Press, New York.
- Porter, M. E. (1991). Towards a dynamic theory of strategy. *Strategic Management Journal*, 12(Winter), 95-117.
- Porter, M. E. (1996). What is strategy? *Harvard Business Review*, 74(6), 61-78.
- Prajogo, D. I., & Sohal, A. S. (2003). The relationship between TQM practices, quality performance, and innovation performance: an empirical examination. *International journal of quality & reliability management*, 20(8), 901-918.
- PricewaterhouseCoopers survey. (2013). Breakthrough innovation and growth. Retrieved 13 October, 2013, from <http://www.pwc.com/gx/en/innovationsurvey/index.jhtml>
- Proctor, T. (2005). *Essentials of marketing research*: Pearson Education.
- Qualtrics. (2013). Qualtrics (Version 37,892). Utah, USA: Provo: Qualtrics Research Suite.
- Rangan, V. K., & Bartus, K. (1995). New Product Commercialization: Common Mistakes. *Harvard Business School, Note#9-594-127*.
- Rangaswamy, A., & Lilien, G. L. (1997). Software Tools for New Product Development. *Journal of Marketing Research*, 34(1), 177-184.
- Reid, S. E. (2005). *Market Vision for Radically-New, High-Tech Products*. (Unpublished doctoral dissertation (Administration)), Concordia University, Montreal, Quebec, Canada.
- Reid, S. E., & de Brentani, U. (2004). The Fuzzy Front End of New Product Development for Discontinuous Innovations: A Theoretical Model. *Journal of Product Innovation Management*, 21, 170-184.
- Reid, S. E., & de Brentani, U. (2010). Market Vision and Market Visioning Competence: Impact on Early Performance for Radically New, High-Tech Products. *Journal of Product Innovation Management*, 27, 500-518.
- Reid, S. E., & de Brentani, U. (2012). Market Vision and the Front End of NPD for Radical Innovation: The Impact of Moderating Effects. *Journal of Product Innovation Management*, 29, 124-139.
- Reinartz, W., Haenlein, M., & Henseler, J. (2009). An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in Marketing*, 26(4), 332-344.
- Rice, M. P., Leifer, R., & O'Connor, G. C. (2002). Commercializing discontinuous innovations: bridging the gap from discontinuous innovation project to operations. *Engineering Management, IEEE Transactions on*, 49(4), 330-340.
- Rice, M. P., O'Connor, G. C., Leifer, R., McDermott, C. M., & Standish-Kuon, T. (2000). Corporate Venture Capital Models for Promoting Radical Innovation. *Journal of Marketing Theory and Practice*, 8(3), 1-10.
- Rice, M. P., O'Connor, G. C., Peters, L. S., & Morone, J. G. (1998). Managing discontinuous innovation. *Research Technology Management*, 41(3), 52.

- Ringle, C. M., Sarstedt, M., & Mooi, E. A. (2010). Response-Based Segmentation Using Finite Mixture Partial Least Squares. In R. Stahlbock, S. F. Crone & S. Lessmann (Eds.), *Data Mining* (Vol. 8, pp. 19-49): Springer US.
- Ringle, C. M., Wende, S., & Will, A. (2005). SmartPLS 2.0 (beta) [Computer Software, Smart PLS], Hamburg: Germany. from [www.smartpls.de](http://www.smartpls.de)
- Ritala, P., & Hurmelinna-Laukkanen, P. (2013). Incremental and Radical Innovation in Coopetition—The Role of Absorptive Capacity and Appropriability. *Journal of Product Innovation Management*, 30(1), 154-169.
- Robinson, W. T. (1988). Marketing Mix Reactions to Entry. *Marketing Science*, 7(4), 368-385.
- Roman, S. (2002). *Access Database Design & Programming (3rd Edition)*: O'Reilly Media.
- Roos, J. (1996). Distinction making and pattern recognition in management. *European Management Journal*, 14(6), 590-595.
- Rossiter, J. R. (2002). The C-OAR-SE procedure for scale development in marketing. *International Journal of Research in Marketing*, 19(4), 305-335.
- Rothwell, R. (1978). Small and Medium Sized Manufacturing Firms and Technological Innovation. *Management Decision*, 16(6), 362-370.
- Rothwell, R., & Zegveld, W. (1982). Innovation and the Small and Medium Sized Firm. *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*.
- Rubenstein, A., Chakrabarti, A., O'Keefe, R., Souder, W., & Young, S. (1976). Factors influencing innovation success at the project level. *Research management*, May, 15-20.
- Rubera, G., & Kirca, A. H. (2012). Firm innovativeness and its performance outcomes: a meta-analytic review and theoretical integration. *Journal of Marketing*, 76(2), 130-147.
- Ruekert, R. W., & Churchill, G. A. (1984). Reliability and Validity of Alternative Measures of Channel Member Satisfaction. *Journal of Marketing Research*, 21(2), 226-233.
- Rumelt, R. P. (1984). Towards Strategic Theory of the Firm. In R. D. Lamb (Ed.), *Competitive Strategic Management* (pp. 131-145). NJ: Englewood Cliffs.
- Sadler-Smith, E., Hodgkinson, G. P., & Sinclair, M. (2008). Chapter 2: A Matter of feeling? The Role of intuition in entrepreneurial decision-making and behaviour. *Emotions, Ethics and Decision-Making*, 4, 35-55.
- Sadler-Smith, E., & Shefy, E. (2004). The Intuitive executive: understanding and applying 'gut feel' in decision-making. *The Academy of Management Executive*, 18(4), 76-91.
- Salomo, S., Keinschmidt, E. J., & de Brentani, U. (2010). Managing new product development teams in a globally dispersed NPD program. *Journal of Product Innovation Management*, 27, 955-971.
- Samiee, S., & Roth, K. (1992). The Influence of Global Marketing Standardization on Performance. *Journal of Marketing*, 56(2), 1-17.
- Sandberg, B. (2007). Customer-related Proactiveness in the Radical Innovation Development Process. *European Journal of Innovation Management*, 10(2), 252-267.
- Santipaporn, S. (2010). *Information and Communication Technology Statistics in Thailand*. Paper presented at the International Seminar on Information and Communication Technology Statistics Seoul, Republic of Korea.
- Santos-Vijande, M. L., & Álvarez-González, L. I. (2007). Innovativeness and organizational innovation in total quality oriented firms: The moderating role of market turbulence. *Technovation*, 27(9), 514-532.

- Sarkar, M. B., Echambadi, R., Cavusgil, S. T., & Aulakh, P. (2001a). The influence of complementarity, compatibility, and relationship capital on alliance performance. *Journal of The Academy of Marketing Science*, 29(4), 358-373.
- Sarkar, M. B., Echambadi, R., & Harrison, J. S. (2001b). Alliance entrepreneurship and firm market performance. *Strategic Management Journal*, 22(6-7), 701-711.
- Saunders, S., Jenkin, M., Derwent, R., & Pilling, M. (2003). Protocol for the development of the Master Chemical Mechanism, MCM v3 (Part A): tropospheric degradation of non-aromatic volatile organic compounds. *Atmospheric Chemistry and Physics*, 3(1), 161-180.
- Schein, E. (1993). How can organizations learn faster? The challenge of entering the green room. *Sloan management review*, 34(2), 85-92.
- Scherer, F. M. (1991). *Changing perspectives on the firm size problem*, In Z. J. Acs and D. B. Audretsch (eds.), *Innovation and technological change: An international comparison*, pp. 24-38. University of Michigan Press.
- Scherer, F. M. (1992). Schumpeter and Plausible Capitalism. *Journal of Economic Literature*, 30(3), 1416-1433.
- Schindehutte, M., Morris, M. H., & Kocak, A. (2008). Understanding Market-Driving Behavior: The Role of Entrepreneurship. *Journal of Small Business Management*, 46(1), 4-26.
- Schmidt, J. B., & Calantone, R. J. (2002). Escalation of commitment during new product development. *Academy of Marketing Science*, 30(2), 103-118.
- Schmidt, J. B., Sarangee, K. R., & Montoya, M. M. (2009). Exploring New Product Development Project Review Practices\*. *Journal of Product Innovation Management*, 26(5), 520-535.
- Schmidt, T. (2005). *What determines absorptive capacity?*, Centre for European Economic Research (ZEW), Mannheim.
- Schoemaker, P. J. H. (1995). Scenario planning: a tool for strategic thinking. *Sloan management review*, 36(2), 25-40.
- Schultz, C., Salomo, S., de Brentani, U., & Kleinschmidt, E. J. (2013). How Formal Control Influences Decision-Making Clarity and Innovation Performance. *Journal of Product Innovation Management*, 30(3), 430-447.
- Schumacker, R. E., & Lomax, R. G. (1996). *A Beginner's Guide to Structural Equation Modeling*. Hillsdale, NJ: Lawrence Erlbaum Associates
- Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Schumacker, R. E., & Lomax, R. G. (2010). *A beginner's guide to structural equation modeling (3rd Edition)*. New York: Routledge.
- Schumpeter, J. A. (1934). *The Theory of Economic Development*. Oxford: Oxford University Press.
- Schumpeter, J. A. (1942). *Socialism, capitalism and democracy*: Harper and Brothers.
- Sechrest, L., Fay, T. L., & Zaidi, S. H. (1972). Problems of translation in cross-cultural research. *Journal of Cross-Cultural Psychology*, 3(1), 41-56.
- Seidel, V. P. (2007). Concept Shifting and The Radical Product Development Process. *Journal of Product Innovation Management*, 24, 522-533.
- Seidler, J. (1974). On Using Informants: A Technique for Collecting Quantitative Data and Controlling Measurement Error in Organization Analysis. *American Sociological Review*, 39(6), 816-831.
- Sekaran, C. (2003). *Research Methodology for Business*. John Wiley and Sons Inc., New York.

- Sethi, R. (2000). New Product Quality and Product Development Teams. *Journal of Marketing*, 64(2), 1-15.
- Sethi, R., & Iqbal, Z. (2008). Stage-gate Controls, Learning Failure, and Adverse Effect on Novel New Products. *Journal of Marketing*, 72(1), 118-134.
- Shafique, M. (2013). Thinking inside the box? Intellectual structure of the knowledge base of innovation research (1988–2008). *Strategic Management Journal*, 34(1), 62-93.
- Shah, R., & Goldstein, S. M. (2006). Use of structural equation modeling in operations management research: Looking back and forward. *Journal of Operations Management*, 24(2), 148-169.
- Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11(4), 448-469.
- Sheehan, K. B. (2001). E-mail Survey Response Rates: A Review. *Journal of Computer-Mediated Communication*, 6(2).
- Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: new procedures and recommendations. *Psychological methods*, 7(4), 422.
- Simon, E. S., McKeough, D. T., Ayers, A. D., Rinehart, E., & Alexia, B. (2003). How do you best organize for radical innovation? *Research Technology Management*, 46(5), 17-20.
- Simon, H. A. (1945). *Administrative behavior*. New York, NY: The Free Press.
- Simsek, Z., Veiga, J. F., & Lubatkin, M. H. (2005). *Challenges and guidelines for conducting Internet-based surveys in strategic management research*. In D. J. Kitchen, Jr. and D. D. Bergh (Eds.), *Research methodology in strategy and management*, pp. 179-196. San Diego, CA: Elsevier.
- Singh, G., & Tromp, N. (2011). *Design, Meanings and Radical Innovation: Designing for an informed future context*. Paper presented at the Diversity and unity: Proceedings of IASDR2011, the 4th World Conference on Design Research, Delft, the Netherlands.
- Sinkula, J., Baker, W., & Noordewier, T. (1997). A framework for market-based organizational learning: Linking values, knowledge, and behavior. *Journal of the Academy of Marketing Science*, 25(4), 305-318.
- Sivadas, E., & Dwyer, F. R. (2000). An Examination of Organizational Factors Influencing New Product Success in Internal and Alliance-Based Processes. *Journal of Marketing*, 64(1), 31-49.
- Slater, S. F., Mohr, J. J., & Sengupta, S. (2013). Radical Product Innovation Capability: Literature Review, Synthesis, and Illustrative Research Propositions. *Journal of Product Innovation Management*, 31(3), 1-15.
- Slater, S. F., & Narver, J. C. (1994). Does Competitive Environment Moderate the Market Orientation-Performance Relationship? *Journal of Marketing*, 58(1), 46-55.
- Slater, S. F., & Narver, J. C. (1995). Market Orientation and the Learning Organization. *Journal of Marketing*, 59(3), 63-74.
- Slater, S. F., & Narver, J. C. (1998). Customer-Led and Market-Oriented: Let's Not Confuse the Two. *Strategic Management Journal*, 19(10), 1001-1006.
- Slater, S. F., & Narver, J. C. (2000). Intelligence generation and superior customer value. *Journal of the Academy of Marketing Science*, 28(1), 120-127.
- Slater, S. F., & Olson, E. M. (2001). Marketing's contribution to the implementation of business strategy: an empirical analysis. *Strategic Management Journal*, 22(11), 1055-1067.
- Smith, K. A., Vasudevan, S. P., & Tanniru, M. R. (1996). Organizational learning and resource-based theory: an integrative model. *Journal of Organizational Change*, 9(6), 41-53.



- Smith, P. G., & Reinertsen, D. G. (1991). The Strategist's Role in Shortening Product Development. *Journal of Business Strategy*, 12(4), 18-22.
- Smith, P. G., & Reinertsen, D. G. (1992). Shortening the product development cycle. *Research Technology Management*, 35(3), 44-49.
- Song, X. M., & Montoya-Weiss, M. M. (1998). Critical Development Activities for Really New versus Incremental Products. *Journal of Product Innovation Management*, 15, 124-135.
- Song, X. M., Montoya-Weiss, M. M., & Schmidt, J. B. (1997). The Role of Marketing in Developing Successful New Products in South Korea and Taiwan. *Journal of International Marketing*, 5(3), 47-69.
- Song, X. M., & Parry, M. E. (1996). What Separates Japanese New Product Winners from Losers. *Journal of Product Innovation Management*, 13(5), 422-439.
- Song, X. M., & Parry, M. E. (1997a). The Determinants of Japanese New Product Successes. *Journal of Marketing Research*, 34(1), 64-76.
- Song, X. M., & Parry, M. E. (1997b). A Cross-National Comparative Study of New Product Development Processes: Japan and the United States. *Journal of Marketing*, 61(2), 1-18.
- Song, X. M., & Swink, M. (2009). Marketing & Manufacturing Integration Across Stages of New Product Development: Effects on the Success of High- and Low-Innovativeness Products. *Engineering Management, IEEE Transactions on*, 56(1), 31-44.
- Sorescu, A. B., Chandy, R. K., & Prabhu, J. C. (2003). Sources and Financial Consequences of Radical Innovation: Insights from Pharmaceuticals. *The Journal of Marketing*, 67(4), 82-102.
- Spanjol, J., Tam, L., Qualls, W. J., & Bohlmann, J. D. (2011). New Product Team Decision Making: Regulatory Focus Effects on Number, Type, and Timing Decisions\*. *Journal of Product Innovation Management*, 28(5), 623-640.
- Stanko, M. A., Molina Castillo, F. J., & Munuera Aleman, J. L. (2012). Speed to Market for Innovative Products: Blessing or Curse? *Journal of Product Innovation Management*, 29(5), 751-765.
- Stanton, J. M. (1998). An Empirical Assessment of Data Collection Using the Internet. *Personnel Psychology*, 51(3), 709-725.
- Steenkamp, J.-B. E. M., & van Trijp, H. C. M. (1991). The use of LISREL in validating marketing constructs. *International Journal of Research in Marketing*, 8(4), 283-299.
- Stevens, E. (2014). Fuzzy front-end learning strategies: Exploration of a high-tech company. *Technovation*.
- Stevens, G., Burley, J., & Divine, R. (1998). Profits and Personalities: Relationships Between Profits from New Product Development and Analyst's Personalities. *Product Development Management Proceedings*, 157-175.
- Stevens, G., Burley, J., & Divine, R. (1999). Creativity Business Discipline = Higher Profits Faster from New Product Development. *Journal of Product Innovation Management*, 16(5), 455-468.
- Stevens, G. A., & Burley, J. (2003). Piloting the rocket of radical innovation. *Research-Technology Management*, 46(2), 16-25.
- Stiles, J. (2003). A philosophical justification for a realist approach to strategic alliance research. *Qualitative Market Research: An International Journal*, 6(4), 263-271.
- Stock, G. N., Greis, N. P., & Fischer, W. A. (2001). Absorptive capacity and new product development. *The Journal of High Technology Management Research*, 12(1), 77-91.

- Stock, R. M., & Zacharias, N. A. (2013). Two Sides of the Same Coin: How Do Different Dimensions of Product Program Innovativeness Affect Customer Loyalty? *Journal of Product Innovation Management*, 30(3), 516-532.
- Stokes, S. L. (1991). *Controlling the future: Managing technology-driven change*. Boston: QED Information Sciences, Inc.
- Stolper, M., Blut, M., & Holzmueller, H. H. (2009). *Market Driving and Firm Performance*. International Marketing Trends Congress. Paris.
- Story, V., Hart, S., & O'Malley, L. (2009). Relational resources and competences for radical product innovation. *Journal of Marketing Management*, 25(5-6), 461-481.
- Strauss, A. L., & Corbin, J. (1990). Basics of qualitative research: grounded theory procedures and research. *New-bury Park: CA, Sage*.
- Stringer, R. (2000). How to Manage Radical Innovation. *California Management Review*, 42(4), 70-88.
- Sun, P. Y. T., & Anderson, M. H. (2010). An Examination of the Relationship between absorptive capacity and organizational learning, and a proposed integration. *International Journal of Management Reviews*, 130-150.
- Suwannaporn, P., & Speece, M. (2003). Marketing research and new product development success in Thai food processing. *Agribusiness*, 19(2), 169-188.
- Suwannaporn, P., & Speece, M. (2010). Assessing new product development success factors in the Thai food industry. *British Food Journal*, 112(4), 364-386.
- Swanson, E. B. (1994). Churchman's Theory of Design Integrity. *Interfaces*, 24(4), 54-59.
- Swink, M. (2003). Completing projects on-time: how project acceleration affects new product development. *Journal of Engineering and Technology Management*, 20(4), 319-344.
- Szulanski, G. (1996). Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic management journal*, 17, 27-43.
- Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics, (4th Edition)*. Boston: Pearson Education
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics, (5th Edition)*. Boston: Pearson Education
- Tallman, S. (2005). Forming and Managing Shared Organization Ventures: Resources and Transaction Costs. In D. Faulkner & M. De Rond (Eds.) *Cooperative Strategy: Economic, Business, and Organizational Issues*. Oxford University Press.
- Tashakkori, A., & Creswell, J. W. (2008). Editorial: Mixed methodology across disciplines. *Journal of mixed methods research*, 2(1), 3-6.
- Tatikonda, M. V., & Montoya-Weiss, M. M. (2001). Integrating operations and marketing perspectives of product innovation: The influence of organizational process factors and capabilities on development performance. *Management Science*, 47(1), 151-172.
- Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.
- Tellis, G. J. (2006). Disruptive Technology or Visionary Leadership. *Journal of Product Innovation Management*, 23, 34-38.
- Tellis, G. J., Prabhu, J. C., & Chandy, R. K. (2009). Radical innovation across nations: the preeminence of corporate culture. *Journal of Marketing*, 73(1), 3-23.
- Tenenhaus, M., Vinzi, V. E., Chatelin, Y.-M., & Lauro, C. (2005). PLS path modeling. *Computational Statistics & Data Analysis*, 48(1), 159-205.

- Tessarolo, P. (2007). Is Integration Enough for Fast Product Development? An Empirical Investigation of the Contextual Effects of Product Vision\*. *Journal of Product Innovation Management*, 24(1), 69-82.
- Thailand Board of Investment. (2012, 10 December). Thailand: The Detroit of South East Asia. Retrieved 26 December, 2012, from <http://us.industrysourcing.com/articles/260147.aspx>
- Thailand Board of Investment. (2013). Why Thailand? Retrieved 26 June, 2011, from [http://www.boi.go.th/tir/issue/201302\\_23\\_2/4.htm](http://www.boi.go.th/tir/issue/201302_23_2/4.htm)
- The World Bank. (2011). Thailand Overview. Retrieved 26 June, 2011, from <http://www.worldbank.org/en/country/thailand/overview>
- Thomas, R. J. (1993). *New product development: Managing and Forecasting for Strategic Success*. New York: John Wiley & Sons.
- Thomke, S., & von Hippel, E. (2002). Customers as Innovators: A New Way to Create Value. *Harvard Business Review*, April, 5-11.
- Thompson, L. F., Surface, E. A., Martin, D. L., & Sanders, M. G. (2003). From paper to pixels: Moving personnel surveys to the Web. *Personnel Psychology*, 56(1), 197-227.
- Treacy, M. (2004). Innovation as a Last Resort. *Harvard Business Review*, 82 (7/8), 29-30.
- Tripsas, M. (2000). Commercializing Emerging Technology through Complementary Assets. In Day, G S & Schoemaker, P. J. H. (Eds.), *Wharton on Managing Emerging Technologies* (pp. 172-186). New York: Wiley.
- Troilo, G., De Luca, L. M., & Atuahene-Gima, K. (2013). More Innovation with Less? A Strategic Contingency View of Slack Resources, Information Search, and Radical Innovation. *Journal of Product Innovation Management*, 31(2), 1-19.
- Tsai, W. (2001). Knowledge Transfer in Intraorganizational Networks: effects of network position and absorptive capacity on business unit innovation and performance. *The Academy of Management Journal*, 44(5), 996-1004.
- Tuominen, M., Rajala, A., & Moller, K. (2004). Market-driving Versus Market-driven: Divergent Roles of Market Orientation in Business Relationships. *Industrial Marketing Management*, 33, 207-217.
- Tushman, M., & Anderson, P. (1986). Technological Discontinuities and Organizational Environments. *Administrative Science Quarterly*, 31(3), 439-465.
- Ulrich, K. T., & Eppinger, S. D. (1995). *Product Design and Development*. New York: McGraw-Hill, Inc.
- Ulwick, A. W. (2002). Turn Customer Input into Innovation. *Harvard Business Review*, January, 5-11.
- Urban, G. L., & Hauser, J. R. (1980). *Design and Marketing of New Products*. Englewood Cliffs, NJ: Prentice-Hall.
- Urban, G. L., & Hauser, J. R. (1993). *Design and Marketing of New Products, 2nd Edition*. Englewood Cliffs, NJ: Prentice-Hall.
- Urban, G. L., & von Hippel, E. (1988). Lead user analyses for the development of new industrial products. *Management Science*, 34(5), 569-582.
- Utterback, J. M. (1994). *Mastering the Dynamics of Innovation: How Companies can Seize Opportunities in the Face of Technological Change*. Boston, MA: Harvard Business School Press.
- Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. *Omega*, 3(6), 639-656.
- Van den Bosch, F. A. J., Volberda, H. W., & de Boer, M. (1999). Coevolution of Firm Absorptive Capacity and Knowledge Environment: Organizational Forms and Combinative Capabilities. *Organization Science*, 10(5), 551-568.

- Van Fraassen, B. C. (1980). *The scientific image*: Oxford: Oxford University Press.
- Van Oorschot, K., Sengupta, K., Akkermans, H., & Van Wassenhove, L. (2010). Get Fat Fast: Surviving Stage-Gate® in NPD. *Journal of Product Innovation Management*, 27(6), 828-839.
- Varadarajan, P. R. (1996). From the editor: Reflections on research and publishing. *Journal of Marketing*, 60(October), 3-6.
- Varadarajan, P. R. (2009). Fortune at the Bottom of the Innovation Pyramid: The Strategic Logic of Incremental Innovations. *Business Horizon*, 52, 21-29.
- Venkataraman, S. (1997). The distinctive domain of entrepreneurship research. *Advances in Entrepreneurship, Firm Emergence and Growth*, 3, 119-138.
- Venkataraman, N., & Ramanujam, V. (1986). Measurement of business performance in strategy research: a comparison of approaches. *Academy of management review*, 11(4), 801-814.
- Verganti, R. (1997). Leveraging on systemic learning to manage the early phases of product innovation projects. *R&D Management*, 27(4), 377-392.
- Verganti, R. (2008). Design, Meanings, and Radical Innovation: A Metamodel and a Research Agenda. *Journal of Product Innovation Management*, 25, 436-456.
- Verganti, R. (2009). *Design-Driven Innovation: Changing the Rules of Competition by Radically Innovating What Things Mean*. Boston, MA: Harvard Business Press.
- Verhees, F. J. H. M., & Meulenbergh, M. T. G. (2004). Market Orientation, Innovativeness, Product Innovation, and Performance in Small Firms. *Journal of Small Business Management*, 42(2), 134-154.
- Verona, G. (1999). A Resource-Based View of Product Development. *The Academy of Management Review*, 24(1), 132-142.
- Verworn, B. (2009). A structural equation model of the impact of the "fuzzy front end" on the success of new product development. *Research Policy*, 38, 1571-1581.
- Verworn, B., & Herstatt, C. (1999). Approaches to the "fuzzy front end" of innovation: Working Papers/Technologie-und Innovationsmanagement, Technische Universität Hamburg-Harburg.
- Verworn, B., & Herstatt, C. (2001). Managing the fuzzy front end of innovation: Working Paper, Department of Technology and Innovation Management, Technical University of Hamburg.
- Verworn, B., Herstatt, C., & Nagahira, A. (2008). The fuzzy front end of Japanese new product development projects: impact on success and differences between incremental and radical projects. *R&D Management*, 38(1), 1-19.
- Veryzer, R. W. (1998a). Discontinuous Innovation and the New Product Development Process. *Journal of Product Innovation Management*, 15, 304-321.
- Veryzer, R. W. (1998b). Key Factors Affecting Customer Evaluation of Discontinuous New Products. *Journal of Product Innovation Management*, 15, 136-150.
- Vincent, L. (2008). Differentiating Competence, Capability and Capacity. *Innovating Perspectives*, 16(3), 1-2.
- Vinding, A. L. (2006). Absorptive capacity and innovative performance: A human capital approach. *Economics of Innovation & New Technology*, 15(4/5), 507-517.
- von Hippel, E. (1978). Successful Industrial Products from Customer Ideas. *Journal of Marketing*, 42(1), 39-49.
- von Hippel, E. (1986). Lead Users: A Source of Novel Product Concepts. *Management Science*, 32, 791-805.
- von Hippel, E. (1989). New product ideas from lead users. *Research Technology Management*, 32(3), 24-27.

- von Hippel, E., Thomke, S., & Sonnack, M. (2000). Creating Breakthroughs At 3M. *Health Forum Journal*, July/August.
- Wang, C. L., & Ahmed, P. K. (2007). Dynamic capabilities: A review and research agenda. *International Journal of Management Reviews*, 9(1), 31-51.
- Wattanasupachoke, T. (2012). Design Thinking, Innovativeness and Performance: An Empirical Examination. *International Journal of Management & Innovation*, 4(1), 1-16.
- Weber, R. (2004). Editor's comments: the rhetoric of positivism versus interpretivism: a personal view. *MIS Q.*, 28(1), iii-xii.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171-180.
- Westerlund, M., & Rajala, R. (2010). Learning and innovation in inter-organizational network collaboration. *Journal of Business & Industrial Marketing*, 25(6), 435-442.
- Wetzels, M., Odekerken-Schroder, G., & Van Oppen, C. (2009). Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration. *MIS Quarterly*, 33(1), 177-195.
- Wheelwright, S. C., & Clark, K. B. (1992). *Revolutionizing Product Development: Quantum Leaps in Speed, Efficiency, and Quality*: Free Press.
- Williams, A. (2013). Thailand's internet users set to double. Retrieved 5 January, 2013, from <http://investvine.com/thailands-internet-users-set-to-double/>
- Wind, J., & Mahajan, V. (1997). Issues and Opportunities in New Product Development: An Introduction to the Special Issue. *Journal of Marketing Research*, 34(1), 1-12.
- Winter, S. G. (2000). The satisficing principle in capability learning. *Strategic Management Journal*, 21(10), 981-996.
- WIPO. (2008). Women Inventors Awarded a WIPO Medal or other Distinction. *The World Intellectual Property Organization (WIPO)*. Retrieved 19 June, 2010, from <http://www.wipo.int/ip-outreach/en/awards/women/year.html>
- WIPO. (2009). King of Thailand Receives WIPO Award for Contribution to Intellectual Property. *WIPO Press Releases: World Intellectual Property Organization*. Retrieved 16 June, 2010, from [http://www.wipo.int/pressroom/en/articles/2009/article\\_0001.html](http://www.wipo.int/pressroom/en/articles/2009/article_0001.html)
- Wold, H. (1975). Path models with latent variables: The NIPALS approach. *Quantitative Sociology: International perspectives on mathematical and statistical model building*.
- Wright, K. B. (2005). Researching Internet-Based Populations: Advantages and Disadvantages of Online Survey Research, Online Questionnaire Authoring Software Packages, and Web Survey Services. *Journal of Computer-Mediated Communication*, 10(3).
- Yap, C. M., & Souder, W. E. (1994). Factors Influencing New Product Success and Failure in Small Entrepreneurial High-Technology Electronics Firms. *Journal of Product Innovation Management*, 11, 418-432.
- Youngsuksathaporn, P. (2005). Innovation in Thai Government. In S. L. Emery, W. Ellis & M. Chulavatnatol (Eds.), *Thailand Competitive Innovation Strategies* (pp. 113-149): National Innovation Agency.
- Zahra, S. A. (1996). Technology strategy and financial performance: Examining the moderating role of the firm's competitive environment. *Journal of Business Venturing*, 11(3), 189-219.
- Zahra, S. A., & George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, and Extension. *The Academy of Management Review*, 27(2), 185-203.

- Zahra, S. A., Sapienza, H. J., & Davidson, P. (2006). Entrepreneurship and Dynamic capabilities: A Review, Model and Research Agenda. *Journal of Management Studies*, 43(4), 917-955.
- Zhang, J., & Duan, Y. (2010). The impact of different types of market orientation on product innovation performance. *Management Decision*, 48(6), 849-867.
- Zhang, Q., & Doll, W. J. (2001). The fuzzy front end and success of new product development: a casual model. *European Journal of Innovation Management*, 4(2), 95-112.
- Zhou, K. Z. (2006). Innovation, imitation, and new product performance: The case of China. *Industrial Marketing Management*, 35(3), 394-402.
- Zhou, K. Z., & Wu, F. (2010). Technological capability, strategic flexibility, and product innovation. *Strategic Management Journal*, 31, 547-561.
- Zhou, K. Z., Yim, C. K., & Tse, D. K. (2005). The Effects of Strategic Orientations on Technology- and Market-Based Breakthrough Innovations. *Journal of Marketing*, 69(2), 42-60.
- Zikmund, W. G. (2000). *Business Research Methods (6th Edition)*. Chicago, IL: The Dryden Press.
- Zikmund, W. G., & Babin, B. J. (2007). *Exploring Marketing Research (9th Edition)*. USA: Thomson South-Western.
- Zirger, B. J., & Maidique, M. A. (1990). A model of new product development: an empirical test. *Management Science*, 36 (7), 867-883.
- Zollo, M., & Winter, S. G. (2002). Deliberate Learning and The Evolution of Dynamic Capabilities. *Organization Science*, 13(3), 339-351.
- Zortea-Johnston, E., Darroch, J., & Matear, S. (2012). Business orientations and innovation in small and medium sized enterprises. *International Entrepreneurship and Management Journal*, 8(2), 145-164.
- Zou, S., & Cavusgil, S. T. (2002). The GMS: A Broad Conceptualization of Global Marketing Strategy and Its Effect on Firm Performance. *Journal of Marketing*, 66(4), 40-56.

# APPENDICES

## Appendix 1: Project Information Statement

(Both English and Thai languages)



School of Economics, Finance and Marketing  
College of Business

Building 80, Level 11  
445 Swanston Street  
Melbourne VIC 3000  
Australia

GPO Box 2476V  
Melbourne VIC 3001  
Australia

Tel. +61 3 9925 1474  
Fax +61 3 9925 5986

[www.rmit.edu.au](http://www.rmit.edu.au)

### INVITATION TO PARTICIPATE IN A RESEARCH PROJECT

### PROJECT INFORMATION STATEMENT

***Project Title:***

Market-driving Innovation: Understanding the Critical Success Factors at the Front End of Development Process

***Investigators:***

- Onnida Thongpravati, BBA (eCom), MBA IT  
Candidate for Doctor of Philosophy (Marketing), RMIT University  
Ph: +61 3 9925 5926  
Email: [onnida.thongpravati@rmit.edu.au](mailto:onnida.thongpravati@rmit.edu.au)
- Assoc Professor Mike Reid, PhD (Otago)  
Research Supervisor, RMIT University  
Ph: +61 3 9925 1474  
Email: [mike.reid@rmit.edu.au](mailto:mike.reid@rmit.edu.au)

---

Dear Manager,

You are invited to participate in a research project being conducted by RMIT University. We are required by the University to provide you with this more detailed overview of the project.

The project relates to the management of product innovation and some of the factors that make it successful. This information sheet describes the project in straightforward language. If you have any questions about the project, please email or call Dr Mike Reid.

***Who is involved in this research project? Why is it being conducted?***

This research project is being conducted by Onnida Thongpravati, as part of a Doctor of Philosophy degree, under the supervision of Associate Professor Mike Reid. Both researchers are based in the School of Economics, Finance and Marketing at RMIT University. The project designed to investigate the critical success factors in developing and commercialising innovative new products. This project has been approved by the RMIT University Human Research Ethics Committee (project number 1000360).

***Why have you been approached?***

The success of this project relies upon receiving insights from managers with experience in developing and commercialising new products. We have therefore sent this survey to you as someone who has experience in this area and as someone who is able to shed light on the activities associated with the front end of innovation.

***What is the project about? What are the questions being addressed?***

The project is focused on very innovative new products or innovations and is also focused on the front end of the product innovation process. Managing the front end of the new-product development (NPD) process, or the fuzzy front end (FFE), can be a difficult and challenging task for firms, particularly for radical or really-new innovations. In particular being able to maintain the integrity of an innovative idea through concept development and testing, and into production and launch, seems to be a significant issue for managers.

This study aims to investigate the role of several emerging innovation concepts that shape breakthrough innovation and integrity including market visioning, market visioning competence and absorptive capacity (information and knowledge management). Whilst there are many factors that shape success, the ones we focus on appear to be gaining some prominence in both the managerial and academic research literature. The key aims of the project are:

1. To investigate the significance of market visioning competence and market vision on the front end success of breakthrough-type products;
2. To investigate the significance of absorptive capacity on the effectiveness of market visioning competence and market vision for breakthrough-type products;
3. To understand how the above relationships are moderated by NPD team's intuitive decision making, the level of NPD process rigidity and the level of customer involvement inherent in the NPD process and the nature of the external environment.

We hope to have results from at least 200 managers in order to be able to draw some useful conclusions about breakthrough product innovation success.

***If I agree to participate, what will I be required to do?***

If you agree to participate in this study you will be asked to complete associated online questionnaire. It is expected that the questionnaire will take approximately 15 -20minutes to complete. In order to complete the questionnaire just click on the link provided and it will take you to the host site. Alternatively if you wish for a hard copy please contact Onnida and one will be sent to you via email.

We are using Qualtrics Survey Software as the host for this project. Qualtrics is supported by RMIT University and allows us to create a customised survey and e-mail participants with a unique URL link that directly tied to the survey.

Please note that every time you hit the "Continue" or "Back" button in the survey, your current progress is saved automatically. Ideally we would like you to complete the survey in one go. If you have to exit temporarily you can just begin pick up where you left off by clicking on the same survey link.



Once you have completed the online questionnaire, please click the “Submit” button at the end of the survey.

***What are the risks or disadvantages associated with participation?***

Users should be aware that the World Wide Web is an insecure public network with the potential risks that a user’s transactions are being or may be viewed, intercepted or modified by third parties or that data which the a user downloads may contain computer viruses or other defects. However, completing the questionnaire does not present any perceived risks outside your normal daily activities. All data will be de-identified and no respondents or companies will be identified during the research.

***What are the benefits associated with participation?***

While there may not be any direct benefits to you as a result of participating in this study, it is expected that the information from this research will contribute to a better understanding of the development of market-driving innovation by advancing its early performance during concept generation and evaluation, and commercial success. Therefore, this research may help to increase the chances of profitable outcomes to your company.

We do recognise that we are asking for your time and your insights and would like to offer a small token of our appreciation.

- Firstly a management report on the findings. This would be returned quickly to you once the data has been collected and analysed.
- A \$2 donation to the Children’s Starlight Foundation for every fully completed questionnaire received. This is funded by both myself and Dr Reid and not part of any grant or university monies.

***What will happen to the information I provide?***

Your participation in this study will remain anonymous and you will not be personally identified in any subsequent reports, publications or presentations arising from the study. All data is analyzed at the aggregate level. All the information that you provide is strictly controlled at every stage of the investigation, meaning that it will only be accessible to myself and Dr Reid; the identified researchers.

If you agree to participate in this survey, the responses you provide to the survey will initially be stored on a host server that is used by Qualtrics. No personal information will be collected in the survey so none will be stored as data. Once we have completed our data collection we will import the data we collect to the RMIT server where it will be stored securely for a period of five (5) years. The data on the Qualtrics host server will then be deleted and expunged.

Any paper files will be kept in a locked filing cabinet of the research supervisor within the School of Economics, Finance and Marketing at RMIT University. All information will be kept securely for five (5) years before being destroyed. Any information that you provide can be disclosed to other parties only if (1) it is to protect you or others from harm, (2) a court order is produced, or (3) you provide the researchers with written permission. It is expected that the results of the research will be disseminated via the Principal Investigator’s doctoral thesis and through publication in peer reviewed academic journals.

**What are my rights as a participant?**


Participation in this study is completely voluntary and there is no obligation for you to take part. You have the right to withdraw your participation at any time, without prejudice. However, please note, once you have returned the questionnaire, it will not be possible to remove it if you decide not to participate. Throughout the study, you have the right to have any questions answered at any time.

**Whom should I contact if I have any questions?**

If you have any questions or would like more information about this study, please do not hesitate to contact either Onnida Thongpravati or Mike Reid, and discuss your concerns confidentially.

Thank you so much in advance upon your contribution to this research.

Yours Sincerely



Onnida Thongpravati  
BBA(eCom), MBA IT  
+61 3 9925 5926  
onnida.thongpravati@rmit.edu.au



Associate Professor Mike Reid  
(BCom, PhD, Otago)  
+61 3 9925 1474  
mike.reid@rmit.edu.au

If you have any complaints about the conduct of this research project, please contact the Chair, RMIT Business College Human Ethics Advisory Network, GPO Box 2476V, Melbourne, 3001, telephone +61 3 9925 5596, email [bchean@rmit.edu.au](mailto:bchean@rmit.edu.au) Details of the complaints procedures are available at <http://www.rmit.edu.au/browse:ID=2jqmb7hnpyo>

ขอความร่วมมือในการให้ข้อมูลแก่โครงการวิจัย

เอกสารแนะนำโครงการ

---

**ชื่อโครงการ (Project Title):**

**Market-driving Innovation: Understanding the Critical Success Factors at the Front End of Development Process**

**ผู้วิจัย :**

- นส. อรณิดา ทองประวัตติ, BBA (eCom), MBA IT  
Candidate for Doctor of Philosophy (Marketing), RMIT University  
Ph: +61 3 9925 5926  
Email: [onnida.thongpravati@rmit.edu.au](mailto:onnida.thongpravati@rmit.edu.au)
  - รศ. Mike Reid, PhD (Otago)  
อาจารย์ที่ปรึกษา RMIT University  
Ph: +61 3 9925 1474  
Email: [mike.reid@rmit.edu.au](mailto:mike.reid@rmit.edu.au)
- 

**เรียน ท่านผู้บริหาร**

ขอเชิญท่านเข้าร่วมโครงการวิจัย ซึ่งจัดทำโดย มหาวิทยาลัย RMIT (*RMIT University, Australia*) มหาวิทยาลัยมีความประสงค์ในการจัดเตรียมเนื้อหาเบื้องต้นเกี่ยวกับการวิจัยโครงการนี้

วัตถุประสงค์ของโครงการวิจัยนี้ เพื่อศึกษาการจัดการนวัตกรรมของผลิตภัณฑ์ (Product innovation) และปัจจัยที่ทำให้การจัดการนวัตกรรมของผลิตภัณฑ์ประสบความสำเร็จ เอกสารแนบฉบับนี้ได้อธิบายถึงโครงการวิจัยไว้อย่างตรงไปตรงมา อย่างไรก็ตามหากท่านมีข้อสงสัยเกี่ยวกับงานวิจัยนี้ กรุณาติดต่อทางอีเมล หรือโทรถึง รศ. Mike Reid.

**คณะผู้วิจัยและที่มาของโครงการ**

ผู้ทำวิจัยคือ นส.อรณิดา ทองประวัตติ ในฐานะเป็นส่วนหนึ่งของการศึกษาปริญญาเอก ภายใต้การดูแลของ รศ. Mike Reid. ซึ่งบุคคลทั้งสองประจำการอยู่ที่ School of Economics, Finance and Marketing มหาวิทยาลัย RMIT โครงการนี้ต้องการศึกษาปัจจัยแห่งความสำเร็จในการพัฒนาผลิตภัณฑ์ และการนำออกสู่ตลาดของผลิตภัณฑ์ใหม่ โครงการวิจัยนี้ได้รับการอนุมัติจากคณะกรรมการด้านจริยธรรมในการวิจัยทรัพยากรมนุษย์ของมหาวิทยาลัย RMIT (โครงการหมายเลขที่ 1003360).

### เหตุผลในการขอความคิดเห็นของผู้บริหาร

ความสำเร็จของโครงการขึ้นอยู่กับความเข้าใจอย่างลึกซึ้งของผู้บริหารผู้มีประสบการณ์ในการพัฒนาและนำผลิตภัณฑ์ใหม่ออกสู่ตลาดในการให้ข้อมูลแก่ผู้วิจัย ดังนั้นเราจึงได้จัดส่งแบบสอบถามนี้ถึงท่าน เพราะท่านคือหนึ่งในผู้บริหารที่มีประสบการณ์ในสาขาวิชานี้และเพราะท่านคือผู้ที่ให้ความกระจ่างเกี่ยวกับกิจกรรมเบื้องต้นสำหรับนวัตกรรมต่างๆ

### วัตถุประสงค์ของโครงการวิจัยและข้อคำถามที่จะสอบถาม

โครงการวิจัยนี้มุ่งเน้นเรื่องผลิตภัณฑ์หรือนวัตกรรมชนิดใหม่อย่างแท้จริง รวมถึงให้ความสำคัญกับกระบวนการพัฒนาผลิตภัณฑ์ใหม่ตั้งแต่ขั้นเริ่มต้น (Front end). ซึ่งการบริหารจัดการพัฒนาผลิตภัณฑ์ใหม่ตั้งแต่ขั้นเริ่มต้นอาจเป็นกระบวนการที่ยุ่ยากซับซ้อนในขั้นแรกของกระบวนการผลิต แต่ถือได้ว่าเป็นงานที่ทำหายสำหรับบริษัท โดยเฉพาะการพัฒนาผลิตภัณฑ์ชนิดใหม่อย่างสิ้นเชิง และการรักษาความสมบูรณ์ของนวัตกรรม ตั้งแต่การพัฒนาแนวคิด การทดสอบการผลิต จนถึงการนำออกสู่ตลาด ซึ่งดูเหมือนจะเป็นประเด็นสำคัญสำหรับนักบริหาร.

โครงการวิจัยนี้มีเป้าหมายในการสำรวจบทบาททางความคิดของนวัตกรรมต่างๆที่ก่อให้เกิดนวัตกรรมชนิดที่เพิ่งค้นพบ (Breakthrough Innovations) และความสมบูรณ์ของนวัตกรรม รวมทั้ง ยกระดับทางการตลาด สมรรถนะด้านวิสัยทัศน์ทางการตลาด และความสามารถที่คอยๆสั่งสม (การประมวลผลข้อมูลและการจัดการความรู้) ถึงแม้ว่าจะมีปัจจัยหลายด้านที่ทำให้ประสบความสำเร็จ แต่ปัจจัยหลักที่เราให้ความสำคัญนั้นเหมือนว่าเด่นชัดออกมาในทั้งทางด้านการบริหารจัดการ และการวิจัยวิทยานิพนธ์.

### วัตถุประสงค์หลักของโครงการวิจัย มี 3 ข้อดังนี้ คือ:

1. เพื่อสำรวจความสำคัญของการมีสมรรถนะด้านวิสัยทัศน์การตลาด (Market visioning competence) และวิสัยทัศน์ทางการตลาด ต่อความสำเร็จในกระบวนการพัฒนาผลิตภัณฑ์ใหม่ตั้งแต่ขั้นเริ่มต้น (Front end) ของผลิตภัณฑ์ที่ใช้นวัตกรรมที่เพิ่งค้นพบ (Breakthrough-type products).
2. เพื่อสำรวจความสำคัญของความสามารถที่คอยๆสั่งสมไว้ (Absorptive Capacity) ต่อประสิทธิภาพของสมรรถนะหลักด้านวิสัยทัศน์ทางการตลาด และวิสัยทัศน์ทางการตลาดที่ใช้นวัตกรรมที่เพิ่งค้นพบ (Breakthrough-type products).
3. เพื่อทำความเข้าใจถึงปัจจัยดังต่อไปนี้ การหยั่งรู้โดยสัญชาตญาณในการตัดสินใจของทีมพัฒนาผลิตภัณฑ์ใหม่ ระดับความไม่ยืดหยุ่นของกระบวนการพัฒนาผลิตภัณฑ์ และระดับความซิงเกียของลูกค้าในการร่วมกระบวนการพัฒนาผลิตภัณฑ์ใหม่ รวมถึงลักษณะของสภาพแวดล้อมธุรกิจภายนอก ที่มีผลกระทบต่อความสัมพันธ์ที่ได้กล่าวในข้อ 1 และข้อ 2.

ผู้วิจัยมุ่งหวังที่จะได้รับผลวิจัยจากผู้บริหารอย่างน้อย 200 ราย เพื่อที่จะสามารถดึงเอาบทสรุปที่มีประโยชน์เกี่ยวกับความสำเร็จของผลิตภัณฑ์นวัตกรรมที่เพิ่งค้นพบ.

### ความร่วมมือในการให้ข้อมูล

หากท่านมีความประสงค์ที่จะตอบแบบสอบถามนี้ท่านจะต้องกรอกข้อมูลในแบบสอบถามออนไลน์ซึ่งใช้เวลาเพียง 15-20 นาทีใน **โดยกดที่ลิงค์ที่แนบมา** ซึ่งจะนำท่านเข้าสู่ **เว็บหลัก**

นี้ใช้โปรแกรม Qualtrics Survey Software ที่ได้รับการสนับสนุนจากมหาวิทยาลัย RMIT  
e-mail URL สำหรับการเชื่อมโยง เพื่อการสำรวจนี้โดยเฉพาะ

\_\_\_\_\_ ทุกครั้งที่ท่านกดปุ่ม “Continue” “Back” นี้ ข้อมูลของท่าน  
ในครั้งเดียว แต่หากท่านจำ  
ที่จะหะ ชั่วคราว ท่านสามารถกรอกแบบสอบถามต่อจากจุดที่ท่านทำ  
. เพื่อความสมบูรณ์การกรอกแบบสอบถามในครั้งนี้ กรุณาคลิก “Submit” ที่ท้ายแบบสอบถาม  
เมื่อท่านกรอกข้อมูลออนไลน์เสร็จเรียบร้อยแล้ว .

### ความวิตกกังวลของผู้ตอบแบบสอบถาม

เพื่อประโยชน์อย่างอื่น  
จะถูกนำไปใช้เกี่ยวกับการรายงานวิจัยนี้เท่านั้น ทั้งนี้ทั้งนั้นจะไม่มีภาระ  
ทั้งสิ้น.

### ประโยชน์ที่ผู้ตอบแบบสอบถามจะได้รับในการให้ความร่วมมือในโครงการวิจัยครั้งนี้

ถึงแม้ว่าการตอบแบบสอบถามในโครงการวิจัยนี้อาจจะไม่มีผลประโยชน์  
ข้อมูลจากโครงการวิจัยนี้จะช่วย **ขึ้น** เกี่ยวกับพัฒนาการ  
ผลิตภัณฑ์ที่เกิดจากแรงผลักดันจากการตลาด (Market-driving) **ขึ้น**  
ดังนั้นงานวิจัยนี้อาจเป็นประโยชน์ในการเพิ่มไอ  
สิ่งทดแทนน้ำใจได้

ต่อไปนี้

- รายงานสรุปของผู้บริหาร ซึ่งจะส่งกลับให้ท่านทันทีที่ข้อมูลได้รับการรวบรวมและวิเคราะห์เสร็จสิ้นลง
- ร่วมกันทำบุญ เมื่อท่านกรอกแบบสอบถามเสร็จสิ้น

เงินบริจาค 2 ออสเตอร์เลียดอลลาร์ต่อแบบสอบถาม

Children’s Starlight Foundation ซึ่งเป็นเงินบริจาคส่วนตัวของนางสาว อ:

และอาจารย์ที่ปรึกษา รฟ . Mike Reid

( ~ 1 € = 33 )

### การจัดการกับข้อมูลที่ได้รับ

ข้อมูลที่ท่านกรอกออนไลน์จะเก็บดู  
ทั้งนี้ ผู้ที่จัดการข้อมูลปะนั้น  
อาจารย์ที่ปรึกษาท่านนั้น.

ข้อมูลที่ท่านกรอกออนไลน์ จ Host Server Qualtrics เมื่อกร  
สิ้นเร็ว Server RMIT ซึ่งจะเก็บรักษาไว้เป็  
5 ปี หลังจากนั้น Host Server Qualtrics จะถูกลบทิ้งทั้งสิ้น.

ข้อมูลที่เป็นเอกสาร (Paper files) ในตู้เอกสารของอาจารย์ที่ปรึกษา ที่ School  
of Economics, Finance and Marketing RMIT เวลา 5 ปี หลังๆ นั้นเอ ทั้งหมด  
เปิดเผยได้ต่อเมื่อ (1) เพื่อเป็นการปกป้องผู้กรอกแบบสอบถามหรือผู้อื่นจากอันตราย (2)  
ตามคำสั่งหมายศาล (3)  
ยิ่งว่า ผลการวิจัยครั้งนี้จะได้รั รวมทั้งก

### สิทธิของผู้ตอบแบบสอบถาม

ในการวิจัยครั้งนี้ เกิดขึ้นจ ทั้งสิ้น ไม่มีพั  
ในระยะเวลาที่ท่านกรอกแบบสอบถาม ท่านสามารถถาม  
ได้ตลอดเวลา และเมื่อท่านได้กรอกแบบสอบถามเสร็จสิ้นแล้ว ไม่สามารถเพิกถอนภายหลังได้.

### หากท่านมีคำถาม หรือข้อสงสัย

หรือต้องการข้อมูลเพิ่มเติม ก . Mike  
Reid ตามที่อยู่ เพื่อพูดคุยถึงข้อสงสัยของท่าน.

ความร่วมมือของท่าน เพื่อประโยชน์ในการศึกษาวิจัยครั้งนี้.

. Mike Reid

BBA(eCom), MBA IT

(BCom, PhD, Otago)

+61 3 9925 5926

+61 3 9925 1474

[onnida.thongpravati@rmit.edu.au](mailto:onnida.thongpravati@rmit.edu.au)

[mike.reid@rmit.edu.au](mailto:mike.reid@rmit.edu.au)

หากท่านมีข้อร้องเรียนเกี่ยวกับโครงการวิจัยในครั้งนี้ กรุณาติดต่อ the Chair, RMIT Business College Human Ethics Advisory  
Network, GPO Box 2476V, Melbourne, 3001. +61 3 9925 5596 Email: [bchean@rmit.edu.au](mailto:bchean@rmit.edu.au)  
รายละเอียดและขั้นตอนการร้องเรียน หาได้ที่ <http://www.rmit.edu.au/browse;ID=2jqrb7hnpyo>

## **Appendix 2: New Product Development Survey**

*(A bilingual instrument in English and Thai languages)*

### **NEW PRODUCT DEVELOPMENT SURVEY**

---

**REVIEW YOUR ORGANIZATIONAL VISIONING CAPABILITIES!**

**And receive a report on Factors Influencing Breakthrough Innovation Success**

**Investigating Breakthrough Innovation Success:  
A National Survey 2012**

**RMIT University**  
School of Economics, Finance and Marketing  
College of Business

*Supported by:*

**PDMA Australia**  
The Product Development and Management Association of Australia  
*Connecting Innovators Worldwide*

**Researchers:**

**Onnida Thongpravati  
Associate Prof Mike Reid**

## Survey Instructions

Thank you in advance for taking part in this study.

Your contribution and insights will help make this a successful and useful study.

In answering the questions, please think about the **breakthrough innovations** your company or Strategic Business Unit (SBU) has developed and commercialized in the last 3 years (whether or not they were successful), and in which you have actively participated.

**Our focus is on the Product innovation or New Product Development program rather than any one product.** In terms of making your judgements, please check the box that best represents "**how things actually are**" rather than on "how things ought to be".

### **What do we mean by "Breakthrough Innovation"?**

We define a breakthrough innovation as any product that you consider to be something quite **radical** or **really-new to the market in terms of its technology or the benefits offered to customers**.

More specifically a breakthrough innovation refers to one or more of the following:

- A product that has been developed using very new idea or very new technology that has never been used in the industry before, and/ or;
- A product that has caused significant changes in the industry or product category (e.g. 5 to 10 times improved benefits or 30% cost reduction compared with the previous generation), and/ or;
- A product that was one of the first of its kind introduced into the market, and/ or;
- A product that is considered to be highly innovative by commentators and competitors in the market.



## NEW PRODUCT DEVELOPMENT SURVEY

### SECTION 1: General Characteristics of Your Job, Company and Product Development Activities

#### Your Role:

Please state your formal job title:

1.1 How would you best describe the organization's structure of the company you work for?

- I work in a company with a single structure and only one NPD program for all products.
- I work within a division/ strategic business unit (SBU). Each SBU has its own approach to NPD and strategy formulation.

1.2 Does your job have a Marketing or R&D emphasis?

- Totally Marketing focused
- More Marketing focused than R&D
- Balanced Marketing and R&D
- More R&D focused than Marketing
- Totally R&D focused
- Other (Please specify)

1.3 How long have you held your current job?

- |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 1 - 3 years           | 4 - 6 years           | 7 - 10 years          | more than 10 years    |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

1.4 How long have you worked for this company?

- |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 1 - 3 years           | 4 - 6 years           | 7 - 10 years          | more than 10 years    |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

#### Your Company:

(Please answer as either a SBU or Company depending on your answer in question 1.1):

1.5 How many employees are there within your company or SBU?

- 1 - 20
- 21 - 40
- 41 - 60
- 61 - 100
- 101 - 200

- 201 - 500
- 500+

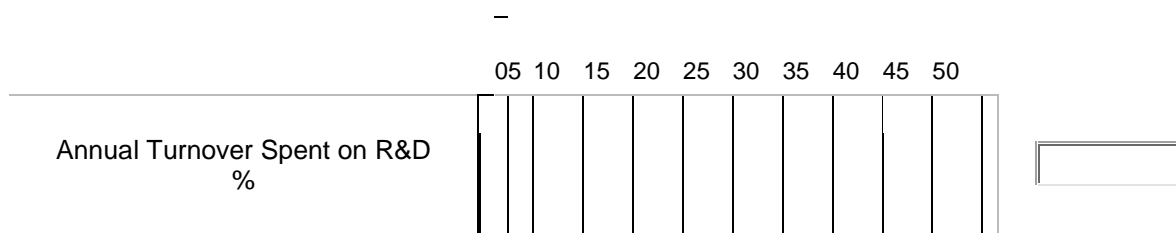
**1.6 Please indicate which of the following markets your company or SBU mainly competes in:**

- Consumer Packaged Goods (e.g. pet foods)
- Consumer Durable Goods (e.g. automobiles)
- Business to Business Industrial Goods (e.g. manufacturing equipment)
- Consumer Services (e.g. retail banking)
- Other (Please specify)

**1.7 Please indicate what the Annual Turnover (sales \$AUD) is for your SBU or company:**

- Under A\$1 million
- Between A\$1 million – A\$2 million
- Between A\$ 2.01 million – A\$3 million
- Between A\$ 3.01 million – A\$4 million
- Between A\$ 4.01 million – A\$5 million
- Between A\$ 5.01 million – A\$15 million
- Between A\$ 15.01 million – A\$25 million
- Between A\$ 25.01 million – A\$50 million
- Between A\$ 50.01 million – A\$100 million
- Above A\$100 million

**1.8 Please indicate what Percentage of Annual Turnover of your company or SBU spent on R&D**



**Organizing for Product Development:**

(Please answer as either a SBU or Company depending on your answer in question 1.1):

**1.9 Which of the following best describes the way the new product effort is structured in your company or SBU?**

- New product department with permanent staff members.
- Distinct division or venture group.

- A new product committee oversees all development efforts.
- Each business unit's general managers direct their own NPD efforts.
- A single function is responsible for NPD: (Please specify whether it is R&D, planning, marketing or engineering).

- A product development process owner helps deploy our process across the firm.
- Other (Please specify)

**1.10 Reflecting on your NPD activity over the last 3 years, please indicate how many new products of different types were introduced during that period:**

**Number of Radical Breakthrough Products**

Products that are **new** for **both** the **company** and the **marketplace**--a new line of business. These products are the first of their kinds, providing entirely new level of functionality to the customers (either offer 5-10 times improved benefits or 30% cost reduction compared with the previous generations). *An example includes the first consumer microwave oven as a radical breakthrough; the many subsequent improvements were not.*

**Number of Technological Breakthrough Products**

Products that build on a **new or novel idea / technology** that has never been used in the industry before. The products may not be new to the market but the technology application is. *An example includes the Canon LaserJet printer (using new technology to extend the existing product line from InkJet printer).*

**Number of Market Breakthrough Products**

Products that build on an **existing idea or technology** and create a **new market**, becoming the first of its kind and totally new to your markets, and/ or cause significant changes in the industry or product category. *An example includes the Apple's iPhone3 or iPod (market breakthroughs using existing technologies within new platforms).*

**Number of Incremental Innovations**

Products that are **adapted from the existing products** to provide new features, benefits, or improvements to offer in the **existing market**. *An example includes the Apple's iPhone4 where the product improved only by incremental technologies of Apple's iPhone3 to introduce new benefits based on current platform.*

**SECTION 2: ASPECTS OF BREAKTHROUGH INNOVATION PERFORMANCE**

**NEW PRODUCT DEVELOPMENT SURVEY**

**SECTION 2: Aspects of Breakthrough Innovation Performance**

Please think about how the breakthrough innovations developed by your company / SBU over the last 3 years have performed, from the early phase of the NPD process through to launch:

**2.1 In terms of *Breakthrough Integrity*, please tell us to what extent "*breakthrough innovations were able to...*"**

	Not at all	To a very limited extent	To a limited extent	To a moderate extent	To a decent extent	To a great extent	To a very great extent
Maintain their innovativeness from the initial idea through to the final product launched.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintain their originality from the initial idea through to the launch of the product.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resist the pressure from management to modify the idea and reduce their breakthrough integrity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**2.2 In terms of *Early Success with Customers*, please tell us how strongly you disagree or agree with each of the following statements:**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Early customers were always satisfied with our breakthrough innovations even prior to formally launching them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Early customers readily accepted our breakthrough innovations even prior to formally launching them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Early customers' needs were better met through our breakthrough innovations than our	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
--	-------------------	----------	-------------------	----------------------------	----------------	-------	----------------

existing ones.

**2.3 On average, over the last 3 years, in terms of how quickly breakthrough innovations were developed and launched, please tell us how strongly you disagree or agree with each of the following statements:**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
--	-------------------	----------	-------------------	----------------------------	----------------	-------	----------------

Our breakthrough innovations were developed and launched faster than the major competitor for similar products.

Our breakthrough innovations were completed in less time than what is considered normal and customary for our industry.

Our breakthrough innovations were launched on or ahead of the original schedule developed at initial project go-ahead.

Top management was pleased with the time it took for breakthrough innovations to get to full commercialization.

**2.4 In terms of opening up new opportunities for your company / SBU, please tell us how successful your breakthrough innovations were in:**

	Not at all successful	Not successful	Somewhat unsuccessful	Neither successful nor unsuccessful	Somewhat successful	Successful	Extremely successful
--	-----------------------	----------------	-----------------------	-------------------------------------	---------------------	------------	----------------------

Opening new markets to your company / SBU?

Leading your company /

	Not at all successful	Not successful	Somewhat unsuccessful	Neither successful nor unsuccessful	Somewhat successful	Successful	Extremely successful
SBU into new product arenas (i.e., products you did not have 3 years ago)?							
Opening new technologies for your company / SBU to leverage?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**2.5 In terms of Sales and profitability performance in your company / SBU, how successful were your breakthrough innovations in:**

	Not at all successful	Not successful	Somewhat unsuccessful	Neither successful nor unsuccessful	Somewhat successful	Successful	Extremely successful
Meeting your sales volume objectives (units sold)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meeting your sales value objectives (revenue generated)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meeting your profit objectives?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being profitable relative to the resources invested in them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## NEW PRODUCT DEVELOPMENT SURVEY

### SECTION 3: Information Processing and Knowledge Management (Absorptive Capacity) of Your Company / SBU

We are interested in the general **organizational routines** and **processes** in your company / SBU quite apart from innovation related activities.

Please think **across all of the departments such as R&D, production, marketing and accounting within your company / SBU**. Please consider how well they communicate with each other and how well employees connect within and outside the industry and apply new knowledge in their practical work.

**3.1 In terms of how your company / SBU acquires knowledge from external sources, please tell us to what extent you agree or disagree with each of the following statements:**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The search for relevant information concerning our industry is an every-day business in our company / SBU.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our management motivates employees to use multiple information sources within our industry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our management expects that employees deal with information beyond our industry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**3.2 In terms of how your company / SBU processes the externally acquired knowledge, please tell us to what extent you agree or disagree with each of the following statements:**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
In our company / SBU, ideas and concepts are effectively communicated across departments.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our management emphasizes cross-departmental support to solve problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
In our company / SBU, there is a quick information flow e.g. if a business unit obtains important information it communicates this information promptly to all other business units or departments.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our management demands cross-departmental meetings to exchange information on new developments, problems, and achievements.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**3.3 In terms of how employees within your company / SBU combine their existing knowledge with new knowledge, please tell us to what extent you agree or disagree with each of the following statements:**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Our employees have an exceptional ability to structure and to use collected knowledge.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our employees are used to absorbing new knowledge as well as preparing it for further purposes and to make it available.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our employees successfully link existing knowledge with new insights.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our employees are able to apply new knowledge in their practical work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**3.4 In terms of how your company / SBU exploits new knowledge to develop new products, please tell us to what extent you agree or disagree with each of the following statements:**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Our management supports the development of product prototypes to test a concept or process and make sure things work before starting actual development.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our company / SBU regularly reconsiders technologies and ideas and adapts them according to new knowledge.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our company / SBU has the ability to work more effectively by adopting new technologies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our company / SBU has the ability to work more effectively by adopting new ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## NEW PRODUCT DEVELOPMENT SURVEY

### SECTION 4: Organizational Visioning Capabilities

Now thinking about breakthrough innovations again, we are interested in understanding more about how people undertake product innovation related tasks and thinking within your company / SBU.

4.1 Market Visioning Competence is *"the ability of individuals or NPD team in organization to link new or existing ideas/advanced technologies to future market opportunities"*.

Please think about *the nature of market visioning for breakthrough innovations within your company / SBU* and indicate the degree to which you agree or disagree with these statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
We try to keep our market opportunity options open as long as possible for potential breakthrough products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
We try to develop several potential product and technological scenarios before choosing market(s) to pursue.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
We use several forecasting and market estimation techniques before making a final market selection.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
We continuously try to discover additional needs of our customers of which they are unaware.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
We incorporate solutions to unarticulated customer needs in our new products and services.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
We brainstorm on how customers use our products and services.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**4.2 "Individuals who first champion breakthrough innovations in our company / SBU..."**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Share information and quickly obtain senior management support.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Get key decision makers in our company / SBU involved early.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Often make important decisions based on their intuition more so than data.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Secure the required senior management support early.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have a broad network of relationships outside of our company / SBU.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have a network made up of people with a variety of different backgrounds (e.g. different industries, different disciplines, different functions).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are at the centre of the network growing up around the products and their technologies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**4.3 A Market Vision is "a clear and specific early-stage mental model or image of a product-market that enables NPD teams to grasp what it is they are developing and for whom".**

Please think about *the market vision in the very early stages of developing breakthrough innovations in your company / SBU* and indicate the degree to which you agree or disagree with these statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
We have a very specific Market Vision statement that guides each NPD project.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our Market Vision provides clear direction to others in the company / SBU regarding what is being developed and for whom.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our Market Vision clearly highlights the attractiveness of the market opportunity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our Market Vision helps make tangible what is to be developed and for whom.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our Market Vision generates 'buy-in' from other people and groups in the company / SBU.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**4.4 "When you first start thinking about what specific markets would benefit from your breakthrough innovations, you and your NPD team are able to spend an appropriate amount of time thinking and talking about..."**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
How end-users would ultimately interact with and use the breakthrough innovations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How the breakthrough innovations would fit into an overall system of use for potential customers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How customers might use the breakthrough innovations in their environments.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The potentials for standardizing the design of the breakthrough innovations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What the most profitable target market would be for the breakthrough innovations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What the largest target market would be for the breakthrough innovations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What the most important target market would be for the breakthrough innovations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**4.5 "After spending time discussing the specific markets for the breakthrough innovations within your NPD team..."**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
It is generally clear who the target customers would be for the breakthrough innovations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is generally clear what target customers' needs would be for the breakthrough innovations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is generally clear how breakthrough innovations would be used by the target customers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## NEW PRODUCT DEVELOPMENT SURVEY

### FINAL SECTION - THANK YOU FOR GETTING THIS FAR

#### SECTION 5: External Business Environment and NPD Process

**5.1 Please think about the external business environment facing your company / SBU by indicating the degree to which you agree or disagree with the following statements:**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The technology in our industry is changing rapidly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technological changes provide big opportunities in our industry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A large number of new product ideas have been made possible through technological breakthroughs in our industry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In our kind of business, customers' product preferences change quite a bit over time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our customers tend to look for new products all the time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
We are witnessing demand for our products and services from customers who never bought them before.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
New customers tend to have product-related needs that are different from those of our existing customers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Competition in our industry is cut-throat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are many "promotion wars" in our industry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anything that one competitor can offer, others can match readily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Price competition is a hallmark of our industry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**5.2 Finally, please think about the New Product Development (NPD) Process and stages associated with the development of the breakthrough innovations in your company / SBU and indicate the degree to which you agree or disagree with these statements:**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Our company / SBU uses a formal NPD process-that is, standardized set of stages and go/ no-go decisions to guide all new product activities from idea to launch.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our NPD process has clearly defined GO / NO-GO decision points (or gates) for each stage in the process.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our NPD process has defined gatekeepers who review projects at each gate and make go / no-go decision.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our NPD process is quite linear and inflexible; there is little scope to do things differently.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Our NPD process reinforces the status quo by solving customers' existing problems or stated preferences in current markets.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**If there are any comments that you would like to contribute regarding topics under examination by the researchers please do so below, we value any insights you can provide us with.**

Once you have fully completed the survey, **please provide your e-mail address** below if you wish to receive a report on **"Factors Influencing Breakthrough Innovation Success"**. We will send you one as soon as we have analysed the data.

*IMPORTANT: Your information will be held strictly confidential and kept securely on a host server, supported by RMIT University. The e-mail address will be used solely by us for sending you the promised report and will never be used for any other purposes.*

Your e-mail address: \_\_\_\_\_

**END OF SURVEY.**

**THANK YOU VERY MUCH FOR YOUR PARTICIPATION!**