An Analysis of the Organisational Size Construct in Information Systems Research

Siegfried Goode

June 2005

A thesis submitted for the degree of Doctor of Philosophy of The Australian National University

DECLARATION

I declare that this thesis contains no material which has been accepted for a degree or diploma by this or any other institution. To the best of my knowledge and belief it contains no material previously published or written by another person except where due acknowledgment is made in the text of the thesis.

....

ACKNOWLEDGEMENTS

First, my undying and eternal gratitude is due to my supervisor, Prof. Shirley Gregor. Throughout my thesis work, Shirley was fearless, sage and patient. Shirley gave freely of her time, even when this resource was patently scarce as so many hundreds of others also sought her valuable counsel. Shirley works so hard and so selflessly. I hope that one day I might be even half the scholar that Shirley is. Thank you, Shirley.

Thanks to Prof. Michael Martin, who patiently and warmly answered my questions regarding the statistical analysis. His optimistic outlook, positive reassurance and helpful suggestions were of the greatest benefit. Thanks also to my friend and adviser, Dr. Greg Shailer, for his support, insightful help and critical thought over the life of this study. My thanks also to Prof. Gary Monroe for his support and encouragement throughout the thesis process. Gary has always been keen to help out any research student with comments and advice. I am very lucky to have benefited from this.

I am indebted to Alexander Spaans and Willem van der Kloot at the University of Leiden for their excellent PermuCLUSTER function, which massively sped up my cophenetic correlation analysis (unfortunately, I only discovered this function after I had begun to calculate the product moment by hand).

To my fantastic friends, for your support, I thank you. In particular, Tas, Mike Pisasale, Anton, Theo, Paul, Dan, Jason, Russ and Heather, Bartek, Jim, Bri, Nathan, Nigel, Rob, Jaci, Lauren, Rex, Jacqueline and Evan. Also the Pretzels summer soccer team, especially Charles, Ann and Mark. I am also deeply grateful to Wayne and Byron for their continual and caring support and encouragement.

To my work colleagues, who make the School of Business and Information Management such a warm place to come each day, I feel honoured and humbled that I may count so many ANU staff among my best friends. In particular, Teh, Becs, Alex, Craig, Mike K., Mike H., Mark, Andrew, Walter, Dennis, Roger, Alan, Nigel, Bruce, Chris C., the Ikins, George, Osman, and the BIM indoor soccer crowd. Thanks also to my Honours students, especially James, who I feel taught me more than I taught them. Extra special thanks to Mark Wilson, Sumit Lodhia, Edgar Montalvo and Kate Gilchrist for reading the final draft and giving such constructive feedback.

To the members of the Australian information systems community, who offered their support over the life of the thesis, thank you. I cannot overstate the value of even a passing comment such as, "how's your thesis?", which can be the greatest boost to morale for a beginning researcher such as myself. I feel lucky to be a part of such a fertile and supportive learning and research community. In particular, I am grateful for the support of Phil Joyce, John Lamp, Teresa Lynch, Craig McDonald, Roger Clarke, Jennie Carroll, Helen Hasan, Tony Jewels and Darren Skidmore. My deepest thanks is also due to Ken Stevens for his loyal friendship and support over the years.

I do not think I could have written this thesis if I had not been for Toni's support throughout. At every turn, Toni was right by my side to help me through. She never lost faith, even when I did. I am so lucky to have found someone so loyal, honest, gentle, strong and beautiful. Toni, I love you with all my heart, always.

Finally, I contend that it is much easier to undertake a PhD today than it would have been even fifteen years ago, what with substantial technology resources such as online literature databases and electronic mail. My father completed his PhD some thirty years ago without this technological wizardry, in not his second language but his *third*. My mother's love, support and admiration throughout this and all of my endeavours made the journey possible. My parents sacrificed much so that I would have a happy youth and could attend a good school. I could not have asked for a better childhood. Mum and dad, thank you for everything.

"A faithful heart makes wishes come true."
Lo Xiou Hu

For my parents
Who made me
I made this.

And for Toni
Who always makes everything better.

ABSTRACT

'Organisational size' is one of the most popular constructs in information systems and organisation research. However, findings from studies involving organisational size have been inconsistent. Few studies have explored this inconsistency or attempted to address this problem. The importance of the size construct, the inconsistency of its use and the lack of prior work suggest an important research topic.

This thesis explored the size construct in information systems research. The thesis used Churchill's measure development paradigm as a broad framework for conducting three separate but related investigations into the size construct.

Study 1 explored the domain and dimensions of size. Some 2,000 research papers published over an eleven year period in six leading IS journals were read in order to determine what researchers thought size meant and how they measured it. The study found 21 constructs underpinning the size construct and 25 ways of measuring size. However, there was no clear relationship between how size was measured and what it was understood to mean.

Study 2 involved assessing the construct's content validity. A concept map exercise involving 41 participants was conducted. Multidimensional scaling analysis found that the size constructs found in the previous study clustered into three conceptual cluster groups.

Study 3 administered the size construct in a survey with a sample of 1,000 Australian firms with three aims. The first was to see whether real data items clustered in the same way as theoretical clusters. The second was to determine whether this clustering could tentatively be used to differentiate between small and large firms. The third was to determine the factors that best described how respondents saw their own firm size. The study found that the data supported the theoretical constructs observed in Study 2 and that a group of eight constructs could be used to differentiate between smaller and larger firms in the sample. The analysis revealed that organisational levels, risk aversion, geographic distribution and employment reflected respondents' self-nominated size.

The findings have a number of implications. First, researchers do not appear to have a shared explicit understanding of what size means. Second, the evidence suggests that organisation size is a second-order construct comprising more than one dimension. Third, as a result, the use of traditional size indicators such as the firm's number of employees may not capture the entirety of the construct's meaning, possibly resulting in unreliable research.

STATEMENT OF PRIOR PUBLICATION

Parts of this work have been published in the following papers:

"A Concept Map of the Organisational Size Construct in Information Systems Research", Proceedings of the 8th Pacific Asia Conference on Information Systems (PACIS), Shanghai, China, 2004

"On the Theoretical Justification of the Organisational Size Construct in Information Systems Research", Proceedings of the 6th Pacific Asia Conference on Information Systems (PACIS), Tokyo, Japan, 2002

"Organizational Size Metrics in IS Research: A Critical Survey of the Literature 1989-2000", Proceedings of the 12th Australasian Conference on Information Systems (ACIS), Coffs Harbour, Australia, 2001

Some of this work was also presented at the 13th Australasian Conference on Information Systems (ACIS) Doctoral Consortium in 2002.

Table of Contents

List of Figures

List of Tables

CHAPTER 1

INTRODUCTION

"Size is probably a surrogate measure of several dimensions...these unidentified variables have not been clearly understood, or adequately measured in most researches".

Rogers (1962, 1971, 1983, 1995)

Why is organisational size at once so popular in the information systems literature yet at the same time so contentious? Organisational size has been held to be one of the most important explanatory concepts in the analysis of technology (Kimberley and Evanisko 1981, Lind et al. 1989, Kalleberg and Van Buren 1996) and research in the information systems domain has made a number of observations concerning "small" and "large" organisations (Raymond 1985). Some studies argue that technology adopters are larger than non-adopters (Montazemi 1989) possibly because larger businesses can allocate greater financial and personnel resources to the adoption and use of new technology. Larger organisations may have more complex systems developmental approaches (Raymond 1991) and greater risk (Ivancevich et al. 1998), often requiring greater information support networks (Yap 1990) or technology such as CASE tools (Hayley and Lyman 1990). Larger organisations are also held to have more slack resources (Damanpour 1987) and can hence adopt technology earlier than smaller organisations (Zmud and Applegate 1992). Small organisations, on the other hand, may be better able to adopt technology because they are more flexible (King 1996) or can adapt to changing environments more quickly than larger businesses (Grover and Teng 1992). Smaller businesses may experience more successful IT use due to more frequent direct CEO intervention (Delone 1988) and may place more emphasis on customer care than larger organisations (Butler 1999).

The research conducted so far based on organisational size has, however, yielded inconsistent or inconclusive results. Some studies have argued that organisational size has been a poor indicator of behaviour. For instance, Grover and Teng (1992) observed similar technology adoption behaviour between larger and smaller organisations. Sampler and Short (1994) and Ewusi-Mensah (1997) delivered similar findings with regard to project and system development failure respectively. Brynjolfsson et al. (1994) provided inconclusive results with respect to size and technology use. Ettlie et al. (1984) argued that, ultimately, only extremely large organisational size is a useful predictor of technology adoption or organisational behaviour. Gifford (1992:295) wrote, "if firm size matters at all, it matters only in industries with low technological opportunity". The issue of inconsistency with respect to organisational size remains unresolved.

This thesis argues that the organisational size construct (what size *means*) is poorly related to its research indicators (how size is *measured*). In part, this is due to competing theories about what size means as well as how size relates to other concepts. While researchers may have a tacit understanding of organisational size, this understanding does not appear to be shared. Further, whereas many researchers measure size unidimensionally, it is in fact much more complex. These problems at least partially explain why studies involving size have seen mixed or contradictory results. In the words of Hitt and Brynjolfsson (1996), "constructs matter".

1.1 The Seeds of the Study

The problem first became apparent during earlier research into the structural differences between adopters and non-adopters of the World Wide Web in small business. The study, published in Goode and Stevens (2000) and Goode (2002), explored the possibility that structural effects might compel an organisation to pursue a particular technology. These aspects of structure included the firm's age, industry, experience with IT, technology expenditure and size.

Using evidence from the research literature (notably Lind et al. 1989, Grover and Goslar 1993 and Raymond 1985), the study argued that size was one of the most telling factors in innovation and could be used to differentiate between adopters and non-adopters. Literature in the area seemed to suggest that size "somehow mattered"; however, the nature and magnitude of this effect appeared to vary between studies. The literature also revealed several ways to measure size. This uncertainty was confusing: it was difficult to understand how researchers could claim that the construct was important in the analysis of organisational behaviour, yet at the same time be unable to agree on what it meant or how to measure it.

The study found that, while organisational size distinguished between adopters and non-adopters of computers, it did not predict differences between adopters and non-adopters of WWW technology. Explanations advanced at the time were that the WWW is a low entry-price technology (thus allowing both small and large firms to adopt it), that the WWW adoption does not depend on a firm's capacity to provide technical infrastructure or personnel, or possibly that the WWW does not easily lend itself to analyses in terms of dichotomous adoption states. Evidence and support for these explanations could be sourced from the research literature, yet they were unsatisfying. If the WWW was a substantially different technology, then how many other technologies also possessed these differences? Would organisational size, as represented in the literature, be able to categorise other technologies as well or would it fail to have predictive power? Instead, another explanation was sought: what if it was not the nature of the technology which fluctuated, but rather the organisational size construct itself?

That study concluded with two points relevant to this thesis. First, despite its popularity in the literature and apparent predictive power, the size construct required further analysis. Second, the variety of studies employing organisational size is evidence of the number of possible applications of the construct. This observation suggested that a number of valid alternative theories involving size as an independent variable can be developed given different applications and definitions of the size construct. Accordingly, there are many possible ways to explore organisational size itself. Further study into the meaning and effect of organisational size was required. These possibilities are investigated further in this thesis.

1.2 Motivation

Several important issues motivate this study. These are explored here with relevance to researchers, managers and practitioners, and policy makers.

1.2.1 Motivation for Researchers

First, many theoretical constructs, such as "system success", have received considerable analytical attention in the literature. Delone and McLean (1992, 2003), Seddon (1997) and Seddon et al. (1999) each observed the competing views of "success" in the information systems literature. Seddon (1997) also observed the importance of Delone and McLean's original work on better defining and organising the otherwise popular "success" construct in information systems research. Similarly, whereas organisational size has received relatively little rigourous scholarly concern, it continues to receive critical application in many studies. This suggests an *a priori* need to better understand its nature and address this unanswered call in the research literature (as in Rogers 1995).

Second, while some studies using particular indicators of organisational size have presented significant findings, other studies have delivered inconclusive results using the same indicators. Authors have variously proposed different reasons for this, including measurement error, construct disagreement or research misunderstanding. This disagreement has prompted some researchers to call for a reassessment of organisational size with regard to how it is measured and what it means (Blau et al. 1976, Duncan 1995). Gupta (1980:765) wrote, "a theoretical and methodological exposition of the dynamics of this important anatomical characteristic of organisations must be undertaken if the issue of size is to become comprehensible". Weinberg (1994:29) wrote, "in understanding differences between large and small firms, it may be useful to have a notion of what determines firm size."

The final aspect of researcher motivation concerns the depth of the information systems discipline. On one hand, authors in the information systems literature such as Keen (1980), Jarvenpaa et al. (1985) and Delone and McLean (1992) increasingly call for the development of a research pedigree and cumulative tradition in information systems. These authors argue that studies should aim to review and reflect upon the literature so as to develop a coherent and respected body of work. Such research might constitute critical reanalysis and, periodically, revision at the expense of novelty (Benbasat and Weber 1996). However, on the other hand, authors such as Holsapple and Johnson (1994) and Webster and Starbuck (1988) observe that literature analysis and citation in information systems typically only reviews the most recent five years of published work. It could be argued that researchers hence risk missing key foundation points in the older literature. This may also undermine the development of a cumulative tradition, consistent with the argument of Culnan and Swanson (1986) that information systems has not yet produced a coherent body of work. Closer examination of organisational size through a more detailed literature analysis (and close reference to older text from information systems' foundation disciplines) may assist in addressing this by rigourously examining the problem from a number of perspectives.

1.2.2 Motivation for Managers and Practitioners

Managers may benefit from this work for a number of reasons. First, commercial organisations tend to require substantial resources to set up and maintain. New projects may also require significant investments in terms of time, finances and human resources. The management of such resources provides fertile (and, occasionally, lucrative) ground for research. There is hence a healthy supply of, and demand for, research literature in the area. If the models used to manage these investments involve organisational size, then an improved understanding of how size is handled would be beneficial. The users of scholarly research output would hence benefit from a deeper analysis of organisational size as a key concept in organisational and business-related research.

The analysis of organizational size, structure and context will also pay dividends for future research into measuring information systems performance and success. Authors who have already observed this relationship between structural context and success include Weill (1992), Lucas (1975), Banker and Kauffman (1988) and Bakos (1987). Kauffman and Weill (1989) argue that, while the topic of structural and contextual effects has received scant attention in the research literature, it is still of substantial concern. To this end, Prescott and Conger (1995) referred to the arguments of Wildemuth (1990): "without contextual analysis, details of stages, stage cycles, and important events that vary by context will be missed".

The third area of motivation concerns the organisational use of innovations. Aside from scientific and academic applications, commercial firms are the largest markets for data processing tools (Davis and Wetherbe 1979, Merten and Severance 1981, Brynjolfsson and Hitt 1996, Pinsonneault and Rivard 1998). The efficient and effective employment of data processing tools in these environments is important to managers and practitioners. If organisational size is one of the most important aspects in explaining such activity, then it would make good scholarly sense to make sure the construct is fit for the purpose and well understood.

The fourth area of motivation for practitioners concerns the analysis of organisational capability measurement. Many commercial organisations drive research and development through the provision of grant funding and financial assistance. Funding is often granted on the proviso that research be conducted into topics relevant to the organisation. Practitioner models such as those concerning productivity make assessments based on organisational size. However, models developed using "large" companies may have tenuous application in "small" organisation environments (Fayad and Laitinen 1997). In the words of Caplow (1957:485): "it is almost impossible to draft a workable system of procedures for both the giant factory and the small workshop". A deeper understanding of size may help in these circumstances.

1.2.3 Motivation for Policy Makers

Motivation for this study also exists at the policy maker level. Governmental organisations would benefit from having access to a coherent and consistent understanding of size from which to develop standardized approaches to measurement. The Department of Employment, Science and Training (DEST) admits, "a number of different definitions are current for characterising or defining small business" (ESFC 1994a:8). For private sector businesses, DEST inherits a definition from the Australian Bureau of Statistics (ABS) and uses "number of employees" as an indicator (ABS 2002). However, for firms based in the agricultural sector, it measures size using "estimated value of agricultural operations" on the grounds that the total employment indicator may vary seasonally. However, they also make the curious observation, "this recognises that the scale of business operation in the farm sector may be quite unrelated to employment size" (ESFC 1994b:5).

Evidence from policy documents and the research literature illustrates the variety of size indicators in use in governmental organisations. For instance, the ABS uses *Number of Employees* as their indicator (ABS 1999). The Australian Taxation Office (ATO), however, uses different measures, calculating penalties for late tax return lodgement according to business size, where "the size of taxpayer is related to its assessable income, withholder status or its GST annual turnover" (ATO 2002). Additional evidence suggests that the selection of these measurement approaches may depend on data convenience, rather than actual requirements: ABS (1999:55) writes, "Depending on the *source of the statistics*, [size] refers to either the number of employees only or the total employment (employees plus working proprietors and partners)" (emphasis added). In these cases, a consistent approach to size measurement might assist in the fairer allocation of government taxes and subsidies. Firms with similar numbers of employees may have differing levels of revenue (and vice versa). However, each is used to determine individual levels of firm taxation and subsidy (for the ATO and DEST respectively).

The use of more accurate indicators of size may also facilitate data collection and reporting requirements on the part of firms. ABS (2002) wrote, "The ABN registration process and Business Activity Statement (BAS) data from the ATO provide the ABS with the opportunity to use size measures other than employment (or modelled employment) to improve the efficiency of sample designs". Additionally, an understanding of the degree to which these alternative indicators of size are comparable may improve data collection for these groups.

Third, a consistent understanding of the size construct and a standardized measurement approach may facilitate firm comparison across countries. This may assist in the determination of trade and tariff agreements, aid subsidies and productivity analysis. DEST observes that different measures of size are adopted in the USA, UK and Europe: "thus, while many of the conclusions drawn from international research remain valid in the Australian context there are issues of comparability that need to be kept in mind." (ESFC 1994b:5). This evidence suggests that a consistent view of organisational size would be welcome and useful in these areas.

1.3 Research Objectives

This study has the following aims:

a) *To explore and explain the meaning of "organisational size" as a construct.*

b) *To explore the methods for measuring organisational size.*

c) *To improve the use of organisational size in information systems research and theory development.*

In addressing these aims, the study will develop a better understanding of the organisational size construct and its use in information systems research. This thesis constitutes an information systems-specific analysis of the organisational size indicator and aims to address these issues in an information systems context. However the study's findings may also inform other disciplines.

1.4 Problem Statement and Research Questions

Organisational size is a commonly used construct and independent variable in the information systems research literature, however its use has delivered inconclusive results. This could be due to theoretical misunderstanding, mismeasurement, or misspecification of the organisational size construct itself. This discussion leads to the following research questions:

1. *What does the organisational size construct mean? Is there more than one meaning? Is it a construct with a number of sub-dimensions or are there a number of different constructs?*

2. *Is there evidence of more than one construct/meaning in prior literature? How well have the different meanings been distinguished/explicated previously?*
3. *How is the size construct measured? How should the size construct (or constructs) be measured?*
4. *What does this enquiry into the nature of the size construct mean for theory in information systems? How can theory that uses the size construct as an independent variable or dependent variable be made more sound?*

As the forthcoming discussion will show, the problem of organisational size is significant and, arguably, too large for a single study. The first two questions are answered in this thesis. With regard to the third research question, the study develops one instrumental approach to measuring size, however this is by no means definitive. Rather, the instrument development process is presented in order to show how difficult the measurement of size can be. This thesis conducts work on a path to answering the fourth research question and builds a foundation for further work in the area.

1.5 Synopsis

This thesis explores the organisational size construct by describing its underlying dimensions and then organizing these dimensions to develop a better conceptual understanding of the construct. The thesis adopts a pluralistic approach, as advocated by Mingers (2001) and Tashakkori and Teddlie (1998), drawing on a number of methods in order to build a richer understanding of the construct. The thesis draws on papers such as Churchill (1979) for guidance on content and structure.

The unconventional problem presented so far does not lend itself to a conventional doctoral thesis structure. Further, the subject matter is arguably somewhat delicate given the range of applications and the number of authors who have already used (and arguably unwittingly misused) the construct. Accordingly, the rest of this thesis is structured as follows.

The next chapter describes the theoretical background to the thesis. It describes the process of confirmatory research in the social sciences and, after reviewing the literature in the area, settles on specific terms to be used throughout the thesis. The chapter then discusses the characteristics of a good construct in terms of validity and reliability.

Chapter Three describes the problem in broad terms and presents evidence of the problem in two contexts. First, evidence is presented from studies in the literature which have arrived at contradictory conclusions when using size. Second, evidence is then presented from researchers who have observed the problem and had cause to note it in their own work. This chapter then details the published work of scholars who have already attempted to solve the problem.

Chapter Four begins by detailing the process of construct development in the social sciences. The chapter discusses the characteristics of good constructs and then details some methods for developing good constructs. The study selects Churchill's (1979) measure development paradigm based on the approach's suitability to the construct validation requirements outlined earlier in the chapter. With this as a broad framework for the study, Churchill's paradigm then is discussed in greater detail in terms of three related investigations into the size problem.

Chapter Five applies the first two stages of Churchill's paradigm to the organisation size problem in the context of "Study 1". First, the discussion specifies the domain of the size construct and sets up boundaries for its analysis in the rest of the study. Second, the chapter discusses the literature search methods for gathering the dimensions that can be used to describe the size construct. This chapter produces a literature review of the size construct in information systems research in terms of its measurement and meaning.

Chapter Six shows the empirical development of a conceptual model of the size construct in the context of "Study 2". Using the list of dimensions developed in the previous chapter, the study uses a card sorting method to get researchers to group the size constructs into conceptually similar categories. Then, a concept map approach in conjunction with Euclidean Distance Modelling is used to represent the relationship between the variables. This analysis process suggests that these variables can be clustered around three principal groups suggesting a degree of multi-dimensionality in the size construct. Importantly, the experiment's approach, method, data collection and data analysis are described in detail in the interests of replication. Finally, the chapter discusses the elements of bias and other threats to validity in the research method.

Chapter Seven details the development and administration of a survey for assessing the construct in an operational context. This is the third study in the thesis. In particular, the chapter discusses the conversion of each size construct into empirical indicators, and the development of the survey instrument including pilot testing, validity and usability.

Chapter Eight reports the statistical analysis of the survey responses of Study 3 and presents the results. The chapter discusses response bias analysis, outliers, normality testing and missing item analysis. Coverage is given to the statistical analysis, including cluster analysis and logistic regression.

Chapter Nine discusses the new understanding of organisational size in the context of the research literature and summarises the findings of each of the three studies. The chapter discusses the research limitations inherent in the study. Finally, the chapter presents research implications and areas for further research in information systems by discussing extensions to the work.

CHAPTER 2

THEORETICAL CONSTRUCTS AND THEIR MEASUREMENT

This chapter provides a theoretical basis for the rest of the study. Its objective is to establish an understanding of those aspects of theory and research central to the work. Guidance in three matters is required. First, it is important to understand the relationship between phenomena, research constructs, and the indicators used to measure those constructs. Second, because of the variety of potential approaches and naming conventions available in the research literature, and to minimize confusion, it is important to agree on nomenclature. Third, in order to provide a foundation for both the analysis and development of the organisational size construct, it is important to determine the qualities of a good construct.

This chapter is structured as follows. First, the chapter discusses the importance and philosophical position of theoretical development in social science research. The thesis then discusses the components of theory, including some of the competing approaches to terminology. After specifying the nomenclature to be used throughout the thesis, the chapter explores the relationship between constructs and indicators in theory development. The chapter then discusses the characteristics of a good construct in terms of validity and reliability in the interests of delivering good scholarly research.

2.1 Philosophical Foundations

Much research in the sciences is concerned with better understanding the "real world" and the phenomena which lie therein (Nunnally 1978, Astley and Van de Ven 1983). Research in information systems, inheriting direction from many social science disciplines, is also frequently concerned with determining the relationships between real-world phenomena (Orlikowski and Baroudi 1991). The discipline enjoys a broad base of application (Boyer and Carlson 1989) and researchers in the discipline have prolifically documented the diversity of such research (Culnan 1987, Benbasat and Weber 1996, Robey 1996).

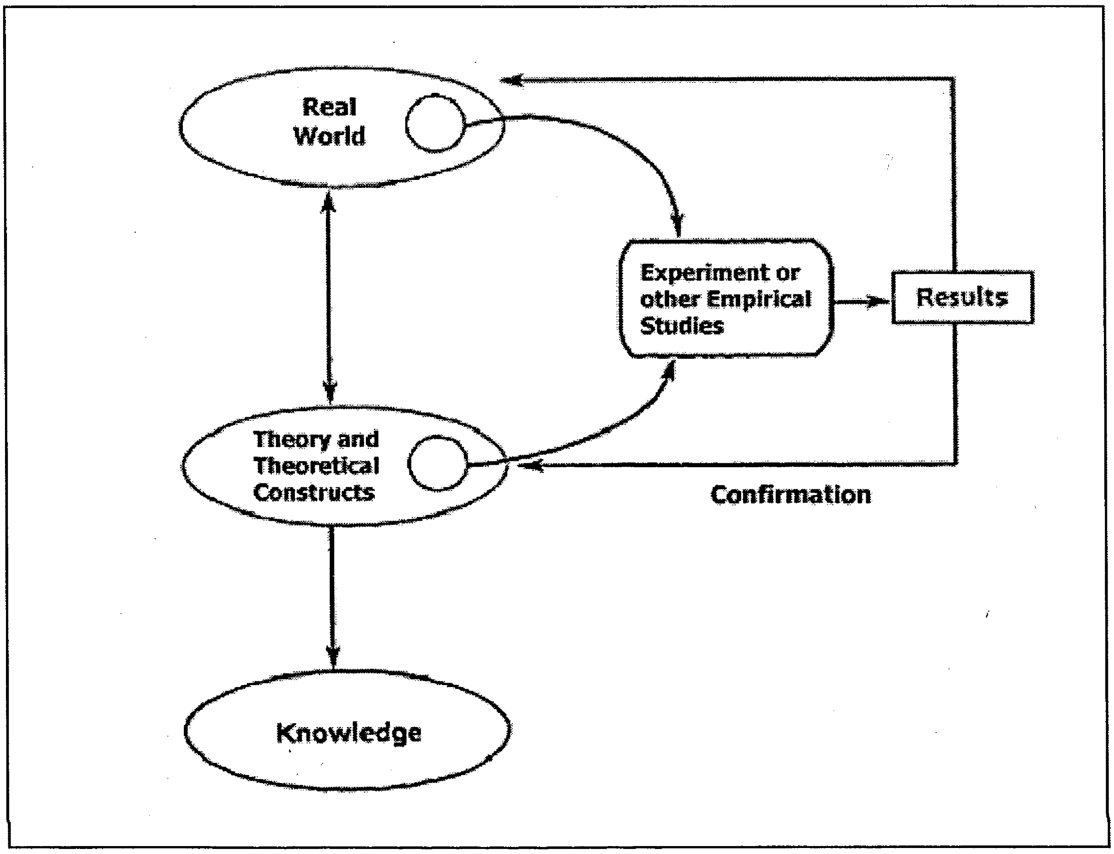
The ontological approach used in this thesis is one of 'scientific realism', where "the world is out there around us, existing regardless of what we think about it" (Godfrey-Smith 2003). The thesis is based on the idea that an organisation, as part of the world, has a 'size'. However "many of its most important features are unobservable to the unaided senses" (Boyd 1980:613). The term, 'organisational size', according to Godfrey-Smith's terminology, is a "representational vehicle", which comprises just one way of viewing an organisation's size; others may be suitable for a given task or requirement. The goal in this thesis is for "accurate representation" (Godfrey-Smith 2003:189) of organisational size.

2.2 Theoretical Development in Scientific Research

Applied research in the social sciences is frequently concerned with the investigation of phenomena. The accurate analysis of these phenomena and their effects is of prime concern to the researcher (Cook and Campbell 1979). While some phenomena are more readily measurable, other phenomena such as user satisfaction (Bailey and Pearson 1983) or information system success (DeLone and McLean 1992, DeLone and McLean 2003) are less tangible and not as easily measured. In order to make analysis easier, researchers may use abstractions of these phenomena (Neuman 1994). However, poor correspondence between the abstraction and the real world phenomenon may result in conflict between study outcomes. The resolution to such problems is generally beneficial to the producers and users of this research.

In order to understand this problem, it is necessary to first explore the development of theory in scientific research. Figure 2.1 represents the process of much research in the social sciences, describing the relationship between the real world, theoretical constructs and knowledge. Figure 2.1 shows that the real world contains a number of phenomena in which researchers are interested. Researchers first observe the real world phenomenon, the construct and the indicators. These researchers conduct experiments which, through process of confirmation, deliver results that can be incorporated into knowledge. They then create theory about the phenomenon which allows others to then build on this work. This, in turn, assists in improving understanding of the real world.

Figure 2.1 The Use of Theory in Information Systems (adapted from Mason 1989)



Researchers may gauge the effectiveness of observations through confirmation, analysis and re-analysis and, in this way, establishing a research pedigree (Straub 1989, Lee et al. 1997). Here, numerous researchers revisit the theory and perhaps the associated phenomenon at different times and in different environments in the hope that they can gather enough "correct" observations. Theory, then, underpins this research work, but also arises from it.

2.3 Perspectives on Theory Components and Nomenclature

The discussion presented so far has argued that researchers deal predominantly with "abstractions" of the real world. Authors in the research literature have differing and not necessarily compatible perspectives on how these abstractions should be used and discussed. In part, this is due to differing perspectives on existence, observability and theory: Gioia and Pitre (1990:584) wrote, "theory-building discussions seem to proceed as if the principles of theory building are somehow universal and transcendent across disparate paradigms of thought and research. They are not.".

Before proceeding with work in the area and in order for this research to be effective, it is important to establish a commonality of thought, terminology and nomenclature for this thesis. That is, researchers should seek a commonality of expression when attempting to standardise their research. A number of authors give guidance in this regard, and some of these are discussed below.

2.3.1 Dubin's (1978) View

Dubin's work on components of "theory" gives considerable discussion to the phenomenon and provides a useful foundation to the discussion of theory in this thesis. Dubin used the term, "unit" to refer to a concept or idea. Dubin's discussion of theory is based on these "units" and they are discussed below.

Units, Dubin argued, fall into five categories. First, units may be enumerative, where the unit possesses a characteristic regardless of the unit's condition. Examples of enumerative units include a person's gender or age. Second, a unit may be associative, where a property is held only under certain conditions. Examples of associative units include a person's level of income or driving skill. Third, units may be relational, whereby the unit's characteristic may only be determined with respect to other properties. Such relationships may be described in terms of interaction between properties or as a combination of properties. Fourth, units may be statistical, where the relevant property describes the statistical distribution of the unit (such as a mean or mode). Finally, units may be summative, where the unit represents a group of properties of a thing. Examples of this type of unit would include the "cash economy" or "technological society".

Dubin noted that a unit may satisfy more than one of these definitions at the same time. Dubin termed such instances "complex units". Dubin also argued, however, that these complex units may be confusing as they can be used in multiple contexts and hence could be open to multiple interpretations.

2.3.2 Neuman's (2000) View

Neuman's discussion of scientific research is, like Fawcett and Downs (1986), predicated with the idea of a "concept". A concept, Neuman argued, can be likened to an idea which is expressed in symbols or words. Concepts may be vague and unclear and hence also typically possess a level of abstraction "from most concrete to most abstract" (p. 43). In order to share these concepts effectively, users may label them with a commonly understood term or phrase (such as "intelligence" or "height"). While Dubin prefers the term, "unit" to Neuman's "concept", Neuman's discussion is generally similar to Dubin's work in the area.

Neuman then describes the "concept cluster", which typically relates one concept to another. These "associated concepts" assist in illustrating or colouring both levels of abstraction and lenses of interest. Concepts may also contain intrinsic assumptions, without which the concept would not exist. The concept cluster of "movement", for instance, describes the human activity of moving: here, there may be associated concepts such as running or walking which describe different aspects of the movement phenomenon.

A concept may possess one or more classifications. Some concepts may have only a simple classification and, in this sense, may be unidimensional. Other concepts may have many classifications or dimensions. These multidimensional concepts may subsequently be divisible into more rudimentary concepts. This subdivision acts in the interests of parsimony (Bailey 1992) and knowledge advancement.

Neuman then discusses two additional components of theory building. First, he observes that theories allow researchers to relate concepts to each other. Hence, theories also involve "relationships" which researchers can describe causally using "propositions" and then empirically tested using hypotheses. These relationships also comprise "causal mechanics" which specify how the relationship works. Second, Neuman argues that theories are also subject to "scope", which describes the universe of application within which a theory may be generalized.

2.3.3 The Use of Terms and Theory in this Thesis

The discussion presented so far has several important implications for theoretical development and discussion in this thesis. While authors appear to agree on the broader aspects of theory development, the description and naming of terms appears to vary. If this variance in nomenclature impedes theoretical development, then it would make good sense to standardise terms before commencing research work.

This thesis will adopt the terminology of Neuman (2000) as follows. Theoretical constructs and concepts (such as organisational size) will in general be termed, "**constructs**" except where the thesis directly quotes other research, where the original authors' own terms will be used. Methods for measuring these constructs (such as metrics) will be termed, "**indicators**". Where such indicators are being quantified empirically, they will be termed, "**empirical indicators**". Where greater precision is required, the term "**first-order construct**" will describe constructs which are proxied for by indicators. The term, "**second-order construct**" will describe constructs which are comprised of other constructs. The term, "**dimensions**" will describe the components of a construct in cases where it is not yet clear whether those components are first- or second-order constructs.

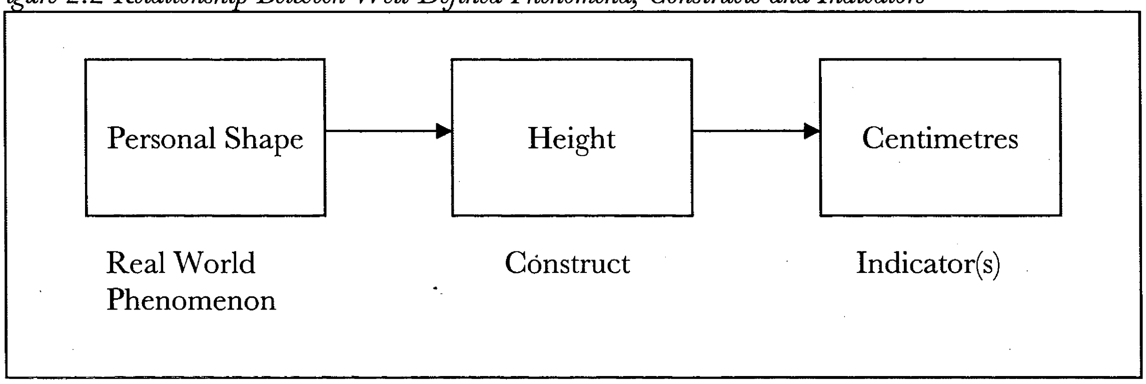
The research acknowledges the existence of different types of theory. With regard to theory, the thesis will also make distinction, where appropriate, between theory about the size construct itself and theory involving size as a research variable.

2.4 Constructs and Indicators

It is now necessary to discuss the nature of constructs and indicators in deeper terms. A construct is a "conceptual definition of a variable" (Schwab 1980). Bagozzi and Fornell (1982) defined a construct as "an abstract entity which represents the 'true', non-observational state or nature of a phenomenon". Nunnally's (1978) description of a construct is more bold, arguing that they constitute half-formed hypotheses, "literally…something that scientists put together from their own imaginations" (p. 96). Researchers may then quantify this construct using one or more indicators. Under ideal circumstances, there is a sound relationship between phenomena, constructs and indicators. Here, observers are able to transact on equal terms about phenomena because there is clear understanding and agreement of terms and relationships. Nunnally (1978) referred to these cases as "concrete" constructs.

Figure 2.2 represents an example of this relationship diagrammatically. In this example, a person has a certain height. Height, in this case, is an instance of a construct. The person has a personal shape, as a phenomenon in the real world and may possess other characteristics which are also constructs (such as weight or gender).

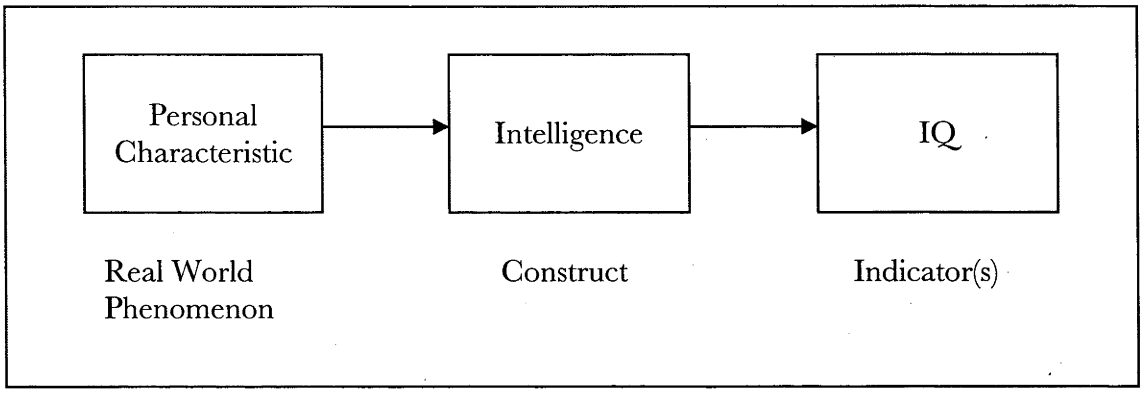
Figure 2.2 Relationship Between Well-Defined Phenomena, Constructs and Indicators



The construct can be quantified or measured using an empirical "indicator" (Winsten and Hall 1961); in this case, a person's height can be measured in centimetres. It should be noted that centimetres, in this case, is just one possible indicator of the height construct (others include inches, feet or metres). Importantly, however, these indicators can be converted and exchanged between each other and the relationship between measurement indicators is well understood. Such a measurement relationship can be verified by other observers and this allows for inter-subjective agreement.

In other cases, however, the relationship between real world phenomena, constructs and indicators may be less clear (an "abstract" construct in Neuman's 2000 terms). Figure 2.3 presents an example of this situation.

Figure 2.3 Relationship Between Poorly-Defined Phenomena, Constructs and Indicators



In the example presented above, a personal characteristic phenomenon is represented by a construct called "intelligence". This construct could be quantified using an indicator (such as Intelligence Quotient or IQ level). However, such measurement is problematic for several reasons. First, while observers can describe the effects of intelligence, they cannot actually observe intelligence *per se*. Second, there may be confounding and intervening factors when measuring intelligence so that researchers cannot be sure if they are measuring intelligence or another phenomenon. Third, the substantial disagreement regarding intelligence and its measurement brings about disagreement regarding appropriate units of analysis. There may also be other methods of quantifying intelligence and this can result in different and possibly conflicting results. Moreover, because the construct is as yet unobservable, researchers cannot be sure that their findings are correct, or that the construct itself even exists.

In more general terms, poor correspondence may result in substantial error variance (Cote and Buckley 1987), false acceptance of null hypotheses (Nunnally 1978), validity and reliability error (Bagozzi et al. 1991) and improper inference (Iacobucci et al. 1999), among others. Ultimately, such error means that science will be unable to confidently build on this research effort (Youngner 1998) and, in terms of Figure 2.1, this poor research will hence result in unreliable knowledge (consistent with Churchill 1979). To this end, Cote and Buckley (1987) argued, "in the future, researchers must be more resolute in their desire to develop construct measures that are valid and free of measurement error".

2.5 The Nature of a Good Construct

Two important problems arise from the preceding discussion of construct error. First, the construct may be unfaithfully representing the real world phenomenon and, second, the construct may not faithfully reflect what the researcher thinks it means (consistent with Nunnally 1978). As researchers report their results, so that other researchers follow similar patterns, they make incorrect observations and draw inappropriate implications from their work. Erroneous knowledge is then accumulated through the process of scientific reporting and the error may be perpetuated.

While constructs "can usually be found independent of developed theories" (Beshers 1957), it is important to clearly specify the qualities of a "good construct" before use or analysis. In particular, any assessment of the effectiveness of a construct development program requires some indication of these qualities.

If, in broad terms, a construct is a "theoretical concept" (Sethi and King 1994) then the value of a good construct must lie in its ability to consistently and accurately reflect the underlying phenomena of interest. It could be argued that a construct that cannot faithfully represent the theoretical concept or phenomenon is unlikely to be useful for knowledge generation. Many social scientists consider reliability and validity to be the most important aspects when undertaking social science research (London 1975, Anastasi 1982). These are discussed below.

2.5.1 Validity

Validity, in general terms, describes whether a given indicator or test is "measuring what it purports to measure" (London 1975). Bartholomew (1996), Cronbach and Meehl (1955) and Venkatraman (1989) observed six types of validity, being predictive (or nomological), convergent, discriminant, content and construct validity. Other authors offer further classifications of validity, including substantive validity (Schwab 1980), context validity (Dunn 2002) and concurrent validity (Bartholomew 1996).. While the exact number of validity classifications appears to be undecided (Kianifard 1994), content and construct validity are often seen as the most important aspects of validity in social science environments (Nunnally 1978, Cook and Campbell 1979).

Content validity describes the extent to which an empirical indicator or instrument measures those qualities that it purports to measure (Thorndike and Hagen 1971) or the "specific domain of the content" (Carmine and Zeller 1991:20). If organisational size is a construct (or conceptual space) that describes a group of underlying dimensions, then content validity describes the degree to which organisational size, "should sample or represent all ideas or areas in that conceptual space" (Neuman 1994). Hence, the phenomenon should be adequately analysed in order to make sure that all aspects are covered through rigourous description of the construct's definition (Neuman 1994). Additionally, if the construct is of a multi-faceted nature, then any indicators used to measure that construct should be used in the correct proportions (Anastasi 1982). Anastasi also warned against over-generalisation and the inclusion of irrelevant items. Clearly, for some phenomena this would be a relatively easy task.

Construct validity is "the extent to which [a] test may be said to measure a theoretical construct" (Anastasi 1982). Construct validity refers to the suitability of the relationship between a construct and its empirical indicators (the method used to measure that construct) (Schwab 1980). Neuman (1994) argued that this aspect of validity is especially important "for measures with multiple indicators" because it describes the degree to which these multiple indicators measure the same construct. As such, the relevance of construct validity to the later stages of this study in particular is marked: indicators should ideally have high construct validity if they are to be reliably used to quantify organisational size. To this end, Churchill (1979) argued, "Construct validity, which lies at the very heart of the scientific process, is most directly related to the question of what the instrument is in fact measuring - what construct, trait, or concept underlies a person's performance or score on a measure?".

There is some debate in the research literature as to the actual nature of construct validity. Hunter and Schmidt (1980) argued that construct validity should be recognised as a quantitative measure which should be adequately assessable by examining the correlation between the expected independent variable (the conceptual construct) and the proxy independent variable (the indicator or indicators used to quantify that construct). Cronbach and Quirk (1976), however, argued that construct validity is a purely qualitative concept and can be described in qualitative terms. Angoff (1988) concurred.

Convergent and discriminant validity are related concepts. Convergent validity describes the extent to which the use of more than one empirical indicator of a construct delivers equivalent or converging results. From the researcher's perspective, this should show that different indicators for a given construct appear to measure the same or a similar effect. Convergence suggests, perhaps by way of a high correlation coefficient, that indicators for a construct all point to the same construct. However, such a condition is indicative only, and on its own, this locus analysis does not guarantee a valid or accurate construct. In conceptual opposition to convergent validity, discriminant validity is the extent to which unrelated empirical indicators of a construct deliver differing or divergent results. This shows that constructs which are conceptually unrelated inform differently in application.

Nomological (or predictive) validity describes the extent to which an empirical indicator accurately predicts a particular construct that it should be able to predict, and is "relevant to tests employed for diagnosis of existing status rather than prediction of future outcomes" (Anastasi 1982:141). If an indicator has been developed to theoretically describe a construct, then it should be able to predict that construct. An empirical indicator would have good nomological or predictive validity if it could accurately make this prediction in the future. In circumstances where it is infeasible to wait for new data, researchers may use concurrent validity to describe the condition (Anastasi 1982). In these circumstances, existing data may be used to assess validity.

2.5.2 Reliability

Reliability has three main arms. First, stability reliability describes an indicator's dependability over time and is frequently assessed using test-retest analysis (c.f. Webster and Martocchio 1992) or the Cronbach Alpha (Cronbach 1971). Second, representative reliability describes an indicator's applicability to different population groups. A measure has high representative reliability if it can be dependably applied to a range of sample groups. This element of reliability may be tested using subpopulation analysis (c.f. Holcomb 2000). Third, equivalence reliability applies to conditions where researchers use more than one measure or indicator for a given phenomenon (Neuman 1994). Equivalence reliability may be examined using equivalent forms analysis (c.f. Sturdivant et al. 1985) and split-half reliability testing (c.f. Fenwick et al. 1983).

Reliability also deals with an indicator's unidimensionality and internal consistency. That is, the indicator should return the same results upon repeated application. The first component of internal consistency is unidimensionality. This describes the extent to which a group of indicators represent a single construct. This component can be assessed operationally according to the degree to which responses conform to a generally consistent pattern (Haer 1955). Without such unidimensionality, the researcher cannot be certain that they are not measuring more than one phenomenon (Girshick and Lerner 1950).

In the process of construct development, some authors (such as Lazarsfeld 1937) advocate a policy of item reduction. Item reduction supports unidimensionality and parsimonious model development (Bailey 1973). However, the literature also points out that such reduction should be conducted with care, lest crucial indicators are also removed from the constituent set. In the words of Bailey (1973:31), "Assignments into monothetic cells may proceed smoothly if one has only a few variables and a few specimens. But typologies with only a few variables are often theoretically irrelevant, and may be the result of attempts at simplification". Further, the number of appropriate dimensions may be difficult to ascertain (Brock and Sulsky

1994). Ultimately, such assessments may be best conducted with further empirical analysis (Schumm 1982).

2.6 Summary and Conclusions

Researchers typically use constructs to represent phenomena of interest. Some of these phenomena are clearly measurable and researchers may have developed appropriate indicators for these dimensions. These indicators facilitate direct computation and inter-subjective agreement. Other phenomena, however, are less easy to quantify. These phenomena, while difficult to measure, remain nonetheless crucial to theoretical development. Divergence between the real world and the corresponding constructs may result if the proxy is lacking in some way (for instance, in completeness or reliability). Such divergence may persist throughout the research if the proxy measures remain unexplored or untested.

This chapter presents a number of important implications for this study. First, where disagreement exists with respect to a particular construct, it can come from disagreement either about the meaning of the construct, or with regard to how it is measured. That is, where researchers are unable or unwilling to agree on what a construct means or how to go about measuring it, there may be divergence and disagreement. This may lead to an unreliable construct.

In the interests of furthering reliable knowledge about the real world, researchers require robust constructs. In order to gauge the robustness of these constructs, the researcher requires an understanding of what constitutes a good construct, and second requires a sound method of construct development.

CHAPTER 3

ORGANISATIONAL SIZE IN THE RESEARCH LITERATURE

The previous chapter argued that divergence can occur in cases where the relationship between the real world phenomenon and the construct is not easily observable. Divergence may also occur when the relationship between the construct and its indicators is unclear or erroneous. Consequently, disagreement may persist in studies that employ the construct in the research literature. This chapter applies this argument to the case of organisational size by examining the extent of the problem and past solutions.

This chapter presents evidence from the research literature where authors have used organisational size and presented contradictory findings in their own studies. Second, evidence is presented from prior research literature in which authors have identified the problem in earlier studies. This evidence is gathered from the literature in information systems and other disciplines in order to illustrate how this inconsistency has persisted over time and over a range of research areas.

The goal of this chapter is threefold. First, it aims to illustrate the contradictory ways in which authors in the wider research literature have treated both the size construct and its indicators. Second, it aims to describe what researchers already know about size. Third, it aims to show how researchers have already approached the problem in order to give some direction for research method development in this area.

This chapter is structured as follows. The chapter first presents an overview of the problem of size inconsistency. Then, the chapter presents two sets of evidence: research inconsistency from the literature, and argument from researchers regarding the inconsistency. Finally, the chapter discusses previous attempts to solve the problem.

3.1 Size Inconsistency in the Research Literature

Theoretical multiplicity is common in many disciplines. For example, authors in domains such as accounting (Watts and Zimmerman 1979), science (Cat 1995) and empirical finance (Fama 1965) have thoroughly documented (and, at times, vigorously defended) competing theories in their respective disciplines. This diversity, however, can mean that competing and conflicting theories exist for the analysis and understanding of a given phenomenon. Consider, for example, the many approaches in information systems to comparing system development success (Olle et al. 1988), quantifying software engineering productivity (Fenton and Neil 1999) or frameworks for analysing strategic information systems implementation (Lee and Adams 1990). While circumstances such as this may not be uncommon in scholarly environments, competition between theories and methods can serve to undermine the validity, reliability and comparability of scholarly analysis and the practical application of research. In general, the steady resolution of such conflict benefits both practitioners and researchers alike.

Amid the many variables that researchers employ in their work, organisational size is of particular importance (Kapur 1995, Dong and Saha 1998, Hausdorf and Duncan 2004). Many have observed it as an important independent variable in the analysis of organisations and technology (Eisele 1974). While researchers persist in using organisational size as a component of their research, its application continues to deliver inconclusive results. Occasionally, this is due to disagreement about size in terms of its meaning as a construct. In other cases, inconsistency arises because of disagreement regarding the construct's measurement (its indicators). Clearly, organisational size deserves sober reassessment.

This study now presents evidence that this inconsistency extends to studies in the published research literature. This section is divided into two categories. First, the section presents a list of studies that have obtained conflicting results when using organisational size. Second, the section presents the observations of researchers which, when considered collectively, suggest significant inter-subjective disagreement with respect to the size construct.

3.1.1 Inconsistent Comments About the Size Construct

Disagreement is apparent in the literature when reading what researchers think the organisational size construct *means*. One approach to exploring what size means is to consider how authors define size. However, many papers do not discuss what size means at all and, instead, size is frequently defined in terms of how it could be measured. For instance, Gupta (1980), wrote, "the 'size effect' has plagued researchers for decades, perhaps because most discussions have adopted a uniform definition of organisational size, namely, the number of members".

Within this definitional discussion, there is some variance. Temtime (2003:55) observed that the "definition of firm size varies, not only from one economy to another, but also from industry to industry within the same economy". Similarly, Banz (1981:161) wrote, "We do not even know whether the factor is size itself or whether size is just a proxy for one or more true but unknown factors correlated with size".

The following comments from the literature illustrate the persistent confusion between the meaning or definition of organisation size and its measurement:

> *"Although no formal definition of firm size exists, most people would define it in terms of a firm's current assets." (Berk 1997)*

> *"Firm size is defined as the number of subscribers who receive the bills from a firm." (Kim 2002)*

> *"Organisational size is defined as the number of employees at any given geographical location." (Beer 1964)*

> *"A firm's size was defined as its relative size: [the] firm's market value [divided by] the mean of beginning-of-year market values of all firms in the COMPUSTAT industrial annual tape." (Chung et al. 1996)*

> *"For the purpose of this study, organization size will be defined by the number of blue-collar employees at a particular manufacturing plant who were covered by one or more labor-management agreements in 1970." (Eisele 1974)*

Talacchi (1960:400) indirectly offered an explanation for this confusion, arguing that "studies in this area have dealt with the variable of size only peripherally because relevant data were collected and analysed incident to some other objective, such as the study of the relationship between morale and behaviour of employees". This suggests that perhaps authors have been more concerned about using size as a construct to predict relationships with other phenomena, rather than exploring size as a phenomenon itself.

Further, the use and discussion of size as a construct may form the basis of many other studies as researchers pursue the important task of reviewing the literature in the natural progression of scientific research. This debate impedes the progression of scientific enquiry as other researchers then seek to replicate these works. This inconsistency is perhaps due to the contention that researchers each have a tacit understanding of size which is not necessarily congruent across authors. Individual researchers, themselves, may each understand and be able to justify their use of the organisational size construct, however this understanding is not generally accepted or congruent across authors.

The absence of definitional discussion in the literature may partially explain the problem of size inconsistency: authors may have difficulty describing the construct's meaning and this means they cannot agree on how to measure it.

3.1.2 Inconsistent Comments About Size Indicators

Disagreement can also be observed when reading literature discussion about the construct's indicators. Each comment below was taken from a blind peer-reviewed published research paper in a journal of good academic standing. That is, these comments have survived both the peer review process and the editorial process without severe modification. When viewed in aggregate, these comments clearly suggest disagreement and inconsistency. However, when each is read in its own individual context, *in situ*, the comments do not appear to be in conflict. These comments follow:

"Number of employees is the most common size criterion used by researchers." (Choe 1996)

"Common operationalisations of firm size include gross sales or gross value of assets." (Karimi and Gupta 1996)

"We measured firm size as number of employees since sales and assets were used to compute performance measures." (Baucus and Baucus 1997)

"Most students of organisational structure have taken the number of employees as the main referent of size." (Child 1970)

"Size...was measured by the number of beds devoted solely to inpatient psychiatric care. This measure...represents a common classification of size in previous research." (Hrebiniak and Alutto 1973)

"The number of persons under the respondent's direction is probably a good approximate measure of the size of the organisation." (Kriesberg 1962)

"The [Private Companies Practice Section] files contain several measures of audit firm size: number of CPAs, number of partners, and total staff." (Colbert and Murray 1999)

"Total assets are commonly used to measure firm size." (Carpenter and Petersen 2002)

"The best indicator for size is the firm's total sales volume." (Ali and Swiercz 1991)

"Number of personnel is the most widely used indicator." (Price and Mueller 1986)

"Commonly used criteria for defining a small business include number of employees, annual sales, fixed assets." (Thong and Yap 1994)

"Companies were identified...by listings of those that employed graduates on a regular basis, as this was felt to be an indicator of size." (Coakes and Merchant 1996)

"The simplest and most adequate way of arranging organisations by size is to count their members." (Caplow 1957)

"The...organisations are of similar size in terms of the total number of users their information architectures support." (Nezlek et al. 1999)

"We used the Department of Transportation's dichotomous [Large or Small] classification, which has been widely used as a key demarcation in airline industry research." (Chen and Hambrick 1995)

"The smallest organisations have two members, this being the least number capable of maintaining an interaction system." (Caplow 1957)

"Certainly one measure of firm size can be the total number of employees [however] typically, other measures such as stock market value of the firm, profits, or total assets are used to measure firm size." (Hallock 1998)

"Several indicators have been employed in the literature to measure firm size. The most popular are the number of full-time employees and sales volume." (Katsikeas and Morgan 1994)

"Variables used to measure firm size include total premium, total admitted assets, and capital and surplus." (Chen and Wong 2004)

The evidence presented above illustrates the inconsistency with which authors approach the understanding or measurement of organisational size. When each comment is considered in isolation, the statement appears acceptable. However, when examined collectively, the inconsistency between statements becomes apparent. For example, while comments by Price and Mueller (1986) and Choe (1996) are similar, the statements by Choe (1996) and Berk (1997) appear contradictory. Contrary to Indik's (1964) claim that the "organisational unit size [is] relatively easy to measure", there appears to be much disagreement in the literature about how this should be done.

Orlitzky (2001) presented an alternative perspective on this issue. Orlitzky conducted a meta-analysis of research into corporate social performance and argued, "Operationalisations of firm size...differed from one study to the next. Multiple operation is, however, not a problem, but a strength. Positive correlations between different operationalisations (e.g., amount of sales revenue and number of employees in the case of firm size) indicate the measurement of the same underlying construct and do not impair the validity of the meta-analysis" (p. 172).

The previous chapter argued that indicators for a given construct should possess content and convergent validity. The evidence presented above suggests that treatment of the size construct lacks these aspects of validity in that repeated use of the size construct does not appear to yield convergent results and the associated indicators also do not measure the qualities that they purport to measure (Thorndike and Hagen 1971).

3.1.3 Inconsistent Research Findings Involving Size

Table 3.1 shows a list of studies taken from the organisation, management and information systems literatures. These empirical studies have provided inconsistent results when using the organisational size construct as an independent variable. The studies in this section were identified by reading journal articles and conducting keyword searches. The thesis does not hold the list of dependent variables to be exhaustive. However, the list does give the reader an indication of the extent of the problem. For each dependent variable, Table 3.1 gives one or more studies in which size (as a construct) was found to have an effect, and similarly one or more studies in which the size construct was found not to have an effect.

Table 3.1 Literature Findings For Organisational Size as an Independent Variable

Dependent Variable	Size is Positively Significant	Size is Not or Negatively Significant
Degree of bureaucratisation	Chapin (1951), Tsouderos (1955)	Hall (1963)
Administration overhead	Terrien and Mills (1955)	Anderson and Warkov (1961), Bendix (1956)
Complexity and structure	Caplow (1957), Grusky (1961), Blau (1970), Meyer (1972)	Blau and Scott (1962), Zelditch and Hopkins (1961)
Innovation adoption	Aiken and Hage (1971), Corwin (1972)	Mohr (1969)
Hardware centralisation	Ein-Dor and Segev (1982)	Olson and Chervany (1980)
Technology use	Hickson et al. (1969)	Woodward (1965)
Economies of ccale	Coates and Updegraff (1973)	Klatzky (1970)
Level of technology use	Yao et al. (2002)	Goss and Vozikis (1994)
Export activity	Kaynak and Kothari (1984), Lall and Kumar (1981)	Ali and Swiercz (1991)
Corporate social performance	Chen and Metcalfe (1980)	Orlitzky (2001)
IS planning	McFarlan et al. (1983)	Premkumar and King (1994)
Innovation	Nord and Tucker (1987)	Aldrich and Auster (1986)
IS use	Lehman (1986)	Gremillion (1984)
IS adoption	Moch and Morse (1977)	Globerman (1975)
Website use	Lin (2002)	Goode and Stevens (2000)
Firm productivity	Herbst (1957)	Marriot (1949), Thomas (1959)
Export ability	Cavusgil and Nevin (1981), Christensen et al. (1987)	Edfelt (1986), Holden (1986)
Trade intensity	O'Rourke (1985)	Bilkey (1978)
Audit disclosure	Singhvi and Desai (1971)	Wallace et al. (1994)
Workplace satisfaction	Marsden et al. (1996)	MacDermid et al. (1999)
Dynamic innovation	Methe (1992)	Stock et al. (2002)

The papers in Table 3.1 point to a number of important issues. First, whereas some studies disclosed their indicator for size, all papers referred to size *at the construct level* (i.e. its meaning). However, the evidence presented in Table 3.1 suggests that disagreement may result at both the construct and indicator levels. Over time, this disagreement manifests itself in terms of disagreement about size *as a phenomenon* (i.e. its theory). Studies on a variety of topics have delivered inconsistent results when using the construct. The range of topics is substantial and the list of topic areas shows no obvious thread of similarity. The list includes example studies of organisational structure, organisational behaviour as well as technological innovation. This inconsistency may extend to other topic areas which are not included in this table. The magnitude of this effect is, as a result, a matter of conjecture. Because so few studies have adequately explored the reasons for this disagreement, researchers are unsure about whether the problem of organisational size is due to its measurement, its meaning, or its theory. These problems need to be disentangled.

The second point to note is that this problem has been present for some time. Studies in Table 3.1 were published between 1951 and 2002. This time span suggests that either researchers have not yet observed or recognised the problem, or that few solutions to the problem have been proposed and subsequently acted upon. With respect to the organisational size construct itself, there appears to be very little evidence of research progression or accumulation.

The main implication of these issues for theory building is that construct disagreement may result in poor theory and, in turn, poor knowledge. Persistent use of the size construct in this regard may mean that researchers increasingly find themselves unable to base their research on reliable evidence. This may result in an inability to build the research pedigree, as observed in Chapter 2.

3.2 The Recognition of Size Inconsistency in the Research Literature

This section establishes that some authors in the general organisational research literature have encountered the inconsistency of organisational size. Several researchers in the broader organisational literature have spent considerable effort analysing the organisational size construct. Most of these studies, such as Robey et al. (1977), Haveman (1993), and Damanpour (1996) have focused on how the size construct has been used in the literature. However, few studies have explored the size inconsistency problem *per se*. This discussion presents an analysis of the work that has recognised the inconsistency of organisational size.

Early studies involving organisational size (such as Hamilton 1921, Walters, 1931, Durkheim 1947 and Warner and Low 1947) focused mainly on structure and administration, in areas such as plant economics and sociology (Tyler 1986). Pugh et al. (1969:97), also citing Porter and Lawler (1965), wrote "there has been much work relating size to group and individual variables...with not very consistent results". At a similar time, Hall and Weiss (1967:319) observed that "previous studies of the effect of size on profitability...have provided only very imperfect information on the subject". Frustratingly, Hall et al. (1967) were critical of the overly simple treatment of size in the literature, but then measured the organisational size construct with a single unidimensional indicator themselves: "determination of organisational size for this study was quite simple. The total number of paid employees in an organisation was taken as an accurate measure of size" (p. 905).

Coates and Updegraff (1973) later observed the conflict between Caplow's (1957) assertion, that firm administrative overhead increases as firm size increases, and evidence from Blau and Scott (1982) and Melman (1951) to the contrary. Murphy (1976) subsequently criticised the Coates and Updegraff study, partly on the grounds of its erroneous handling of size. Robey et al. (1977) wrote, "conclusions regarding size range from Hall's (1972) virtual dismissal of its importance *vis-à-vis* other causal factors to Meyer's (1972) claim that size explains virtually all of the observed variation in structure". This is reflected, to some extent, in the words of Kimberley (1976:575), "in many ways, [size] explained everything and nothing at the same time".

Paulson (1980) and then Dalton and Kerner (1983) later witnessed the "controversy regarding the appropriateness, dimensionality, and psychometric properties of common size metrics", also citing Gupta (1980). Banz (1981:161) wrote, "we do not even know whether the factor is size itself or whether size is just a proxy for one or more true but unknown factors correlated with size". Sutton and D'aunno (1989) observed differences and conflict between the sociological view of size (which focuses on structural features of an organisation) and the 'psychological' view of size (which focuses on an organisation's behavioural factors). These authors also observe that completely contradictory hypotheses can be developed using these two perspectives.

Bonacorsi (1992) conducted a review of the literature on export and trade with regard to size and noted, "all authors state that empirical findings on the relationships between firm size and export behaviour are mixed or conflicting" (p. 606). The authors subsequently attributed this to "conceptual shortcomings of current export research" (p. 631). Aaby and Slater (1989) made similar observations. Simon (1997:109) also sees the problem: "it should be noted, however, that the size variable is unusual in that it suggests differences in the 'nature' of two firms, or of the same firm at different moments, whereas the only difference between firms found in standard theory is a difference in cost functions".

Authors in domains other than those that focus on business analysis have also recognised inter-study inconsistency. Consider the recent arguments of Barber et al. (1999:844) writing in the psychology literature:

> *"...integration of results from these empirical studies is made difficult by the fact that...firm size is categorised differently across studies. For Pritchard and Fidler (1993) and Deshpande and Golhar (1994), firms with fewer than 500 employees are classified as 'small', a classification consistent with the standards of the Small Business Administration. But Bertram et al. (1995) included only firms with fewer than 25 employees as 'small', Heneman and Berkley defined firms with less than 100 employees as 'small', and Marsden's (1994) 'large' category included firms with more than 250 employees."*

Similarly, Dalton et al. (1980:51), in the administrative science literature, wrote:

> *"Measurement can also be problematic...Hrebiniak and Alutto, for instance, used number of beds as an indication of organisation size, a common practice in differentiating hospitals. Bidwell and Kasarda used average daily student attendance, an accepted criterion of school size. Reimann counted the number of full-time employees. Each method is reasonable; comparison of these studies is complicated, however because the measures are neither identical nor interchangeable. Moreover, Reimann, and Bidwell and Kasarda used a logarithmic conversion to normalise size. The others do not do so. Again, this makes responsible comparison difficult".*

Finally, comments from Lee and Smith (1995:245) in the education literature are also relevant:

> *"Findings about the effects of school size have been inconsistent because of weaknesses in the research: inconsistent definitions, inappropriate methodology, and (primarily) an unclear focus about what may be affected by a change in school size and on the process through which those effects may work."*

Within the information systems discipline, there has been little recognition of size inconsistency. Mabert et al. (2003:236) observed that "organizational size is the most frequently examined structural variable and has been used to study issues relating to innovation, R & D expenditures and market power". The size construct continues to receive application in the information systems literature, particularly in the context of technology adoption (Swanson 1994). Yet, Yao et al. (2002:80) warned that "using size as a variable without careful classification may not yield desirable results". Similarly Bajwa and Lewis (2003:32) wrote,

> *"While some innovation studies suggest a positive relationship between organization size and adoption behaviour...a negative relationship between size and adoption behavior has also been observed. In summary, past studies have yielded mixed results on the relationship between organization size and adoption behaviour".*

One example of the few studies to acknowledge this inconsistency in the information systems literature comes from Choe (1996:216):

> *"In terms of organization size, Gremillion has suggested no relationship between IS use and organizational size as measured by geographic area, staff and budget levels, and so on. However, Yap empirically suggested a positive relation between IS use and organization size measured by annual turnover. The results of the two studies were contradictory. Raymond explained these conflicting results through system sophistication. He reported that the effect of organization size on IS usage is mediated by the system sophistication."*

The evidence presented above shows that at least some authors in the published research literature have noticed the problem of disagreement with respect to constructs, indicators or both. This disagreement has persisted for some time. There has, however, been seemingly little recognition of the problem in the information systems literature. Given the importance of organisational research and analysis in information systems, this is a significant problem.

3.3 Possible Explanations

The argument presented in this thesis, based on the evidence presented above, is that the research discrepancy may be due to construct error. In other words, this study argues that organisational size as a construct is improperly treated and measured. It is possible, however, that this inconsistency could be explained through other means. This section considers some of these alternative propositions.

3.3.1 The Effect of Differences Between Organisations

It could be argued that the studies cited in the previous section are exploring organisations which are fundamentally different to each other. Each study is examining organisations which exhibit different contextual properties. These differences in context at least partially explain the variance in research findings. If true, this would suggest that such firms should be compared only in particular circumstances and disregarding these differences might lead to unreliable analysis. This argument would be consistent with Kimberley's (1975, 1976) observations that significant structural differences can exist between tribes and other social groups. Kimberly's arguments may extend to commercial organisations also.

However, it could also be argued that, despite this contention, other studies in the literature do not distinguish between different types of organisation either. Little mention is made of contextual organisational differences in these studies and firms are compared without regard for such contingencies. The effect of this problem may be large, but the issue has been largely ignored in the research literature itself.

3.3.2 The Effect of Measurement Error

The discrepancies presented in the previous section could be attributed to measurement error. That is, the data used in the studies presented in the previous sections are affected by inconsistency, bias or exaggeration. These problems may affect the statistical analysis, leading to erroneous and conflicting results. Differing research methodologies used may also reduce comparability between studies (Calof

1993). This error may not necessarily be systematic, nor need it be predictable or obvious. If the size construct was merely unpredictable or unsystematic, the solution to the size problem would be straightforward: researchers could discontinue the size construct's use in empirical research and subsequently seek out a more reliable construct.

However, the existence of such error is an unsatisfying explanation of the problem. It is unlikely (although admittedly possible) that this error would be so widespread among researchers in different countries and with different datasets. Additionally, if such error is to blame for this inconsistency, then constructs other than organisational size could conceivably also be subject to the problem. Also, in some cases, authors *do* use more than one indicator for size and observe distinct similarity among research hypothesis outcomes (as in Carpenter and Fredrickson 2001). Given the tremendous amount of work undertaken in these studies, data error of such magnitude seems implausible. For the purposes of this thesis, such error will be deemed negligible.

3.3.3 The Effect of Differences Between Industries

The evidence presented so far could be attributed to industry differences, whereby the structural effects of organisations in different sectors cloud the results. For instance, organisations in the mining or manufacturing sectors may be human resource rich, while firms in investment or banking sectors may rely more on financial resources (Cardinal et al. 2001). Paulson (1980) observed that governmental organisations may exhibit yet more differences and also notes that industry may be a limiting factor in size studies in this regard. If this is the case, then a given approach to measuring organisational size may yield different results when conducted in different industries. Given these differences, the most appropriate indicator for measuring organisational size would depend on that organisation's particular industry.

However, authors in the literature themselves frequently do not restrict or divide their data samples with respect to industry. While some studies do clearly narrow analysis to particular industries (such as Robey et al. 1977), studies such as Bannerjee and Golhar (1994) and Teo et al (1997) treated the multi-sector firms in their samples as homogeneous groups. Koberg et al. (1996) did not distinguish between industries but declared that their results may not be generalisable across firms in other industries. Sambamurthy and Zmud (1999), conducting case study analysis of a small group of firms, acknowledged the diversity of industry types but make no obvious distinction in terms of industry thereafter. Ein-Dor and Segev (1982) recognised inter-item correlation and an industry effect as a limitation to their findings. Damanpour (1996) also observed industry effects in his data set but did not control for them in any testing involving organisational size.

The implication of this is that sector differences may have an effect on research outcomes, however not all studies take this into account. The handling of industry and sector types has itself been somewhat inconsistent across research studies.

3.4 Prior Attempts to Solve the Problem

The purpose of this section is to clearly set out what has been done to explore and address the problem of size inconsistency. Many studies in the general organisational literature which have encountered the problem of size inconsistency do not explore it in sufficient depth to offer a solution. The literature shows very few studies that have actually attempted to *solve* the problem of organisational size construct inconsistency. These studies are explored in greater detail below. Discussion of each study will make specific notes on the paper's approach, findings and their implications for this study.

3.4.1 Caplow (1957)

Caplow's work in the organisational theory literature was among the first to critically examine organisational size. Caplow made a number of theoretical arguments and observations regarding size and, as such, his work merits inclusion here. Caplow did not so much attempt to solve the inconsistency of size measurement and use, but rather attempted to organise some of the literature understanding of size itself.

Caplow's work focused predominantly on social organisations and groups of humans. In particular, Caplow discussed the substantial alignment between social and organisational groups (such as tribes and families). First, Caplow discussed different categories of size, developing *a priori* classifications and descriptions of small, medium, large and giant organisations. Small organisations could range in size up to "about one hundred members" and still allow each person to interact with each other person. Medium organisations were already too large to afford inter-personal communications between each pair of members, possessing an "upper limit of perhaps one thousand members". The 'large' and 'giant' organisations have so many members that certain members may know one member, but none can know every member.

Caplow's second argument was that organisational complexity was closely related to size. Caplow divided his discussion of complexity into four types. He first observed pair interactivity, where a group's member has a communication relationship to another member of the organisation. The next category involves pair relationships and group relationships held by one member of the original pair. The third type concerns relationships between groups of organisational members. The fourth category contains all groups and individual relationships in the other three categories combined.

Caplow's work has three important implications that are relevant to this thesis. First, Caplow arguably treated size as a "first-order construct". He argued that the size of a social group should be related to and measured by the number of its members. This argument may explain why later researchers have attempted to also treat size as a first-order construct, using different indicators, with little success and substantial disagreement.

Second, Caplow focused on social organisations (such as families), but justified these arguments empirically using data from commercial organisations (such as private businesses). His comments regarding group membership are not difficult to understand given his focus on social groups, as it could be argued that "membership" is a common trait of social groups such as tribes. However, because subsequent researchers have applied Caplow's theory in commercial organisations, this may explain why researchers have tended to measure size according to the number of employees in the firm. That is, while the original theory concerning size focused on social organisations, the contemporary literature may have transferred this to commercial organisations with little modification to the underlying measurement theory. This may also explain why some authors hypothesize a relationship between size as measured by *Number of Employees* and increasing organisational complexity.

Third, Caplow's work examines not only an organisation's human capacity but also its complexity and degree of internal inter-relationship. Indirectly, Caplow's work seems to suggest that an organisation's size describes not only the members of an organisation but also the activities that these members undertake. This suggests that size may have several dimensions and may not be easily measured by quantifying human capital alone. Researchers instead may need to take into account a behavioural aspect to the organisational size construct, which comprises an organisation's function in addition to its form.

3.4.2 Pugh et al. (1963, 1968, 1969) (The Aston Business School Studies)

The Aston Business School studies have received significant coverage in the research literature. While their contribution focused mainly on the effects and antecedents of organisational structure as opposed to size *per se*, their work involves substantial discussion of organisational size. As a result, it is worth giving their work some discussion in this thesis.

Pugh et al.'s (1963) first theoretical work attempted to relate organisational behaviour to organisational structure by reviewing the literature on bureaucracy. Their intention was to develop an instrument with which firms could be categorised according to structure. Their review of the literature resulted in the development of a conceptual framework comprising six dimensions of structure, being specialization, standardization, formalization, centralization, configuration and flexibility. Organisational size was given short coverage in this study, despite their comment that size is a "major determining factor of organisational structure" (p. 309). Interestingly, the authors directed future researchers to use *Number of Employees* and *Total Net Assets* as indicators for size, however they provide very little theoretical justification for this advice. The relationship between these indicators to the six structural dimensions discussed above is also unclear.

Pugh et al. (1968) later operationalised five of the dimensions of structure developed in their previous research. Insufficient data were available to operationalise the flexibility dimension which, the authors argue, would require more longitudinal analysis. The authors collected data from 52 privately and publicly-held organisations using interview surveys. The authors randomized their sample according to organisational size as measured by *Number of Employees*.

The main implication arising from Pugh et al. (1968) is that, within their organisational analysis, the role of size was not easily understood. As Scott (1975) observes, their factor analysis showed that size loaded significantly onto the formalization, differentiation and standardization factors, but only exhibited a weak loading onto other factors. Finally, Pugh et al. (1968) used a multidimensional scaling technique to analyse the structure construct. This method allows them to separate individual dimensions within the construct.

Pugh et al. (1969) later used the same survey sample and data set to explore the hypothesized relationship between organisational context (comprising seven dimensions, including organisational size) and organisational structure. The study used two indicators of size, being *Number of Employees* and *Total Net Assets*, however the authors appeared uncertain as to which indicator was most appropriate. First, the authors observed substantial skewness in their sample with regard to the *Number of Employees*. This skewness violated the assumption of normality in multiple regression. Their solution to this problem was to take the natural log of *Number of Employees* as an indicator of size instead. On the grounds that "financial size might expose some interesting relationships with organisation structure that would not appear when only personnel size was used" (p. 98), the authors also planned to use *Net Assets* to capture financial size. However, the authors note that "the attempt to differentiate between these two aspects of size proved unsuccessful however [and] the logarithm of employees was therefore taken to represent both aspects of size" (p. 98). The results of the multivariate regression were inconclusive, with the authors positing both that size affects structure and that structure affects size. The authors argue that further research in the area of size is still required.

Pugh et al. (1969) observed the inconsistency of size use in the extant research literature, reiterating Porter and Lawler's (1965) claim to this effect. An important implication for this thesis is that the authors do seem to argue that size appears to be a "summary" of other concepts: "the factor may obscure particular relationships with the source variables which it summarises" (p. 98). Despite this, the authors still treated organisational size as a first-order construct, without further exploring this multi-dimensionality.

3.4.3 Smyth et al. (1975) and Shalit and Sankar (1977)

The economic statistics literature has also given some very brief coverage to solving the problem of size inconsistency. Two studies which discussed size measurement are Smyth et al. (1975) and Shalit and Sankar (1977). These studies are examined together in this section because the latter paper makes critical discussion of the former. Importantly, however, they only give advice as to size measurement, without discussing the actual size construct itself.

Smyth et al. (1975) observed that not only are several size indicators used in the economic statistics literature, but authors appear to believe that these size indicators are easily interchangeable with little adverse effect on the test's outcome. The study then set out to develop some conditions in which size indicator interchangeability is acceptable. Smyth et al. argued that, in order for two indicators to be interchangeable, the measures must be related in longitudinal terms. Conversely, "if the relationship between alternative measures of firm size is nonlinear...then different measures of firm size will yield different conclusions" (p. 112). The study assumed that error variance for these size observations is constant; the degree to which this is an appropriate assumption is unknown.

Shalit and Sankar also explored commonly used organisational size measures, providing critical analysis of Smyth et al.'s study. In part, they aimed to address the lack of stochastic power in the Smyth et al. study. Shalit and Sankar first considered conditions where alternative measures of size are not only correlated but are also subject to the "unobservable true measure" of size. In such circumstances, the authors argue, model parameter mis-specification and significant error variance may cloud the test's result. Shalit and Sankar further developed the model of Smyth et al. by substituting sample terms with population terms, thus reducing the magnitude of possible error but requiring greater knowledge of coefficients and variance. In essence, in order to develop a better test for size indicator interchangeability, the authors imposed a requirement for more information regarding the sample of firms. From this theory and, using some empirical data, the authors developed an index table of different indicators based on different levels of error (lambda). The authors then showed that, in the absence of controlling conditions, size indicators are generally not easily interchangeable. The authors observed that *Total Assets* and *Owner's Equity* may be interchangeable for appropriate error variances.

These two studies provide several important implications for this thesis. First, the studies recognise part of the size problem and attempt to address it by exploring the construct's measurement. The arguments of Shalit and Sankar (1977) also suggest that it is important to contextualise the understanding of measurement with meaning. Further, without understanding the underlying construct, researchers cannot be sure that they are measuring what they think they're measuring. Second, as has been shown in this chapter, there is further evidence that size indicators are not easily interchangeable. This suggests that it is important to take into account the size indicator chosen. In this regard, further analysis of organisational size indicators is warranted.

3.4.4 Kimberly (1976)

Kimberly's work on organisational size is extremely useful for this thesis because the analysis presented therein raises implications for future study in the area. The research is useful for illustrating the existence of the problem and, more importantly, indirectly suggests valuable explanations as to why the problem has not yet been solved.

Kimberly conducted a review of papers that employed organisational size in the sociology literature. Kimberly sourced articles from five leading sociology journals, a select group of books and journals in other areas. Within this literature, Kimberly observed the rise in popularity of the size construct in empirical research but also perceives some disagreement regarding organisational size. From this body of work, Kimberly explored four broad areas, being the theory of size, the role of size in sociology research, the treatment of causality with respect to size and methodological issues of size use. These findings merit reiteration here.

With respect to the theory of size, Kimberly observed little ongoing theoretical development. Few researchers justify their use of organisational size. Theory development that is offered appears to be *post hoc*, where authors attempt not to build theory before conducting testing, but rather to justify occasionally spurious, inconsistent or unforeseen findings afterward. Reliable theoretical definitions of size also appear to be lacking, yet Kimberley observed that researchers can still interpret size discussion from other studies. It is possible that researchers are relying on a 'tacit' understanding of what size means and researchers may find this understanding difficult or unnecessary to articulate.

With respect to the role of size in sociology, Kimberley observed that many authors refer to organisations and organisational types. Within this, however, Kimberly observed that the size construct can be used to explain many phenomena without appropriate justification. This is further complicated by the difficulty of agreeing on what should constitute an organisation in the first instance, and in clearly defining what constitutes an organisation type in the second instance.

With respect to the treatment of causality, Kimberly observed that most researchers merely refer to associative relationships, except where statistical methods have afforded authors the power (and burden) of developing more causal models. Interestingly, Kimberly also observed that most authors see firm size as an exogenous factor in their studies, generally responsible for causing the other phenomena present in their studies.

With respect to methodological observations, Kimberly made four important points. First, he asserted that many studies base their use of size on data availability rather than theoretical suitability, justifying indicator selection on what is perceived to be an approximately equivalent measurement approach in the extant literature. This "empirical pragmatism" (p. 582), Kimberly argued, may be borne partly out of researcher inexperience. Second, Kimberly observed some minor variability in terms of size measures. He noted that *Number of Employees* is by far the most common size indicator in use, though can find little justification for why this should be. He also observed four other indicators, being *Capacity*, *Number of Clients Served*, *Net Assets* and *Sales Volume*. Third, Kimberly discussed the increasing popularity of using natural log transforms on indicators and identifies problems of data distortion and assumptions of curvilinearity with respect to other regression variables. Kimberly's fourth point concerned the problem of developing mathematical models where one of the independent variables is also part of the dependent variable. As a case in point, Kimberly cited the "empirically tautological" problem (p. 584) of relating number of employees (as a size indicator) to the degree of human resource administrative overhead. Kimberly indirectly argued that findings from such testing should be treated with caution. Researchers, Kimberly argued, have not adequately assessed the effects of these problems.

Kimberly offers several directions for research which are of particular relevance to this thesis. First, Kimberly questioned the degree to which size indicators can be substituted for each other. This appears to contradict the earlier argument presented by Smyth et al. (1975) that indicators are interchangeable. Next, Kimberly observed that indicators of size in the literature appear to focus largely on the amount of resources held by the firm. There is a lack of convincing evidence that aspects such as structure, capacity and discretionary resources are adequately captured in these indicators. Further, the interaction between these aspects of size is not necessarily straightforward: the treatment of size may be inconsistent if individual indicators are not properly weighted in research models. Ultimately, Kimberly wrote, it may be necessary to stop using size altogether in organisational research because of the construct's inconsistency.

In the literature discussed by Kimberly, there does seem to be some evidence of cumulative tradition. Authors in the area regularly reference Blau and Caplow for direction and guidance. However, despite considerable recent literature coverage (such as Harris and Katz 1991, Brown and Magill 1994 and Damanpour 1996), Kimberly's findings highlight the need for greater exploration of the conceptual meaning of organisational size. Kimberly's arguments appear to have either been ignored or found to be otherwise lacking.

3.4.5 Bujaki and Richardson (1997)

Bujaki and Richardson conducted a limited study of firm size as a research construct, focusing on its use in the accounting literature. Bujaki and Richardson's motivation originated from the seminal work of Ball and Foster (1982), who observed that size can be "interpreted in many different ways", hence limiting its applicability in research contexts. Bujaki and Richardson observed that, in the accounting literature, size is used as a proxy for many concepts, such as political costs, liquidity and expected returns. The authors then contended that firm size has not yet been validated with respect to these associated constructs and, as a result, is unreliable.

In order to explore these arguments, Bujaki and Richardson conducted a citation analysis of papers published in five core accounting research journals. They noted the construct proxied for by size, the indicator used to quantify size and the citations used to develop theory in each study.

The study found that size was used as a proxy for 18 separate constructs. The authors found five indicators used to quantify size, being *Market Value*, *Assets*, *Sales*, *Income* and *Number of Employees*. They argued that very little theoretical evidence could be found to relate size to each construct. The authors also argued that too few indicators are in use and that more indicators should be explored in order to improve validity.

The Bujaki and Richardson study has some implications for this thesis. First, their study covered just a single year of published research. It could be argued that a longer study might inform researcher understanding of the size construct by revealing more of its underlying dimensions and may give a greater insight into the wider research agenda. Second, their study only examined what organisational size proxies for, on the assumption that a lack of a relationship between organisational size and the construct implies poor construct validity. It could be argued that, before any conclusions can be drawn regarding the semantic correspondence between these dimensions, it is first necessary to understand what size itself actually means. Based on this analysis of meaning, researchers can develop appropriate indicators and some assessment can be made of the size construct's suitability for research purposes.

Importantly, Bujaki and Richardson also foreshadowed difficulties in operationally measuring size if the construct was eventually found to be multi-dimensional. The authors cited McDonald (1981), who argued that a construct must be unidimensional in order to possess construct validity. If size has more than one dimension of relevance, the authors argue, then it will be impossible to ascribe construct validity to it. This may mean that size should not be used in organisational research.

3.5 Implications for this Thesis

The evidence presented in the preceding sections gives some insight into the magnitude and extent of the organisational size problem in the wider literature. The research already undertaken gives direction for initial propositions regarding size. The studies discussed above also offer some direction for this study's approach and method, and it is useful to learn from the methods employed in those papers. These are discussed below, first with respect to size and second with respect to method and approach.

3.5.1 Implications for Organisational Size

The first section presented instances of inconsistency with respect to constructs and indicators in the research literature. The evidence presented therein shows that after a forty year time period, researchers are still experiencing difficulty with the size construct. This difficulty exists at both the construct and indicator levels and may be testament to the extent and difficulty of the problem at hand. Evidence from the second section showed that several researchers have observed the problem in their own disciplines: presented in aggregate, however, the evidence suggests that the problem of size construct inconsistency occurs across disciplines. In the words of Dalton et al. (1980:51), "A lack of consistency in the reviewed studies may lead to an inadequate understanding of the role of organisation size".

Finally, it is worth briefly noting the frequency of use of organisational size in the literature. The arguments of several authors showed that size is receiving increasing use in the research literature. Despite the inconsistency illustrated in this chapter, researchers still appear keen to see if the phenomena under examination can explain, or are related to, organisational size. One explanation for this rise is that there has been a nominal rise in the number of published studies and a corresponding increase in the number of studies using the size construct. However, another possible explanation is that researchers are unsure as to what size means and are ascribing more terms to the construct. Instead of seeking new individual indicators to describe these terms, researchers gather them under the "umbrella" of organisational size. This results in more studies involving size, increased mismeasurement and, ultimately, dilution of the explanatory power of the size construct.

The overwhelming theoretical argument that size must somehow be important (e.g. Rouleau and Clegg 1992) may compel authors to search for potential explanations for the unexpected findings in their work. The ability for researchers to fit the data to match their expectations or research goals is documented in other areas. For example, with respect to factor analysis, Steiger (1990:175) wrote, "What percentage of researchers would find themselves unable to think up a 'theoretical justification' for freeing a parameter? In the absence of empirical information to the contrary, I assume that the answer… is 'near zero'".

3.5.2 Implications for Method and Approach

Despite the lack of research in the area, some tentative observations regarding appropriate research methods can be made. First, the literature review and citation search approaches have received patronage. Whereas many of the authors cited in

Section 3.4 above have mostly used the literature review to identify the problem, rather than develop solutions to construct disagreement, the method is nonetheless useful for identifying dimensions to the size construct.

With regard to data collection, most of the studies employed the questionnaire survey method. In at least one case, the survey provided a data set that was used across two published studies (Pugh et al. 1968 and Pugh et al. 1969). The survey method allows a large number of research variables to be gathered in a relatively quick and cost effective manner. It is important to note, however, that this problem is more than just a conventional matter of instrument development. The literature reviewed above reveals a combination of poor theory development and inconsistent results. This condition has arisen largely because researchers have given so little thought to the problems of measurement, meaning and possible multi-dimensionality.

With regard to statistical methods, the multivariate regression, correlation analysis and multi-dimensional scaling methods have each seen use. Pugh et al. (1968) used the multi-dimensional scaling method as it allowed them to separate and identify possible dimensions within the size construct.

3.6 Summary and Conclusions

The evidence presented in this chapter has illustrated the organisational size problem from two perspectives. First, the evidence showed that, throughout the range of research literature, studies can be found which have clearly delivered conflicting results with reference to organisational size. Some studies find the construct to be statistically or theoretically important while others find it lacks persuasive power.

These studies do not appear to be restricted to a particular field or period of observation.

Evidence presented in this chapter has shown that some other authors have also recognised the problem of size inconsistency. These authors have observed that the findings of previous studies involving size have been inconsistent and occasionally conflicting. To a lesser extent, this observation of inconsistency extends to the information systems literature (notably with regard to technology adoption).

This evidence suggests that the problem requires deeper analysis, however this chapter also saw that there has been very little published work that attempts to solve the size problem. The chapter also showed that there has been little recognition of the problem of size inconsistency, despite the construct's importance in areas such as adoption analysis. Possible explanations for the inconsistency include a lack of agreement over the construct, or a lack of agreement regarding the type or number of indicators to use. Disagreement exists even over these explanations. Clearly, the problem requires further investigation.

CHAPTER 4

SELECTING A METHOD FOR CONSTRUCT INVESTIGATION

The previous chapter observed that there is a lack of common understanding about the meaning of the organisational size construct. Also, it has been employed as an independent variable in a number of research studies with mixed results. Possibly the size construct is a second-order construct, itself comprising more than one construct. While some authors have explored the problem of organisational size, it remains largely unsolved. The evidence suggests that the size construct does not possess the critical qualities of construct and content validity discussed in Chapter 2. If a solution to the problem of size inconsistency is to be found, it should ideally take these aspects of validity into consideration.

This chapter discusses the selection of a method to explore and develop the organisational size construct. The literature presents several methods for investigating and developing constructs and it would be prudent to carefully consider these different approaches.

This chapter proceeds by discussing the different approaches to construct development presented in the research literature, observing that there are structured and unstructured approaches to construct development in the literature. This discussion presents "Churchill's Paradigm of Measure Development" as a suitable program for developing valid and reliable constructs. The chapter then discusses Churchill's paradigm in more detail, including the generation of dimensions and indicators. Finally, the chapter discusses the overall construct development procedure to be used in this research.

4.1 Approaches to Construct Investigation and Development

There are a number of prescriptive methods in the literature for the development of constructs. This, to some extent, reflects the range of approaches to scientific research discussed in the literature. These methods originate from different disciplines and consequently have varying strengths when applied in the information systems domain. The method chosen should ideally take into consideration and encompass the qualities of a good construct as discussed in Chapter 2.

Before work commenced on exploring and developing the size construct, a literature search was conducted in order to find methods which could be used to develop constructs in a robust manner. Following, in part, the layout of Sethi and King (1991), Table 4.1 presents some methods that have been used in the information systems research literature to develop the understanding of the dimensions behind each construct. Of primary interest here are the procedures used to determine construct constituency, and not solely to measure them.

Table 4.1 Research Literature Approaches to Construct Development

Citation	Construct	Method Description	Number of Constructs
Bailey and Pearson (1983)	User satisfaction	Literature review of 22 studies to identify dimensions, expert review by 3 practitioners, 32 user interviews to refine dimension group	39 Constructs
Byrd and Turner (2001)	IT personnel flexibility integration modularity	Churchill's Measure Development program, literature review, pilot to 8 managers and 3 firms. Survey to 207 firms.	1 Construct, 30 Indicators 1 Construct, 7 Indicators 1 Construct, 9 Indicators
Ragu-nathan et al. (2001)	Information management strategy	Dimension conceptualisation according to Venkatraman (1989). *A priori* prescription of construct dimensions	7 Constructs 4 – 5 Indicators each
Galletta and Lederer (1987)	User information satisfaction	Factor analysis refinement of Bailey and Pearson's (1983) study	3 Constructs 3-5 Indicators each
Straub (1990)	IS security	Literature review, primary dimension development through 37 interviews, secondary development in 44 interviews, tertiary pilot of 1,000 DPMA members. Final sample yielded 1,211 useable responses.	6 Constructs 1 – 4 Indicators each
Sampler and Short (1994)	Expertise criticality Time criticality	Literature argument and review. Further field interviews at 14 firms.	Construct dimensions in four groups
Ahire et al. (1996)	Total Quality Management implementation	Literature review, survey of 371 firms	12 constructs 3 – 6 Indicators each
Byrd and Turner (2000)	IT infrastructure flexibility	Churchill's Measure Development program, literature analysis from five studies, pilot to 8 managers and 3 firms. Survey to 207 firms.	4 variables, 33 Indicators 5 variables, 33 Indicators
Gold et al. (2001)	Knowledge management capability	Churchill's Measure Development program, questionnaire survey of 300 firms	2 Constructs 7 Indicators
Lewis et al. (1995)	Information resource management	Churchill's Measure Development program, survey of senior managers in 150 firms	8 Constructs 39 dimensions
Lederer and Sethi (1992)	Strategic IS planning	Churchill's Measure Development program, survey of 80 IS planners	5 Constructs 19 Indicators
Hunton and Price (1997)	User participation	Field experiment of 144 clerks, path analysis to determine factor relationships.	7 Constructs
Moenaert and Souder (1996)	Information utility	Field study of 386 members of 80 teams in 40 firms. Path analysis to determine factor relationships.	8 Constructs
Venkatraman (1989)	Organisational strategy	Churchill's Measure Development program, *a priori* dimension specification, pilot survey of 250 CEOs, survey of 450 managers	7 Constructs
Webster and Martocchio (1992)	Microcomputer playfulness	Cronbach and Meehl's Nomological Network. *A priori* dimension specification, 3 student surveys, 1 MBA survey, 1 employee survey	7 Constructs 17 Indicators

Table 4.1 reveals a number of interesting points regarding construct development in information systems. First, construct development appears to be popular in the literature and takes place in a range of research areas, such as technology playfulness and system security. Second, the constructs discussed in these studies comprise a range of dimensions and indicators. One of Byrd and Turner's constructs, for instance, comprised 33 indicators. Arguably, the number of indicators relating to the construct may make operationalising the construct more difficult as it may be necessary to develop a single, useable instrument for each construct. The complexity and number of indicators for some constructs may also explain some of the research confusion regarding the construct. That is, researchers may only observe or operationalise part of the construct at one time, subsequently obscuring understanding of the rest of the construct. The final point to note is that, with the exception of Straub (1990), none of the constructs in Table 4.1 are proxied for by only one indicator.

Several authors also develop constructs as part of instrument development. For instance, Rivard and Huff (1984) explored Software Development Success by conducting a review of the literature in order to determine descriptive factors, and then holding in-depth interviews with executives at 10 firms. They then conducted secondary analysis using a questionnaire survey and internal documents. Similarly, Raho et al. (1987) explored technology assimilation, specifying *a priori* a selection of dimensions from McFarlan and McKenney (1982). They operationalised these items in a survey of 2000 Data Processing Management Association (DPMA) members.

Construct development appears to be split between those studies that use a structured approach and those which pursue a more ad hoc approach to construct development. Studies which take an explicitly structured approach to construct development include Gold et al. (2001), who used Churchill's program of measure development, and Webster and Martocchio (1992) who used a construct validity assessment framework based on Cronbach and Meehl's (1955) nomological network. Examples of studies which do not use an explicitly structured approach include Ahire et al. (1996), who based their construct development on a method of literature review and survey administration. Similarly, Moenaert and Souder (1996) used a field study and path analysis to explore the dimensions of the information utility construct.

An *ad hoc* approach to construct development may have a number of shortcomings. First, the researcher cannot be certain that the construct's relationship to its indicators and to the real world is complete or well specified. An *a priori* specification of construct dimensions may lead to a biased view of the construct, promoting only those dimensions which are uppermost in the researcher's mind. Researchers may each take a different approach to this construct specification, resulting in conflicting constructs. Second, if the concepts of validity and reliability are important to researchers, then it would be useful to pursue construct development with these ideals in mind from the outset. Relying purely on an *a posteriori* assessment of validity and reliability may be problematic especially if, as Cook and Campbell (1979) argued, an exact assessment of validity and reliability is difficult to undertake. The value of a structured approach was described by Sampler and Short (1994:60): "of course, no attempt is made here to argue the scientific validity of our proposed explanatory framework under traditional norms of hypothesis-testing research".

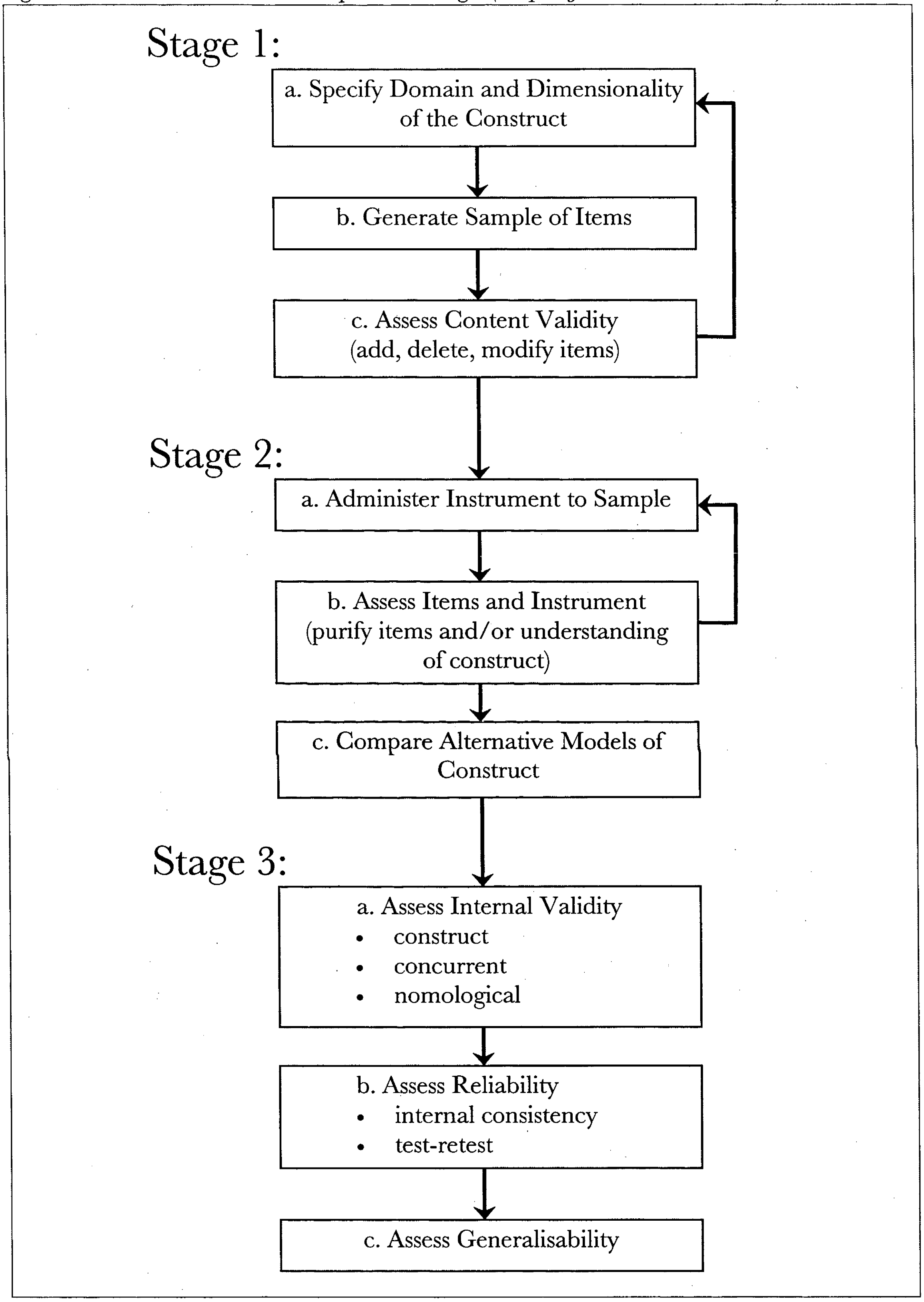
Studies may also use a more prescriptive method of construct development. These include Stevens' (1946) measurement theory and Churchill's (1979) method. Under Stevens' (1946) measurement theory, the researcher first identifies objects of interest and then allocates symbols to those objects, such that the symbols represent some attribute of the object under examination (Sarle 1995). These symbols also help describe the relationships between objects (such as ordinal, interval and ratio classifiers). Researchers may also use these abstract symbols to better measure the object itself.

Stevens' approach, while attractive in principle, has a number of shortcomings which make it unsuitable for use in this study. First, the approach requires some general agreement regarding the empirical indicator used to measure the construct (in order to reduce measurement error). Further, if the construct is multi-dimensional, the researcher would require a detailed understanding of the interaction between these dimensions (Sarle 1995). With regard to organisational size, the discussion presented earlier in Chapter 3 suggests that this agreement is not present in the literature. Second, despite the attraction of a robust classification method, "in real life, a scale of measurement may not correspond precisely to any of the levels of measurement" (Sarle 1995). Ultimately, "reasonable care and diagnostics" may be required to verify the construct's properties before application. Beams (1969:385) provided an excellent basis for criticism of this approach: "Operational definitions bring the construct and the data into perfect correspondence (in other words, the construct is synonymous with the operations performed in its measurement) but tend to leave a gap between the construct and the referent, since only those attributes of the referent selected for measurement are included in the construct definition".

Churchill (1979), extending the discussion of measurement theory with particular reference to Nunnally's (1978) work, also offered a systematic program for measure development. The program constitutes a stage process whereby a construct is developed from basic domain items and subsequently assessed in terms of validity and reliability. A number of authors have applied this program in the information systems domain, including Torkzadeh and Doll (1999), Sethi and King (1991) and Wang et al. (2001). The number and range of studies employing the framework suggests that this procedure would make a good basis for analysis.

Smith et al. (1996), examining personal opinions concerning information privacy, make several minor changes to Churchill's method. Churchill's original paradigm moved from item generation directly to data collection. Smith et al. observed that the content validity of the construct should be explored *before* more extensive data collection because this data collection process could be expensive if the original construct dimensions were erroneous or improperly formed. Their amended model adds this step before formal data collection. Additionally, Churchill's original paradigm directed researchers to assess the construct's reliability *before* assessing validity. One possible effect of this is that the researcher may expend time, effort and funds on instrument reproduction before accurately determining "what the instrument is in fact measuring" (Churchill 1979:70). Smith et al. switched these two stages such that the construct's internal validity qualities are assessed first. Figure 4.1 outlines Churchill's paradigm, as discussed in Smith et al. (1996).

Figure 4.1 Churchill's Measure Development Paradigm (adapted from Smith et al. 1996)



The three main stages of the paradigm are outlined as follows. In Stage 1, the researcher aims to specify the boundary and domain of the construct. Here, the researcher determines *conceptually* what is and is not included in the construct. Based on this delineation, the researcher then acquires a sample of items that constitute or describe the construct. Finally, the researcher assesses content validity, the degree to which the items already identified reflect the entire construct (Anastasi 1982). The researcher may reiterate through each of these steps again, with a view to further construct refinement, should the initial dimension collection be deemed insufficient or lacking.

Stage 2 of the paradigm allows the researcher to refine their understanding of the construct's meaning and measurement. An operationalised version of the construct is administered to a group of respondents, possibly in the form of a questionnaire survey or interview. Based on the outcome of this step, the original dimensions are re-assessed in terms of completeness in order to determine an appropriate mix of dimensions. At the conclusion of this stage, the researcher can compare the various models of the construct and select the most appropriate one for further use.

In Stage 3, the researcher assesses the construct's validity and reliability. The first step deals with the construct's internal validity, based on the three components of validity outlined by Cronbach and Meehl (1955) of construct, concurrent and nomological validity. Next, the researcher assesses the construct's reliability in terms of internal consistency and test-retest analysis. Finally, the researcher assesses the construct's degree of generalisability, which allows the researcher to "develop norms". Here, the final construct may be employed in several real-world contexts in order to determine the characteristics of a population with respect to the construct. In the case of organisational size, such "norms" might involve being able to make statements and predictions about "large" and "small" firms. Eventually, this process makes for the accumulation of knowledge.

Churchill's paradigm is appropriate for four reasons. First, it presents a prescriptive, structured approach to measure and construct development. This alleviates the problems raised earlier by Beams (1969). Second, the method was developed with particular reference to validity and reliability, which were noted earlier in Chapter 2 as being essential for good research, and the development of good constructs. Third, the method is applicable to a range of constructs and has been used with success in the research literature before.

Finally, studies that use Churchill's paradigm are typically able to contextualise the approach with other research methods. For instance, Lederer and Sethi (1992) also used a questionnaire survey. Straub (1990) used three rounds of pilot interviews. Byrd and Turner (2000) also used a series of interviews. Another pattern observable in studies that use Churchill's paradigm is that many also use experts or people with knowledge in the area to develop their list of dimensions. For instance, Straub (1990:259), when examining factors affecting system security, interviewed "criminologists, IS practitioners and auditors, and state and local law enforcement officers…security officers, IS managers, and internal auditors". This additional expert opinion assists in the triangulation of research findings.

4.2 Methods for Investigating and Developing the Size Construct in this Thesis

The purpose of this section is to review how the paradigm can be undertaken in the context of information systems research methods. As noted in Chapter 3, researchers frequently contextualise Churchill's measure development paradigm with other research methods. Ostensibly, this allows researchers to triangulate their work, and lend a degree of structure to their research.

The entire development paradigm represents a significant undertaking. Churchill (1979), on reviewing the process, argued that "it is infeasible to complete the entire...procedure at one time". Sethi and King (1994) made similar observations. It is therefore necessary to carefully plan the way forward.

The discussion presented below carefully examines how this thesis will follow Churchill's method, making particular reference to the relationship between method stages and thesis chapters. The next section gives an overview of research methods available in the information systems research literature. This is followed by a discussion of the stages of Churchill's paradigm with respect to the methods to be used in each.

4.2.1 Approaches to Information Systems Research

The information systems researcher has a range of research methods available. These methods include laboratory experiments, archival research, field studies, case studies, action research and survey methods (Galliers 1992). Each of these methods exhibits strengths and weaknesses with respect to a given theatre of application. Within this range of approaches, research appears to be divided between qualitative and quantitative research. Critics of qualitative research argue that its findings cannot be relied upon given its lack of statistical and research rigour. Proponents of such approaches argue that the shortcomings of qualitative research can be alleviated through the use of careful scientific method wherever possible.

While the range of research methods might be beneficial in terms of variety of approach and rich disciplinary framework, it means the researcher is occasionally confounded by choice. It is hence worthwhile to clearly discuss available methods in order to select the most appropriate. Jenkins (1985) and Orlikowski and Baroudi (1991) listed the range of research methods present in the information systems literature. These methods, however, prove generally unsuitable for this thesis. It is worth giving this contention some discussion here.

First, some methods are deemed unsuitable for the conduct of this study. Methods such as the case study, mathematical modelling, free simulation, the adaptive experiment, the field study, participative (or action) research and philosophical research are each aimed at different research study requirements. These methods do not easily handle direct interaction with large numbers of potentially discrete research items or the analysis of conceptual relationships between items. None of these methods are suited to the determination of the meaning and measurement of a construct.

In Jenkins' (1985) classification, this leaves the experimental simulation, the laboratory experiment, the field experiment, group feedback analysis and opinion research. Each of these methods allows the researcher to obtain responses from a range of participants directly. The methods support both quantitative and qualitative data analysis and, additionally, participant costs are generally low. Finally, the researcher can have first hand analysis and interaction with participants. While the theory regarding many of these methods is well developed, they remain unsuitable for this study. These methods appear to be aimed either at testing for the existence or behaviour of a particular condition, the effects of a treatment or support the analysis of a particular item in an operational setting.

While evidence from this chapter shows that construct development in the information systems literature is not uncommon, other disciplines may have greater experience in this area. For instance, researchers in the management literature use "brainstorming" in order to develop concepts because this method can solicit a number of opinions on the concept in a short space of time. Similarly, the education literature uses "free hand concept development", which affords not only the extraction of concepts from opinions but also the development of these concepts into hierarchical lists. Importantly, however, the study requires a structured approach to concept organisation in the interests of good science.

This thesis will use a number of methods to develop a solution to the size problem. This is consistent with the arguments of Galliers (1992) that a policy of research pluralism may be most suitable for the information systems discipline. Banville and Landry (1989) offered similar arguments. To this end, Mumford (1999) argued, "a variety of techniques can and should be used to rule out competing explanations and demonstrate that the measure is indeed 'measuring what we think it is'". Because this study is interested in both the meaning of the size construct and how it might be measured in future research, the thesis will conduct a number of overlapping studies, each aimed at revealing different facets of the size problem. The section below discusses the methods to be used in each stage of Churchill's paradigm.

4.2.2 Procedure for Study 1

Stages 1a and 1b, covered in Chapter 5 as "Study 1", involve specifying the construct's domain of interest or applicability. The goal here is to narrow the field of interest such that no less than the entirety of the construct is captured. Churchill (1979:67) argued that, "the researcher must be exacting in the conceptual specification of the construct and what is and is not included in the domain". This refinement and specification process should also assist in more clearly guiding the researcher in the coming analysis.

One way of specifying the construct's domain is to examine the definitions of the construct as discussed in the research literature (Sethi and King 1994). While these definitions may vary between studies (Churchill 1979), some synthesis of the range of statements in this regard may guide the researcher's understanding of the construct's variance. Additionally, the process may inform the researcher as to salient elements in the construct's makeup. Ultimately, this stage of the research also assists in eventually operationalising the construct (Venkatraman 1989). Venkatraman (1989) lent structure to this process by framing the discussion in terms of four theoretical research questions guiding the extent, nature and limits of the construct. While that study focused on organisational strategy, the framework employed is nonetheless useful.

The second part of Stage 1 requires the researcher to determine the dimensions underlying the construct. The intention in this stage is to capture the entirety of the construct's domain. This process may be undertaken through a review of the research literature (Selltiz et al. 1976). Churchill also advocated exploring the practitioner literature and other organisational documents in order to give an indication of how the construct is actually employed. The emphasis, however, is on literature analysis for this stage.

4.2.3 Procedure for Study 2

Stage 1c, covered in Chapter 6 as "Study 2", requires assessment of content validity and may involve editing or re-organisation of the item list developed during the previous step. The goal of this stage is to develop a more parsimonious model of the construct. During this stage, Smith et al. (1996) argued that the researcher should make use of "input from individuals, expert judges" and the literature in order to refine the item list.

One method used in the psychology literature is the concept map method (Trochim and Linton 1986) and card sorting technique (developed by Barlow et al. 1969). Concept mapping is a structured approach to modelling concepts (Johnsen et al. 2000). The framework, outlined in Trochim (1989), uses expert input to categorise a group of constructs in terms of similarity and, if necessary, importance. The end product is a diagrammatical representation of the relationship between dimensions underpinning a construct.

Concept mapping has its roots in the study of cognition and learning development. Ausubel (1963) observed that the general learning process was best undertaken in conjunction with existing knowledge of the topic being examined. Knowledge in this context helps illustrate meaning, which provides some context and structure for the topic being studied (Leauby and Brazina 1998). The graphical representation of topics within the frame of knowledge allows students to understand or critically analyse the relationship between conceptual components (Raelin 1997).

The concept mapping process has been applied in a number of studies. The method is similar to that used for grouping concepts in user interface design (as in Mullet and Sano 1994) and similar methods have received attention in the information systems domain, notably in Moore and Benbasat (1991) and Chau and Hu (2002). Authors have also used concept mapping in various forms to examine social policy implementation and planning (Cataldo et al. 1970). A similar approach has been used to explore intelligence and aptitude in the form of the Wisconsin Card Sort method (Heaton et al. 1993). Over time and through diverse application, concept mapping has grown in complexity and rigour as a research process. The primary development has been the use of statistical methods such as multidimensional scaling and cluster analysis (Johnsen et al. 2000). These additional applications allow the researcher to make a more informed decision regarding the underlying concept.

Concept mapping is suitable to this study for a variety of reasons. First, and most importantly, it allows a large selection of individual construct dimensions to be grouped according to similarity. Additionally, the method has seen much prior application in a range of disciplines, which suggests that the method is versatile and flexible. Third, when coupled with multidimensional scaling, the method affords mathematical analysis of results. Fourth, the process can be conducted by individuals outside of a group environment, thus alleviating some of the disadvantages outlined earlier. Finally, Gammack (1987) observed that the card sort method is useful in conditions where the dimensions of a knowledge construct exhibit a many-to-many relationship and the researcher requires an understanding of hierarchy or levels within the construct.

The use of groups to solve problems has received much attention in the research literature. The benefits to such an approach are marked. The use of groups allows the researcher to gather a range of perspectives about the construct under examination and, under ideal conditions, should give similar results as individual analysis (Nunnally 1978). It also should allow the researcher to more easily resolve any disagreement about the construct while group members are present. Group analysis takes less time to administer and may be less expensive (Nunnally 1978). Additionally, the range of perspectives should inform the researcher as to face validity.

However, authors have also observed the downside of using groups. Disagreement between group members may be substantial and, even with all group members present, not easily resolved. Group co-ordination and management might be difficult (Barlow et al. 1984). Some authors have also noted the possibility of bullying or coercion (West et al. 2000) so that conclusions are delivered not through considered agreement, but through intervening effects. Also, in the presence of others, group members may feel pressured to give an objectively "correct" result, even if no such result exists. Further, "enlightenment effects" may occur where participants are allowed to discuss answers and experiences with each other (Gergen 1973). Further, it may be difficult to extrapolate group behaviour to individuals, or to narrow the effects of dominant individuals in the group (Barlow et al. 1984). The perspectives of individuals is also of merit: such perspectives may exhibit differences, however each may be intrinsically valid (Walsham 1993) and is hence particularly useful in the early stages of research (Dubin 1978). Group approaches also may not work if team members are young or lack motivation to participate (Nunnally 1978).

Figure 4.2 shows the first stage of Churchill's paradigm in greater detail, with potentially relevant methods provided for each step. It shows how each stage has been investigated previously in the literature and the methods used to conduct these investigations.

Figure 4.2 Stage 1 of Research Framework for Construct Development

Section	Methods and References
Specify Domain and Dimensionality of the Construct	Literature Search *(Churchill 1979, Sethi and King 1991†, Sethi and King 1994)*
Generate Sample of Items	Literature Search *(Churchill 1979, Venkatraman 1989, Sethi and King 1991, Sethi and King 1995)* Experience Survey *(Churchill 1979)* Focus Groups *(Churchill 1979, Smith et al. 1996)* Interest Groups *(Venkatraman 1989)* Case Studies *(Sethi and King 1994)* Anecdotes *(Sethi and King 1994)*
Assess Content Validity (add, delete, modify items)	Focus Groups *(Smith et al. 1996)* Expert Judges *(Smith et al. 1996)* Pilot Tests *(Smith et al. 1996, Sethi and King 1991)* Concept Maps *(Daley et al. 1999, Wheeler and Collins 2003)* Experience Surveys *(Churchill 1979)*

† Sethi and King (1991) do not explicitly state that the literature review method is appropriate, but the authors do use a literature search method to specify the domain of the competitive advantage construct.

At the conclusion of stage 1, as shown in Figure 4.2, the researcher should be able to re-specify or clarify the construct's domain using the new understanding. In this way, the researcher might already be able to explain some of the variance observed in the literature.

4.2.4 Procedure for Study 3

The first two steps in Stage 2 of Churchill's paradigm, covered in Chapters 7 and 8 as "Study 3", require the researcher to employ the new construct in an operational setting, using real world data. Here, the dimensions of the construct are operationalised. This stage assists in providing meaning to the construct by exploring the construct's meaning in different contexts and organisations.

The study's aims placed three requirements on the research method for Stage 2. First, the method had to accommodate an exploratory approach to the exposure of research variables from a variety of respondent types. Second, the research method ideally had to be well established and reliable. Third, the method had to accommodate the analysis of a range of constructs from a large number of respondents.

Of the approaches to social measurement within the information systems discipline, the survey method has received much use, and has been found to provide consistently valid and usable results (Straub 1989). Cook and Campbell (1979) and Galliers (1992) argued that the survey method may give little insight into causal relationships, can be open to respondent and researcher bias and only portrays the state of affairs at a single point in time. However, Galliers also argued that a large number of variables can be examined under real world conditions in a short space of time.

The research method had to be inexpensive yet expeditious and had to gather a range of data from many businesses in order to give a richer understanding of different firm sizes. A substantial amount of business data was also required. These requirements suggested that, consistent with the arguments of Debreceny et al. (2002), a questionnaire survey would be most appropriate for the study. From the viewpoint of this research, the mail survey was considered the most suitable given the time, cost and data constraints.

Churchill (1979) himself advocated the use of a survey instrument for this purpose. Koste et al. (2004), Wickliffe (2004), Newell and Goldsmith (2001) and Chan et al. (1997) are among the recent authors to also employ a survey at this stage.

The third step in Stage 2, covered in Chapter 8, involves conducting statistical analysis of the data gleaned from the survey developed in the previous chapter. This stage requires the researcher to further develop suitability and understanding by comparing alternative models of the construct. This stage assists in determining whether or not the "new understanding" is superior to the older view of the construct. As noted in the previous chapter, statistical methods that have seen prior use in the literature include multidimensional scaling (distance analysis) and correlation analysis.

Stage 3, covered in Chapter 9, requires the researcher to assess aspects of validity, reliability and generalisability. As noted in Chapter 2, these two aspects are crucial to good research and a well-developed construct will have good levels of each.

4.3 Conclusions

In order to arrive at reliable and valid knowledge, researchers require valid and reliable constructs. While a number of methods exist in the literature for guiding construct development, Churchill's (1979) measure development paradigm directly relates to the requirements of validity and reliability of concept development. The paradigm specifies steps to be taken for domain specification, item generation, measure purification and validity assessment. Churchill's paradigm constitutes an excellent basis for the development of the organisational size construct and the rest of this study.

In operationalising Churchill's paradigm, the study uses several methods. For specifying the construct's domain of relevance, the study uses a literature search and review. For refining the list of underlying dimensions, the study uses a concept map method. Multidimensional scaling will be used to analyse the results of this stage. The study will then develop an instrument to evaluate the construct in an operational context. A questionnaire survey will be used for this purpose. Each of these methods is undertaken as a separate but related investigation into the size problem. The results from each of these studies are compared in Chapter 9.

CHAPTER 5

STUDY 1: THE DOMAIN AND DIMENSIONS OF ORGANISATIONAL SIZE

The first step in developing a construct, according to Churchill's paradigm, is to specify the domain and dimensions of that construct. This stage provides a foundation for the rest of the study by providing a more thorough understanding of the meaning and dimensions of the construct. These dimensions can be revealed by examining the words and arguments of other researchers in the literature.

The purpose of this chapter is twofold. First, it aims to specify the boundary of the size construct domain. Second, it aims to clearly discuss the literature search process used to obtain the list of size indicators and dimensions. This represents "Study 1" in the context of the thesis.

This chapter comprises two main parts and is structured as follows. First, in accordance with Churchill's directions, the chapter specifies the construct's domain, with reference to the research literature in the area. Second, the chapter then presents the method used for obtaining the different dimensions of the construct by way of a detailed literature analysis.

5.1 Specifying the Domain of Size

The purpose of this domain specification is to determine what is and is not included in the construct. Domain specification broadly involves exploring the construct's use and definitions in the research literature. Loevinger (1995) wrote, "some discussion, broad or narrow, is made as to *content* at this point...a test constructor must have some purpose in mind, and this purpose defines the universe of discourse or area of content from which he will choose items for the original pool" [emphasis added].

Next, Loevinger discussed the degree of breadth of relevance in dimension generation. While a broader application may inform the researcher on a wider variety of problem areas, the generation of constructs from a wider field may be error-prone and time-consuming. This suggests that a clear and appropriate depiction of breadth of application is required. Finally, Loevinger used the terms "universe of discourse" and "area of content". The universe of discourse for some sciences may be broad: discussion presented in Chapter 3 suggests that many research constructs in information systems originate from or are also used by other disciplines. This applies to the organisational size construct which, as has been noted, is prevalent in a variety of other research disciplines.

These arguments suggest that, when specifying the construct's domain, the researcher requires guidance as to the construct's conceptual level, field of relevance and disciplinary perspective. Just as Venkatraman (1989) specified a series of questions to define the 'strategy' construct, this study poses three questions to assist in defining the organisational size construct:

a) To what conceptual level does the size construct apply?

b) *Does the construct refer to the object's structure or is there a broader field of relevance?*

c) *Does the construct have a purely IS perspective or is it analogous to the same construct in other disciplines?*

5.1.1 Conceptual Level of Reference

Organisations receive substantial coverage in the literature. Despite this coverage and the fundamental nature of the subject in many information systems curricula, a consistent all-encompassing definition eludes researchers. There are a number of explanations for this. First, different literature sources exist, each offering different definitions of an 'organisation' (Kimberly 1976). Second, researchers in different areas use definitions that are of particular relevance to their particular research domains. Third, regulatory groups may also use different definitions based on their own requirements and stipulations (Keen 1980). Because of these problems, developing an understanding of the conceptual level of reference may be difficult.

Organisations may be classified in different ways. Avison and Shah (1997) described an organisation as a "person or group of people united for some purpose". Rosen (1995) offered a similar definition. This definition is somewhat broad and makes no distinction as to the purpose of or requirement for unity (for instance, an entire country could be considered an organisation under this definition). Lucas (2000) grouped organisations in terms of management using the categories of 'bureaucratic' or heavily governed organisations, 'charismatic' organisations which exhibit strong leadership and management and 'adaptive' organisations which largely react to changes in the environment. Rosen (1995) classified organisations based on structure, using the categories of functional, divisional, multidivisional, matrix and *ad-hoc*.

Of particular interest to researchers is the nature of the organisation itself, as distinct from its environment. In this vein, the degrees of formalisation and centralisation have been of distinct interest (Hall et al. 1967). Research in these areas has sought to understand behavioural differences among organisations with formal or relaxed management and policy structures, and the degree to which geographic spread or managerial flexibility affects organisations (Brancheau et al. 1996). Debate in this area extends to the type of management and degree of planning. Research in this area has, in the main, been concerned with the relationship between management and organisational performance (Pearce et al. 1982), and planning models and frameworks (Teo and King 1999).

This evidence suggests that, while an organisation can simply be a "collection of individuals" (Avison and Shah 1997), the importance of managerial behaviour and environmental interaction cannot be discounted. Certainly, in some studies, the conceptual boundary between the organisation proper and its environment is blurred. This study, then, takes its conceptual frame of reference as 'an entire commercial organisation', meaning a business organisation or firm.

5.1.2 Structural Relevance

Debate concerning the relationship between size and structure with respect to the organisation has flourished, notably in the adoption and innovation research. Work in the area appears to revolve around three broad perspectives of organisations, being structuralist, individualist and interactive perspectives. This tripartite classification was originally proposed by Pierce and Delbecq (1977), and has received affirmation in Pfeffer (1982), Chaffee (1985) and, recently, Slappendel (1996).

However, with respect to structure, these can be classified into "structuralist" and "non-structuralist" perspectives for the purposes of this thesis.

5.1.2.1 The Structuralist Perspective

The main assumption under this perspective is that the organisation is driven by structural characteristics, such as its age, size, capacity and complexity, of which some say "size is the most telling indicator" (Lind et al. 1989). The structuralist perspective has been in use for some time: Kimberly (1976) cited Weber (1946) as a defining influence on the perspective. Scott (1975) also dated the perspective's inception to the late 1940s.

Foundation papers such as Caplow (1957) and Kimberly (1976) on the subject of organisational size were based primarily in the structuralist school. Pugh et al. (1969:97) wrote, "with few exceptions, empirical studies relating size to variables of organisational structure have confined themselves to the broad aspects of...structure". These studies typically argued that organisational size was the primary motivator of much to do with the organisation and structural aspects in particular. Within this endeavour, researchers examined a variety of organisations including religious institutions and sporting teams (c.f. Caplow 1957), prisons, factories and political parties (c.f. Scott 1975).

In this regard, scholars took structure as "the dependent variable" (Scott 1975:2) and used it to explore causal and associative relationships with other constructs. While size was then viewed as a primary antecedent of structure, the relationship between size and structure proved problematic in this regard. In the words of Hall et al. (1967: 904), "there is agreement that size affects structure, but there is no agreement on the relative importance of size *vis-à-vis* other aspects of organisational structure".

Amid the discussion of size and structure, there has been much debate regarding the existence and magnitude of an "optimal" firm size. This debate is situated primarily in the economics and organisation science literatures (such as Quirk 1961 and Huberman and Loch 1996). It centres on the idea that there may exist an optimal level of capital budgeting and managerial structure that will maximise the economy of production and minimize the bureaucracy of management (Beckmann 1960). However, critics argue that firms exhibit too many differences to be so easily classified in terms of "optimal" structure (Mansfield 1963). Pugh et al. (1968:88) argued, "organisations may be bureaucratic in any number of ways. The concept of the bureaucratic type is no longer useful". Additionally, Kimberly (1976) argued that it is not preferable to separate structure from context and Negandhi and Reimann (1976) found no causal link between size and structure. This thesis argues that this debate may be spurious if the exact nature of size itself has not yet seen researcher agreement.

In an effort to address the inconsistent approach to size, researchers moved from a closed view of the organisation (isolating it from its environment) to incorporate a more open view (Scott 1975). This new and open view meant that the analysis of organisational behaviour became much more complex, at least from the structuralist perspective. The work of Beer (1964), Katz and Kahn (1966) and Thompson (1967) illustrates this in particular. Buckley (1967), for instance, described organisational behaviour as a "morphogenic" process which, in turn, transforms the organisation's structure. This contrasted with more traditional structural research which saw innovation and other processes as linear and largely static.

This wider view of the firm then poses a problem for using a purely structural view of size in this thesis. While structure appears to be firmly established in the research lens, researchers have increasingly found that it alone cannot explain the variance in research findings: "we cannot hope to account for all of these differing variations" (Scott 1975:11). If size somehow affects structure, yet structure itself is too variable or incomplete to predict the phenomena under examination, then perhaps a purely structural view of size will also be insufficient: "we are not dealing with a homogenous category. Not only does the response pattern to size vary for these different aspects: their organisational significance also varies" (Scott 1975: 12).

The discussion presented so far suggests that researchers believe that size has various roles with respect to structure: size may govern, represent, change or merely be a contingent part of organisational structure. The relationship appears unclear and debate in the literature continues. If structure is most important, then researchers ought to be able to explain most or all of organisational size using purely structure-related indicators alone (such as *Number of Employees*). As the research has moved towards other structural variables, in an effort to explain phenomena, these structure-related indicators may also be insufficient to handle the problem as they no longer completely describe the original construct under analysis. This contention is supported by evidence in Chapter 3 regarding the inconsistency of size understanding. A purely structuralist perspective is not wholly suitable for the analysis of organisational size.

5.1.2.2 Non-Structuralist Perspectives

The individualist approach is one of the oldest perspectives from which to examine organisational behaviour (Arrow 1994). The primary assumption underlying this perspective is that the behaviour of individual actors drives organisations, particularly with respect to activities such as innovation (Newell et al. 1998). This perspective implies that individuals subsequently seek to gather together in organisations as a way of benefiting from economies of scale and, indirectly, increasing their personal benefit: "The individual is viewed as an inherently social, interdependent being who voluntarily serves as a means toward the moral goal of maximising goodness for the group" (Ryan and Scott 1995:447).

Despite the theoretical strength of the individualist perspective, its application in the research literature has been inconclusive. Some authors argue that, fundamentally, researchers should be wary of abstracting from the individualist perspective to the organisational perspective: Tornatzky and Klein (1982) argued, "it is not logical to generalize from the individual adoption process to the organizational process as the two processes may be quite different". Downs and Mohr (1976) concurred. Hage (1980) also noted that personal innovators may be more prone to or adept at innovation, and hence there may be inconsistency with regard to generalisation in this way. Newell et al. (1998) went so far as to argue that "micro-level analysis" (p. 304) is likely to ignore important factors present in more macroscopic studies.

Under the interactive perspective, organisations are a complex *interaction* between individuals and structure (Slappendel 1996). Organisations approach activity based on the knowledge and experience gleaned from past adoption, word of mouth from other firms, organisational necessity, dissatisfaction with the current state of affairs or other reasons. Such behaviour is deemed to be complex and dynamic as the behaviour of the firm undergoes constant redefinition and change (Hackney et al. 2004). Weill and Olson (1989), among others, argued that this behaviour is likely to further vary across organisational structures. This suggests that the analysis of structure is *integral* to even the interactive perspective.

The evidence suggests that researchers appear to be confused or undecided as to the effectiveness of the interactive perspective in explaining research outcomes. One possible explanation for this is that the perspective's foundation is poorly specified. That is, the interactive approach is unable to adequately predict innovation because it relies, in part, on theory used in the older individualist and structuralist approaches. This argument would be consistent with the seminal work by Downs and Mohr (1976), who argued that much survey-based research into innovation has been compromised by inconsistent operationalisation of research variables, inadequate control over interaction effects and poor structural measurement. Another explanation is that researchers will have difficulty separating individual research outcomes and, ultimately, "cannot account for differences in diffusion patterns due to variances in environmental and institutional factors" (Damsgaard and Lyytinen 1997:43).

5.1.2.3 Implications for This Thesis

The literature appears to agree that structure affects the adoption process, however the extent of this effect remains a point of contention. Orlikowski and Baroudi (1991) wrote, "organisations are understood to have a structure and reality *beyond* the actions of their members" [emphasis added]. This suggests that the organisation's structure alone is a necessary, but not sufficient, descriptor of organisational intent or position. Importantly, this suggests that organisational structure may also be influenced by the behaviour of its actors.

While organisational size has been assumed to be a part of the structuralist perspective, the size construct has seen little significant application in non-structuralist approaches. One reason for this is that much argument has identified the structural relationships to size, even though much of this research is unclear on the exact nature of this relationship (Kimberly 1976). However, because size does not appear to have been presented in terms of non-structuralist perspectives (such as behavioural, operational or managerial aspects), the construct has not featured as prominently in these approaches. In other words, organisational size *could* conceivably feature in both perspectives if the construct is shown to have behavioural components. (Weick 1969, Hendershot and James 1972, Freeman and Hannan 1975)

This study adopts the advice of Kieser (1994:611) that "historical analyses teach us to interpret existing organisational structures not as determined by laws but as a result of decisions made in past choice opportunities, some of which were made intentionally and others made implicitly". If size is related to structure, then size may be a product of or party to more complex phenomena than simple physical organisation. For instance, the use of market power to proxy for organisational size seems to imply a behavioural component towards market interaction. If this behavioural aspect does exist as part of the construct, the structuralist perspective alone does not appear to recognise this. Rather, the evidence suggests that when a researcher undertakes to use organisational size in their studies, they are admitting more than just structure to their theory and findings. They may also admit behavioural components, and the discussion presented thus far suggests the influence and involvement of a variety of other effects in this regard.

5.1.3 Disciplinary Perspective

For a construct as broad as organisational size, there are bound to be various bases of research which make delineation within a single research domain difficult. There is evidence in the research literature that many disciplinary areas use organisational size in their work, such as those in the administrative and managerial sciences, economics, sociology and psychology. Massetti (1998) advocated an interdisciplinary literature review within individual studies and, indeed, discussions of organisational size can be found in each of these disciplinary areas: administrative science (Beyer and Trice 1979, Pugh et al. 1968), management (Damanpour 1987, Brynjolfsson et al. 1994), economics (Cohen and Klepper 1992), sociology (Moch and Morse 1977, Hall et al. 1967) and psychology (Schminke et al. 2000, Dekker et al. 1996). Ruhl and Salzman (2003) wrote, "It may seem obvious to many in administrative law that size must matter, but exactly how does it matter, why should we care, and what should we do about it?" (p. 760).

The practitioner literature, interestingly, also provides some evidence in this context. This practitioner literature has identified that governmental and private accreditation programs may not apply across firms of differing sizes (regardless of industry). Those programs which were developed using larger organisations may mean that smaller organisations cannot compete, are unviable or lack value (Bamberger 1997). Consider the words of Fayad et al. (2000): "definitions of 'small' business vary by industry and by government agency from 100 to 500 employees or more".

The information systems research literature exhibits a healthy diversity of subjects related to organisations. This variety is also reflected in attempts to categorise information systems research literature, notably in Boyer and Carlson (1989) and Benbasat and Zmud (2003). Popular information systems topics featured in the Boyer and Carlson study range from technical and AI areas through to telecommunications and business areas such as office and managerial publications. Claver et al. (2000) and Barki et al. (1988) made similar observations. While there is a core of information systems journals such as *MIS Quarterly*, *Information and Management* and *Journal of Management Information Systems*, "there are also some journals which, though not specialising in information systems regularly publish articles relating to this area" (Claver et al. 2000:182).

Studies in the information systems discipline which use size frequently use discussion and definitions from the literature areas discussed earlier, such as organisation science, accounting and management. For instance, papers such as Martinez-Ros (1999), Kim (2002), Stock et al. (2002), and Teo and Ranganathan (2004) each cited Schumpeter (1934) and Schumpeter (1942) in their evidential discussion of size. Burton et al. (1991), Lee and Han (2000), Schulz and Jobe (2001) cite Blau (1970) and Blau and Scott (1962). Harris and Katz (1991) and Brown and Magill (1994) cited Kimberly (1976).

The effect of size on technology adoption is one phenomenon that has been frequently examined in the information systems literature. Researchers appear keen to determine the differences in adoption behaviour between "larger" and "smaller" firms. Despite competing theories the topic remains popular in the literature. Unsurprisingly, given this intense literature coverage, a number of technologies have been examined with regard to organisational adoption. These include database management systems (Grover and Teng 1992), expert systems (Shao 1999), microcomputers (Robey 1981, Delone 1988, Lind et al. 1989), and Electronic Data Interchange (Iacovou and Benbasat 1995). Swanson (1994) observes that size is critical to reasons for technology adoption. He observed that larger organisations are more knowledgeable about market developments due to "market spanners" and, citing Fuller and Swanson (1992) and Anderson (1981), are more likely to adopt innovations for a variety of reasons. Swanson's meta-analysis evidence suggests that many studies have found that size was either an explaining or associated factor in many adoption studies. Yao et al. (2002) went so far as to say that the construct is necessary for adoption analysis.

5.1.3.1 Implications for This Thesis

The preceding discussion regarding organisations has suggested that organisational size is multidisciplinary in aspect. This raises several implications for information systems research in general and this thesis in particular. First, the scholarly examination of this phenomenon may benefit organisations of all types, however research conducted on one organisation may not necessarily apply to others. This is consistent with the arguments of Ahituv and Neumann (1990), who extended this concept of organisational idiosyncrasy to the process of organisational modelling: "Organisations…are too many for us to examine them all. They are too 'human' and not rigorous enough for us to use pure logic…the answer depends on the purpose for describing the organisation".

Second, the research literature appears to be divided as to the magnitude and direction of the effect of firm size with regard to organisational innovation. This is apparent at both the construct and indicator level. Damanpour (1996:710) posited that "personnel measures of size, the most commonly used measure of size in organisational studies, might not always be the best measure in innovation studies". He also argued that future studies should seek to employ different size measures in different contexts. This is especially important given the popularity of innovation research in information systems. Research into innovation may be error-prone and hampered by an inability to make accurate binding assumptions regarding organisational behaviour. This conclusion would be consistent with Damanpour (1996:695): "clearly, researchers' views on the size-innovation relationship are incongruent".

Third, it is likely that information systems may have inherited definitions and conceptual formulation from these foundation disciplines. Many of the definitions raised in the literature in fact originate from other research domains (such as economics). Hence, an analysis of the size construct in this way also constitutes an opportunity to inform disciplines other than information systems.

From a methodological point of view, researchers in the information systems discipline should continue to be aware of the variety and depth of the discipline's heritage. The discussion provided above has shown that the definition of an organisation can vary between studies depending on each study's research requirements and frame of reference. This variety presents a fertile area for research, however it also compromises the researcher's ability to rely on a single approach to such research (Earl 1989). If researchers wish to avoid potentially confounding results, then they should clearly specify the type of organisation under examination and define their frame of reference in order to alleviate the effects of noise.

5.1.4 Defining Organisational Size

An examination of the literature shows that while many studies use organisational size, there are very few published articles that focus exclusively on organisational size and its underlying theory at once. This produces two effects in the extant research literature. First, without explicit literature justification, researchers appear to use their own tacit understanding of what size means. Kimberly (1976:575) wrote, "in some cases, researchers would be talking about the identical concept - identical in the sense that it would have the same substantive and operational meaning to all concerned- but in others they would not". Second, when authors do refer to the research literature for direction or argumentative support, they resort to studies outside of the core information systems literature. Such studies may originate from the management, organisation, science and economics literature. This diversity in source material produces a range of definitions of organisational size.

Individual researcher definitions may only reflect part of the construct at one time. Hence, there may also exist many definitions of the size construct itself, all equally valid from a construct perspective, but heterogeneous from a research perspective. Given the amount of extant research involving size, it would be dangerous to define the construct *a priori*: to do this may lead the study into the same problems already seen in the published research literature.

Additional problems are encountered when defining size, as authors themselves define size not in conceptual terms, but rather how they propose to go about measuring the construct. For instance, Childers et al. (1971:816) "define the size of an organisation to be the number of individuals (employees, personnel) it contains", citing Starbuck (1965). Krishnaswami and Pottier (2001:669) wrote, "The authors define size as the natural logarithm of total assets". Asthana and Mishra (2001) wrote, "We define firm size as the...market value of common shares outstanding", also citing Atiase (1985). Again, in these cases, authors may believe there is a sound *prima facie* relationship between size measurement and meaning because, for all intents and purposes, they are deemed to be the same thing.

However, this literature discussion does allow the researcher to develop a working grasp of the construct for the purposes of this study. First, consistent with the research literature in the area dating from Caplow (1957), the construct bears most relevance to "organisations" or "groups". However, whereas earlier research focused on structural aspects of the organisation (notably, the relationships between members of the organisation), more recent research considered the effects and behaviour of this structure. Second, there is clear appeal of research into firms, with governmental and social organisations exhibiting fundamental differences to these commercial organisations (Bretschneider and Wittmer 1993, Yetton 1994).

5.2 Determining the Dimensions of Size

Having delineated the construct, according to Stage 1a in Churchill's paradigm, the study now needs to determine a sample of dimensions that describe the construct. The goal of this section is to develop an accurate and complete assessment of the construct by observing those dimensions that underpin the construct.

In circumstances where the construct structure is known and understood, dimension selection can be conducted according to set formulae (Elfving et al. 1959). However, as noted in Chapter 2, constructs are not always well defined or ordered. In such circumstances, a broader approach is necessary in order to be sure of capturing most or all of the construct's dimensions.

The rationale behind the dimension generation stage of Study 1 was guided by Loevinger (1957). Loevinger argued that dimension generation should follow three principles. First, "at the very least, the items in the pool should be drawn from an area of content defined more broadly than the trait expected to be measured". The researcher took this to mean that dimensions should be generated from a variety of journals and studies. Earlier discussion argued that, while this study may inform other disciplines, it focuses on the construct within the information systems domain. This study seeks variety within the information systems discipline.

Second, "when possible, the items of the pool should be chosen so as to sample all possible contents which might comprise the putative trait according to all known alternative theories of the trait" (Loevinger 1957). The researcher understood this to mean that not only should an exhaustive study be conducted, but a method should be used that could manage acquiring dimensions from a variety of sources. Additionally, it was understood that dimensions should be gathered for completeness as a priority. Eventually, a method would be needed to sort these dimensions into a more manageable conceptual model.

Third, "the various areas or sub-areas of content should be represented in proportion to their *life-importance*" (Loevinger 1957, emphasis added). The researcher understood this to mean that the appropriate mix and weighting of individual dimensions within the construct may not be straightforward. Somewhere during the dimension generation and analysis stage, it will be necessary to conduct deeper analysis of this dimension mix. This analysis may require some experimental analysis of the construct and its dimensions, perhaps using knowledge gained from human participants. This would make for a better understanding of the "life importance" of these construct dimensions.

5.3 Method

Discussion presented in Chapter 4 showed that there are several methods available for investigating construct dimensions. Principal among these is the literature search. This approach was deemed suitable to this stage of the study as it satisfied the two requirements outlined above, and it received support from Churchill (1979) and Loevinger (1957). First, the literature search should be able to reveal the number and extent of construct dimensions in use in the research community. The literature search approach should be able to contend with this requirement even if the number of dimensions is large. Second, the literature search should be able to acquire these dimensions from a vast range of sources. Because the literature review takes direction and input from many sources at once, the perspectives of many researchers can be sought and obtained with efficiency. Methods such as the focus group or individual interview may not yield as complete a list of dimensions because time and cost would prohibit including a large number of participants. Further, asking researchers directly (perhaps by way of a survey) might be unfeasibly expensive to undertake and may induce response bias in terms of those who were already interested in the construct.

An understanding of the size construct is likely to require some analysis of meaning *and* measurement. If a construct represents an understanding of the real world and facilitates measurement of a real world phenomenon, then it would make good sense to take both meaning and measurement into account. This is consistent with the arguments of Twiggs et al. (1999) and Orlikowski and Baroudi (1991):

"understanding phenomena is thus primarily a problem of *modelling and measurement*" (emphasis added). London (1975) argued that any study assessing construct validity requires a thorough understanding of measurement.

While meaning and measurement are inter-related, it would be wise to clearly separate the literature analysis of these dimensions for several reasons. First, some studies may discuss meaning but not measurement (and vice versa). Second, there may be different numbers of studies mentioning indicators and constructs. Finally, however, constructs and indicators are conceptually different things and it would be wise to approach their analysis carefully. Given the extent of the size problem in information systems research, the researcher should be particular about extracting its constituent parts from the published research. These arguments suggest that analysis of construct dimensions and indicators should be kept separate.

This section of the study follows Perry's (1998) prescriptive approach to method discussion, based on the popularity of Perry's work in thesis development and authorship (Love 2001).. The next section discusses the unit of analysis. This is followed by the study's procedures and materials, and finally administration.

5.3.1 Unit of Analysis

The unit of analysis in this study consisted of a selection of information systems academic journals. As noted earlier, a range of journals exist in the information systems literature to disseminate news of scholarly research. Lest the literature reviewer be overwhelmed by source material and choice, it is important to carefully select a subset of journals for study which reflect both the core interests and diversity of information systems research. A group of six important information systems journals was selected from those available: *MIS Quarterly*, *Information Systems Research*, *Information and Management*, *Information Systems Management*, *Journal of Management Information Systems* and *Communications of the ACM*. It was felt that this selection would give a healthy indication of the dimensions in use and was similar to the range of journals used in other studies in the information systems literature such as Barki et al. (1988), Straub (1989), Baroudi and Orlikowski (1989), Delone and McLean (1992), Holsapple and Johnson (1994) and Chan (2000). *Information and Management* was included to, in part, address the 'balance' of North American and European journals (Webster and Watson 2002, Chen and Hirschheim 2004). The journal selection was slightly larger than Kimberly's (1976) review of organisational size in the administrative social sciences. Table 5.1 compares the journal selection for study 1 with other studies in the IS literature.

Table 5.1 Journal Selection for Study 1 and Other IS Studies

	Study 1	Barki et al. (1988)	Straub (1989)	Baroudi and Orlikowski (1989)	Delone and McLean (1992)	Holsapple et al. (1994)	Chan (2000)
Management Science		•		•	•		
MIS Quarterly	•	•	•	•	•	•	
Communications of the ACM	•	•	•	•	•	•	•
Decision Sciences				•	•	•	•
Information & Management	•	•	•		•	•	
Journal of Management Information Systems	•				•	•	•
ICIS Proceedings		•			•		
Information Systems Research	•						•
Information Systems Management	•						

The time interval for articles included in the search was restricted to eleven years: expressly, the period 1989 – 2000. Research from this (relatively short) period encompasses more traditional firms in addition to those that have not followed "classical" growth patterns (such as electronic commerce organisations) and those that are subject to unconventional technology-enabled operating environments (such as virtual offices and telecommuting). Consistent with the discussion given in Section 5.1.4 above and Kimberly's (1976) review paper, studies had to be "primarily concerned with organisational size and structure" in an operational sense.

5.3.2 Procedures and Materials

Based on the discussion presented above, this study's procedure comprises two main parts. The first part details the approach and procedure of examining constructs in the literature (the meaning of size). The second part details the approach and procedure of examining indicators in the literature (the measurement of size).

5.3.2.1 Approach to Examining the Meaning of Size

This stage of the study explored researchers' understanding of the meaning of the size construct, by examining a group of research papers in the information systems literature which employ the construct. Difficulties arise when attempting to determine intention from reported behaviour: supporting discussion regarding organisational size may extend to just a few paragraphs and this affords the researcher little useable discussion. Additionally, for ostensibly well-known constructs, authors may not feel compelled to provide substantial discussion, on the understanding that article space is limited and the reader is likely to understand the problem or construct already. In these circumstances, a literature analyst must take care when reading the material and, accordingly, a robust scientific approach would be useful.

Researchers in the psychology literature often use a method of coding in order to determine intention or belief from a given piece of text. Miles and Huberman (1984) argued that codes are, "retrieval and organising devices that allow the analyst to spot quickly, pull out, then cluster all the segments relating to a particular question, hypothesis, concept or theme". When undertaken correctly, the approach of response post-coding can deliver significant and generally reliable insight into behaviour (Krippendorff 1980).

In order to ascertain the researcher understanding of organisational size in information systems research Strauss and Corbin's (1998) and Neuman's (1994) program of textual post-coding was followed. The method of post coding, ordinarily designed for extracting concepts and data from interview transcripts, allowed the researcher to draw out constructs from research papers and then classify these constructs into categories.

5.3.2.2 Procedure for Examining the Meaning of Size

Papers were first "open coded". The process of open coding constitutes a first pass over the research papers in an attempt to identify the major theories behind what information systems researchers believe "size" to mean. Here, a piece of text (such as an interview transcription) is read in detail to allow the researcher to determine broad, salient concepts. After a close reading of the text, labels are applied to relevant phrases or words in the text. In this initial stage, these concepts are permitted to be broad and largely disorganised: of greatest importance is the capture of contextual meaning within the passage (Strauss and Corbin 1998).

Three examples from this study follow. For each example, the relevant part of the passage is underlined and the label for the concept follows in bolded square brackets (following Strauss and Corbin's convention). The first example paper is Yap's (1990) study, which explored the characteristics of firms using computer technology. The study posited that larger firms were more likely to be using computers. Yap's discussion of size was as follows:

> *"Size is probably a surrogate measure of several dimensions that lead to the adoption of innovations: resources* ***[resources]****, organisational structure* ***[structure]*** *and so on. Another explanation is that as the size increase, organisational structure becomes more complex* ***[complexity]****, and coordination of work activities* ***[co-ordination]*** *more complicated.*
>
> *Another line of reasoning is that increasing size leads to economies of scale* ***[economies of scale]*** *which enhance the feasibility* ***[feasibility and capability]*** *of adopting innovations* ***[adoption]****. It is likely that the large volume of information processed* ***[volume of information and need for communication]*** *by large organisations gives them the advantage of scale* ***[scale]****. There is some evidence to suggest that large organisations enjoy some cost advantage* ***[cost advantages and economies of scale]****, as the price of computer systems increases at a rate equivalent to the square root of their power...It is also likely that small organisations have more difficulty justifying investments in IT* ***[investment and acquisition]****. They face a number of problems arising from limited financial* ***[investment resources]*** *and human resources* ***[employment resources]****." (p. 102)*

In the above example, Yap refers to several themes which have been highlighted as candidate concepts. For instance, Yap appears to be invoking a sense of "volume" or "scale" of the organisation in his discussion. The paragraph suggested that larger organisations somehow have greater extent than smaller organisations.

The second example is Kivijärvi and Saarinen's (1995) study, which focused on system innovation and investment with respect to firm financial performance. As part of their analysis, Kivijärvi and Saarinen explored the effects of organisational context and strategy on IT investment. A portion of Kivijärvi and Saarinen's size discussion is as follows:

> *"Because of the many organisational levels* ***[levels]****, large organisations have an extensive need for communication and information exchange* ***[need for communication]****. Usually they also have more resources* ***[resources]*** *and expertise* ***[expertise]*** *than smaller ones, making them more effective users* ***[effectiveness and capability]*** *of information systems...Delone distinguishes between small and large firms in their adaptation patterns* ***[adoption]****; large firms are more likely to be early adopters* ***[adoption]*** *of computer systems than smaller ones. Also the findings of Ein-Dor and Segev indicate the larger the personnel* ***[employment]*** *of the organisation, the greater the probability of IS success. Hence, the relationship between IS investments* ***[investment and acquisition]*** *and financial performance* ***[investment and expenditure]*** *seems to be related to organisational size. Organisational size is assumed to reflect the organisation structure* ***[structure]*** *as well as the communication and information processing requirements* ***[need for communication]****." (p. 147)*

In this example, Kivijärvi and Saarinen make similar but not identical observations about size as Yap (1990). For instance, whereas Yap mentions the "volume of information processed", Kivijärvi and Saarinen discuss the "need for information exchange" in the organisation. Similarly, both authors discuss investment in IT with respect to size.

The third example is Thong (1999), which reviewed the theory on innovation and develops an integrated model of system adoption in small business. Acknowledging the structural literature, Thong gives brief discussion of the organisational characteristics of adopters. Organisational size is one of these characteristics, and an example of his discussion is as follows:

> *"The technological innovation literature has found that larger businesses have more resources* ***[resources]*** *and infrastructure* ***[infrastructure]*** *to facilitate innovation adoption* ***[adoption]****. Small businesses suffer from a special condition commonly referred to as resource poverty* ***[resources]****. Resource poverty results from various conditions unique to small businesses, such as operating in a highly competitive environment* ***[competition and competitiveness]****, financial constraints* ***[financial resources]****, lack of professional expertise* ***[expertise]****, and susceptibility to external forces* ***[market power]****. Because of these unique conditions, small businesses are characterized by severe constraints on financial resources* ***[investment resources]****, a lack of in-house IS expertise* ***[expertise]****, and a short-range management perspective* ***[managerial co-***

> ***ordination]**. Consequently, small businesses face substantially more barriers to adoption of IS **[adoption]** and are less likely to adopt IS than large businesses. Alpar and Reeves argue that, even among small businesses, the larger the business, the more able it is to hire people **[employment]** with specialized skills **[skills and expertise]**, such as knowledge of IS. In addition, it would appear reasonable to suppose that larger businesses have more potential to use IS **[potential for use and capability]** than smaller businesses, simply because of their larger scale of operations **[scale]**." (p. 195)*

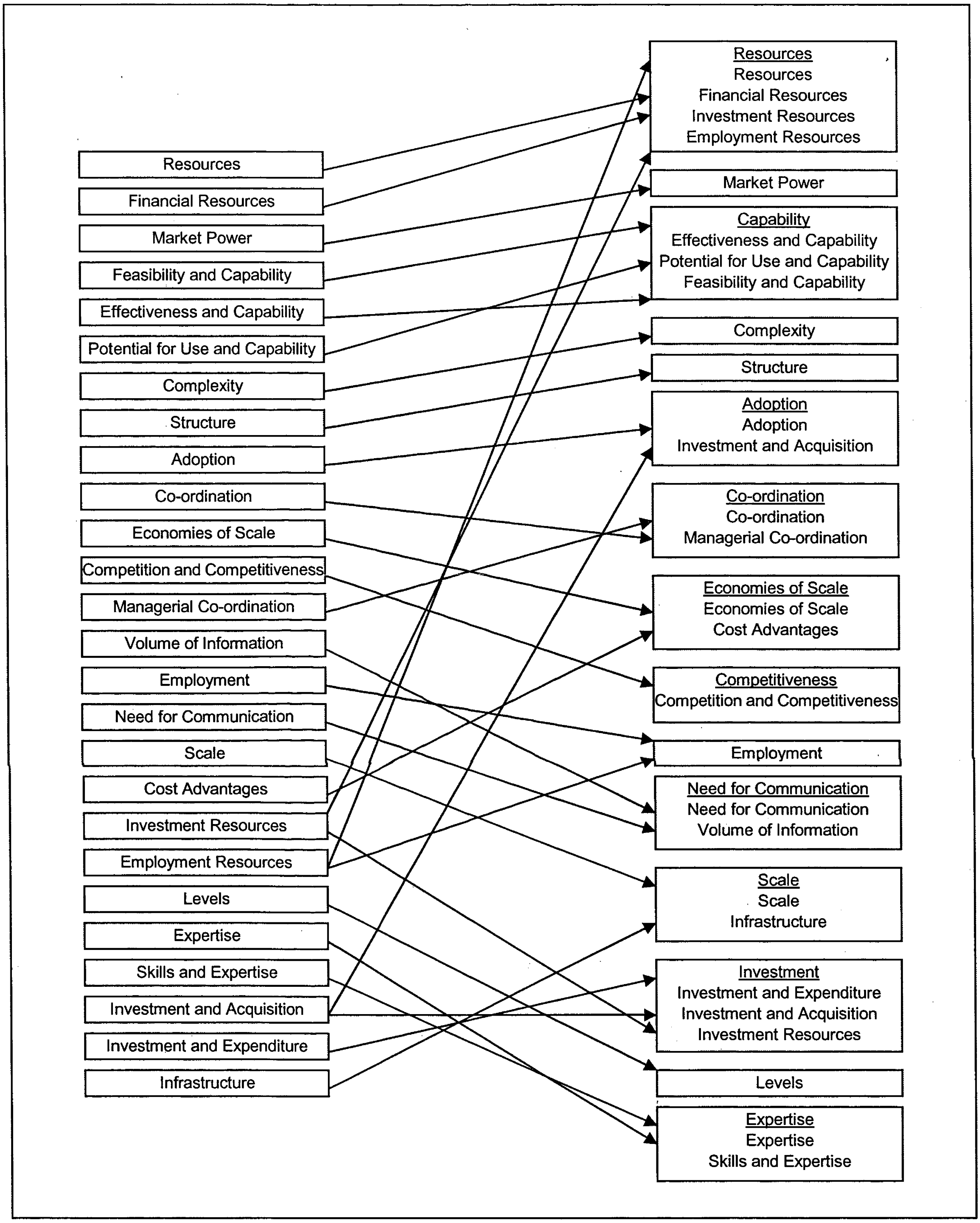
Once again, there are some similarities between this passage and the two previous examples. All three passages feature coded terms such as resources, expertise and investment. However, Thong also discusses themes such as capability and competition. This initial coding step already gives some indication that researcher understanding of organisational size is diverse.

The next stage involved "axial coding" of the text. This stage allowed the researcher to link the concepts extracted in the previous stage. This stage of the coding process is designed to establish relationships between these categories. For instance, the previous stage showed that some authors had a variety of reasons for using organisational size which, at first glance, appeared to be closely related. However, during the axial coding analysis, it was found that these relationships were largely only superficial. Baskerville and Pries-Heje (1999) argued that the axial process should give rise to "the discovery and specification of the differences and similarities among and within the categories" (p. 13). Glaser (1978) also offered direction in circumstances where categories are unclear, and argues that researchers should aim to "refit" and reduce categories in order to improve understanding and clarity. Heath and Cowley (2004) concurred.

An example illustration of this reduction process is shown in Figure 5.1, using the sample studies and coding items discussed above. This figure gives an indication of how the label reduction process was conducted. It shows how 26 original textual labels were refined down into 15 final labels. Each construct on the left of the diagram was reviewed in order to see if it could be grouped with other constructs without loss of meaning. The resulting groups are shown on the right hand side of the diagram.

This stage was valuable in that it revealed several redundant classifiers from the previous stage. For instance, the term "cost advantages" was rarely used and was incorporated into the larger category of "economies of scale". Similarly, "volume of information" was collapsed into "need for communication". One of the largest label groups to be removed in this stage was that of "adoption and innovation". While this concept was frequently mentioned in the passages as being closely related to size, it was decided that this was a separate construct to size, and not a dimension or indicator. It was also felt that this frequency of appearance merely reflected the popularity of the adoption phenomenon in the general research literature (consistent with Lind et al. 1989).

Figure 5.1 Example Axial Coding Process for Reducing Coding Labels



The final stage involved selective coding of the established categories. While some authors, such as Berg (1989), do not include this stage, it may assist in clarifying the literature use of the construct. The goal is to re-evaluate the dimensions already extracted from the text in the context of the relationships and attempt to understand the situation. As the final stage in the coding process, this stage should allow the researcher to develop some propositions regarding the construct or set of concepts under examination. The primary task undertaken in this stage is, according to Strauss and Corbin, "deciding on relationships in the central category". This central category should represent the main concept being examined. The researcher then relates each category to this central category, possibly by way of diagrammatical representation.

5.3.2.3 Approach to Examining the Measurement of Size

This stage of the literature analysis study aimed to determine how researchers in the literature go about measuring organisational size. This requirement involved searching for indicators of size in the literature. March and Smith (1995) outlined the importance of indicators in general research:

> *"[Indicators] define what we are trying to accomplish. They are used to assess the performance of an artifact. Lack of metrics and failure to measure artifact performance according to established criteria result in an inability to effectively judge research efforts".*

A range of studies in information systems research pursue the development and analysis of indicators, for instance Igbaria and Greenhaus (1991) examined computer departments (number of IT employees), Gopal and Sanders (1997) examined software piracy clubs (number of members), Mukhophadyay and Kekre (1995) examined production plants (thousands of vehicles produced per year), Choudhury (1998) examined airlines (number of aircraft component purchase orders per year) and Schwartz and Wood (1993) examined email administrative domains (number of email users). In addition, the accurate measurement of system effectiveness

(Srinivasan 1985), system performance (Brancheau and Wetherbe 1987) and system success (Delone and McLean 1992) remain areas of substantial debate in the information systems literature.

5.3.2.4 Procedure for Examining the Measurement of Size

Organisations were included if they satisfied the definition in Section 5.1.4 of being a distinct commercial entity (organisations such as hospitals and educational institutions fell into a grey area, and were admitted to the study on a case by case basis). Studies had to make use of the term, "size", "larger" or "smaller" in an organisational context. Papers that examined an aspect of an organisation but did not use it as an indicator or proxy for size were excluded. For example, studies that examined total assets as an indicator for size were admitted to the study; those that simply examined a firm's total assets were not.

5.3.3 Administration

The researcher read every paper that was published during the 1989 – 2000 time period in the six journals mentioned above. A collection was made of all theoretical and empirical papers that referred to organisational size. The data collection process was divided into two stages in order to reflect earlier discussion regarding the dimensions of organisational size. The first explored the relevant literature for dimensions that would describe the size construct in terms of measurement indicators. The second explored the relevant literature for dimensions that described the construct in terms of dimensions of meaning.

For both analysis stages, the author conducted the search. As Delone and McLean (1992) argued, cases of ambiguity and imprecision inevitably arise when conducting taxonomic analysis of this kind. In cases of ambiguity, the opinion of a second senior academic staff member was sought. At the end of the data collection process, the entire list was verified by the researcher and two others also involved in organisational research (as in Venkatraman 1989).

5.4 Results of the Literature Search for Meaning

In total, the analysis found 21 separate constructs in 214 papers that authors related to organisational size. These constructs and the relationships between them are shown in Table 5.2. The table lists the study, organisational size construct label determined during the coding process and the area of the application. Only those studies that made use of organisational size as a dependant or independent research variable (instead of a classifier) are shown.

Table 5.2 Relationship Between Size Constructs and Areas of Application

Construct	Citation	Area of Application
1. Need for Co-ordination	Pavri and Ang (1995)	Strategic planning practices
	Yap (1990)	Firm use of IT
	Teo et al. (1995)	EDI benefits
2. Resources	Chau and Tam (2000)	IT adoption
	Iacovou and Benbasat (1995)	EDI adoption
	Kivijarvi and Saarinen (1995)	IS investment and firm performance
	Palvia et al. (1994)	Computing in small business
	Karimi and Gupta (1996)	Competitive strategy
	Grover et al. (1994)	IS outsourcing
	Yap (1990)	Firm use of IT
	Al-Khaldi and Wallace (1999)	Attitude towards PC use
	Lind et al. (1989)	IT adoption
	Choe (1996)	AIS performance and evolution
	Grover and Teng (1992)	DBMS adoption
	Palvia and Palvia (1999)	IT satisfaction
	Riemenschneider and Mykytyn (2000)	IT management knowledge
	Teo et al. (1995)	EDI benefits
	Thong (1999)	IS adoption in small business
	Shao (1999)	Expert system diffusion
	Straub and Nance (1990)	Computer abuse
3. Competitiveness	Choudhury (1997)	IOS Development
	Teo et al. (1995)	EDI benefits
	Thong (1999)	IS adoption in small business
4. Need for Communication	Kivijarvi and Saarinen (1995)	IS investment and firm performance
	Al-Khaldi and Wallace (1999)	Attitude towards PC use
	Harrison and Farn (1990)	IS management issues
5. Organisational Levels	Kivijarvi and Saarinen (1995)	IS investment and firm performance

	Mitra and Chayam (1996)	IT spending and cost-effectiveness
	Truman (2000)	Electronic exchange integration
	Harris and Katz (1991)	IT investment intensity
	Yap (1990)	Firm use of IT
	Hitt (1999)	IT and firm boundaries
	Palvia and Palvia (1999)	IT satisfaction
	Ryan and Harrison (2000)	IT Investments and firm performance
	Thong (1999)	IS adoption in small business
	Torkzadeh and Xia (1992)	Telecommunications management
6. Expertise	Kivijarvi and Saarinen (1995)	IS investment and firm performance
	Palvia et al. (1994)	Computing in small business
	Mitra and Chayam (1996)	IT spending and cost-effectiveness
	Yap (1990)	Firm use of IT
7. Need for Control	Law and Gorla (1996)	IS effectiveness
	Conrath and Mignen (1990)	User satisfaction
	Mitra and Chayam (1996)	IT spending and cost-effectiveness
	Pick (1991)	IS in non-profit organisations
8. Slack Resources	Chau and Tam (2000)	IT adoption
	Grover and Goslar (1993)	IT initiation and adoption
	Thong (1999)	IS adoption in small business
	Ang and Straub (1998)	IS outsourcing
9. Risk Aversion	Chau and Tam (2000)	IT adoption
10. Risk Tolerance	Chengular-Smith and Duchessi (1999)	Client-server adoption
	Lind et al. (1989)	IT adoption
	Shao (1999)	Expert system diffusion
	Straub and Nance (1990)	Computer abuse
11. Scale	Karimi and Gupta (1996)	Competitive strategy
	Truman (2000)	Electronic exchange integration
	Lind et al. (1989)	IT adoption
	Riemenschneider and Mykytyn (2000)	IT management knowledge
	Thong (1999)	IS adoption in small business
12. Flexibility	Grover and Goslar (1993)	IT initiation and adoption
	Lind et al. (1989)	IT adoption
	Grover and Teng (1992)	DBMS adoption
	Li and Ye (1999)	IT and firm performance
13. Economies of Scale	Karimi and Gupta (1996)	Competitive strategy
	Mitra and Chayam (1996)	IT spending and cost-effectiveness
	Grover and Goslar (1993)	IT initiation and adoption
	Yap (1990)	Firm use of IT
	Mendelson and Pillai (1998)	Businesses and IT use
	Li and Ye (1999)	IT and firm performance
	Ang and Straub (1998)	IS outsourcing
14. Expenditure	Chengular-Smith and Duchessi (1999)	Client-server adoption
	Teo et al. (1997)	IS strategic planning
	Harris and Katz (1991)	IT investment intensity
	Li and Ye (1999)	IT and firm performance
	Riemenschneider and Mykytyn (2000)	IT management knowledge
	Pick (1991)	IS in non-profit organisations
15. Capability	Pick (1991)	IS in non-profit organisations
16. Investment	Kivijarvi and Saarinen (1995)	IS investment and firm performance
	Karimi and Gupta (1996)	Competitive strategy
	Harris and Katz (1991)	IT investment intensity
	Hitt (1999)	IT and firm boundaries

	Ryan and Harrison (2000)	IT Investment and firm performance
	Torkzadeh and Xia (1992)	Telecommunications management
17. Structure	Premkumar and King (1994)	IS planning
	Harris and Katz (1991)	IT investment intensity
	Lind et al. (1989)	IT adoption
	Thong (1999)	IS adoption in small business
18. Complexity	Beauclair and Straub (1990)	GDSS utilisation
	Talmor and Wallace (1998)	CEO salary
	Mitra and Chayam (1996)	IT spending and cost-effectiveness
	Premkumar and King (1994)	IS planning
	Yap (1990)	Firm use of IT
	Torkzadeh and Xia (1992)	Telecommunications management
19. Market Power	Choudhury (1997)	IOS Development
	Harris and Katz (1991)	IT investment intensity
20. Distribution	Ahituv et al. (1989)	Distributed computing policy
21. Employment	Coakes and Merchant (1996)	Expert system use
22. No Justification	Post et al. (1999)	CASE Tools
	Anandarajan and Arinze (1998)	Client/Server processing architecture
	Wang (1994)	IS management issues
	Meyer (1997)	Visual information acceptance
	Yang (1996)	Information management issues
	Lai (1994)	Computing in small business
	Li and Rogers (1991)	IS profile of US firms
	Katz (1993)	IT and business value
	Ahituv et al. (1998)	IS and new product introduction
	McLean et al. (1993)	Use of end-user computing
	Zeffane (1992)	Structural control in organisations
	Swanson and Dans (2000)	System life expectancy
	Poon and Swatman (1999)	Small business Internet issues
	Maansaari and Iivari (1999)	CASE usage
	Nabali (1991)	IS in hospitals
	He et al. (1994)	IS in manufacturing
	Udo and Davis (1992)	DSS Benefits

The evidence presented here raises a number of interesting points. First, Table 5.2 shows that 21 constructs were discovered. In addition to these constructs, however, 17 studies offered no identifiable discussion of their understanding of organisational size. The number of such studies warrants its inclusion as an indicator of how authors perceive organisational size. Second, authors appear to lack an accepted view of the dimensions underpinning organisational size in terms of what the size construct actually means. For instance, papers examining information system adoption feature in almost all of the categories presented in Table 5.2. Third, it should be noted that the concept of "employment" featured only once in Table 5.2. This is despite the popularity of *Number of Employees* as a research indicator for organisational size. This may suggest that while researchers think size has a definite meaning, they do not reflect on the link between their measures and the meaning of the underlying constructs.

5.5 Results of the Literature Search for Measurement

The results show, over the eleven year period under examination, 25 indicators in use across 214 studies in the information systems literature. In the main, papers offered little in the way of supportive discussion regarding their choice of indicator, despite the importance of this procedure as argued by March and Smith (1995). Additionally, some discrepancy was noted between the online and print versions of research papers. The online versions occasionally saw volume numbers out of sequence and were frequently missing author names and editorial content.

These indicators were grouped into tentative categories as shown in Table 5.3. Each of these groups is examined in more detail in the following sections. For each indicator, the study, research environment and the nature of the indicator's application are noted. Only those studies that used the size indicator as an independent variable (as opposed to a classifier) are shown.

Table 5.3 Indicators of Organisational Size in the Information Systems Literature

Sales/Revenue Indicators	Resource Indicators	Other Indicators
Annual Revenue	Number of Employees	Patient Days
Gross Revenue	Total IS Employees	Self Nominated
Sales Revenue	Total IT Users	Fortune 500
Total Sales	Total Assets	Geographical Spread
Net Sales	Book Value of Assets	Number of Beds
Annual Sales	Fixed Assets	
Sales Volume	Production Assets	
Annual Turnover	IS Budget	
Premium Income	Operating Expenditure	
	IS Expenditure	
	Total Annual Budget	

5.5.1 Resource Indicators

Table 5.4 shows those studies that used resource-related indicators. *Number of Employees* (NOE) was by far the most common indicator, a finding consistent with the arguments of Raymond (1985), Delone (1988) and Choe (1996). NOE has, for some time, been seen as a suitable indicator of organisational size. Additionally, NOE is relatively easy to determine from official documents, particularly for publicly listed firms (Miller 1991). The use of NOE, however, has tenuous application to those work environments that experience substantial fluctuation, such as telecommuting, virtual offices (Snizek 1995) and network organisations (Ching et al. 1996). *Total Assets* was the next most popular indicator in use. Kim and McLeod (1999) argued that total assets represents firm stability and credibility. It is also interesting to note that, almost unanimously, studies that examined hospital environments used *Number of Beds* as their indicator.

Table 5.4 Organisational Size Indicators Based on Resources

Citation	Study Topic	Indicator	Dependant Variable	Significant
Nabali (1991)	IS in hospitals	Number of Beds	IT adoption	No
Ahituv et al. (1989)	Distributed computing policy	Number of Employees	Hardware distribution	No
Al-Khaldi and Wallace (1999)	Attitude towards PC use	Number of Employees	Attitude ranking	Yes
Choe (1996)	AIS performance and evolution	Number of Employees	User satisfaction	Yes
Coakes and Merchant (1996)	Expert system use	Number of Employees	ES use	No
Grover and Teng (1992)	DBMS adoption	Number of Employees	IT adoption	Yes
Harrison and Farn (1990)	IS management issues	Number of Employees	IT adoption	Yes
Hitt (1999)	IT and firm boundaries	Number of Employees	IT use	Yes
Li and Ye (1999)	IT and firm performance	Number of Employees	IT performance	Yes
Maansaari and Iivari (1999)	CASE usage	Number of Employees	Technology expectations	Yes
Palvia and Palvia (1999)	IT satisfaction	Number of Employees	IT satisfaction	No
Poon and Swatman (1999)	Small business Internet issues	Number of Employees	Internet use	Yes
Riemenschneider and Mykytyn (2000)	IT management knowledge	Number of Employees	Knowledge item	No
Ryan and Harrison (2000)	IT investments and firm performance	Number of Employees	Social group cost	No
Swanson and Dans (2000)	System life expectancy	Number of Employees	System size	Yes
		Number of Employees	System age	No
		Number of Employees	Complexity	Yes
		Number of Employees	Life expectancy	Yes
Teo et al. (1995)	EDI benefits	Number of Employees	Inventory control	Yes
Thong (1999)	IS adoption in small business	Number of Employees	Likelihood and extent of IS adoption	Yes
Torkzadeh and Xia (1992)	Telecommunications management	Number of Employees	Use of formalised planning	Yes
Udo and Davis (1992)	DSS benefits	Number of Employees	Communication benefits	Yes
Zeffane (1992)	Structural control in organisations	Number of Employees	IT usage intensity	No
Ang and Straub (1998)	IS outsourcing	Total Assets	Outsourcing	Yes
Shao (1999)	Expert system diffusion	Total Assets	Adoption date	Yes
Straub and Nance (1990)	Computer abuse	Total Assets	Severity of discipline	No
Pick (1991)	IS in nonprofit organisations	Total Annual Budget	Funding intensity	No
		Total Annual Budget	Hardware complexity	Yes
		Total Annual Budget	Software complexity	Yes
		Total Annual Budget	Staff professionalism	Yes
		Total Annual Budget	IS control	Yes
		Total Annual Budget	IS morale	No
		Total Annual Budget	IS satisfaction	No

5.5.2 Sales/Revenue Indicators

Table 5.5 details those studies that make use of sales or revenue measures of organisational size. The most popular Sales/Revenue indicator, based on frequency of application, is *Annual Sales*.

It could be argued that sales and revenue measures may only be suitable in certain circumstances. While "larger" firms may have to lodge financial documentation with the relevant regulatory body (such as the ASX in Australia), "smaller" firms are not necessarily bound by this formality: determining such figures for these firms may be difficult. The application of financial measures to firms in financial sectors is seen by some as error-prone (Grover and Teng 1992), either because these firms do not sell physical products or they exhibit fluctuating revenue streams which may obscure size analysis. Additionally, several authors note the fervency with which firms may seek to downplay unfavourable financial aspects, such as operating costs, and exaggerate favourable aspects, such as revenue (Mitchell et al. 1996).

Table 5.5 Organisational Size Indicators Based on Sales/Revenues

Citation	Study Topic	Indicator	Dependant Variable	Significant
McLean et al. (1993)	Use of end-user computing	Annual Revenue	IT adoption	No
Ahituv et al. (1998)	IS and new product introduction	Annual Sales	Application success	No
Katz (1993)	IT and business value	Annual Sales	IS performance measurement	No
Li and Rogers (1991)	IS profile of US firms	Annual Sales	Hardware expenditure	Yes
		Annual Sales	Computing expenditure	Yes
		Annual Sales	Telecommunications expenditure	Yes
		Annual Sales	Analysis effort	Yes
		Annual Sales	Programming effort	Yes
		Annual Sales	Data processing mode	Yes
		Annual Sales	IS resource structure	Yes
		Annual Sales	Data organisation benchmarks	Yes
		Annual Sales	Statistical software usage	Yes
Lind et al. (1989)	Size impact on IT adoption	Annual Sales	IT adoption	Yes
Mendelson and Pillai (1998)	Businesses and IT use	Annual Sales	IT Use	No
Yap (1990)	Firm use of IT	Annual Turnover	IT adoption	Yes
Harris and Katz (1991)	Size and IT investment intensity	Premium Income	IT expenditure	No
Truman (2000)	Electronic exchange integration	Premium Income	EDI volume	No
		Premium Income	EDI diversity	Yes
		Premium Income	No. of professional employees	Yes
		Premium Income	No. of admin employees	Yes
Premkumar and King (1994)	IS planning	Sales Revenue	Quality of planning	No
Grover and Goslar (1993)	IT initiation and adoption	Total Sales	IT adoption	No
Mitra and Chayam (1996)	IT spending and cost-effectiveness	Total Sales	IT cost returns	No

5.5.3 Compound Indicators

Some studies used a multivariate proxy or using two separate indicators to measure the same proxy when examining size. Table 5.6 details the use of such compound measures in the literature. Particularly interesting is Iacovou and Benbasat (1985), which used two separate indicators of organisational size to test for EDI adoption: of *Number of Employees* and *Total Sales*, only the latter indicator was found to be significant.

Table 5.6 Organisational Size Indicators Based on Compound Measures

Citation	Study Topic	Indicator	Dependant Variable	Significant
Conrath and Mignen (1990)	User satisfaction	Number of Employees, Annual Revenue	User satisfaction measurement	No
Grover et al. (1994)	IS outsourcing	Number of Employees, Annual Sales	IS outsourcing	No
Karimi and Gupta (1996)	Competitive strategy	Number of Employees, Annual Sales	Strategy type	Yes
Lai (1994)	Computing in small business	Number of Employees, Annual Sales	IT adoption	No
Palvia et al. (1994)	Computing in small business	Number of Employees, Annual Sales	Computer use	Yes
Pavri and Ang (1995)	Strategic planning practices	Number of Employees, Annual Sales	Strategic planning	Yes
Yang (1996)	Information management issues	Number of Employees, Annual Sales	Issue importance	Yes
Teo et al. (1997)	IS strategic planning	Number of Employees, Annual Sales, Number of IS Employees, IS Expenditure, Operating Expenditure	Strategic IS planning	Yes
He et al. (1998)	IS in manufacturing	Number of Employees, Annual Sales, Production Assets	IS adoption	Yes
Meyer (1997)	Visual information acceptance	Number of Employees, Annual Turnover	Manager attitude	Yes
Wang (1994)	IS management issues	Number of Employees, IS Budget, IS Employees	Issue importance	Yes
Kivijarvi and Saarinen (1995)	IS investment and firm performance	Number of Employees, Net Sales	IS investment	Yes
Chengular-Smith and Duchessi (1999)	Client-server adoption	Number of Employees, Total Sales	IT adoption	No
Iacovou and Benbasat (1995)	EDI adoption	Number of Employees	EDI adoption	No
		Total Sales	EDI adoption	Yes
Talmor and Wallace (1998)	CEO salary	Total Sales, Total Assets	CEO salary	Yes

5.5.4 Other Indicators

Five studies used indicators that did not fit into any of these three categories. In the main, these studies were specific to certain industries or business types. The indicators used included *number of patient days* (used in a study about hospitals), *Fortune 500*, *geographical spread* and *respondent-nominated.* None of these studies offered convincing discussion as to why these unconventional size indicators were chosen over more conventional indicators. It is interesting to note the frequency with which studies used unaudited self-reported measures for firm size: in these cases, responding organisations were typically asked to classify themselves as either "small", "medium" or "large". The effect of this on experimental reliability is unknown.

5.5.5 No Indicator

In total, 27 studies (over 10%) did not declare the indicator used, with five of these studies using organisational size as an independent variable. A number of authors (such as Miller 1991) note the importance of variable and parameter declaration when conducting scientific analysis and these omissions may undermine the scientific approach taken and conclusions made in these papers.

5.6 Limitations

The literature analysis study conducted in this chapter is subject to a number of limitations. First, it is possible that the search method used did not capture every paper that made use of organisational size. While every effort was made to reduce the number of missed papers, the researchers cannot rule out the possibility of missed papers due to human or technical error. Triangulation and confirmation procedures were used to minimise this, however the size and effect of this error is, unfortunately, unknown.

A second source of potential error lies in the selection of journals. First, only six journals were selected from the hundreds that are available to the information systems researcher and practitioner. Given the human and technology resources available to the researcher, it would have been unfeasible to pursue a substantially larger number of journals. There is also no guarantee that these journals provide a representative (or even indicative) sample of the research involving organisational size.

The effect of this error has hopefully been alleviated somewhat through the careful traversal of journal references and the sheer number of journal articles examined (over 2,000). Also, in this regard, most of the journals are North American. The inclusion of a wider selection of journals in future iterations of this study should at least partially address this issue. Additionally, a degree of inconsistency was found between the print and online versions of some papers: the effect of this, while unknown, should be borne in mind by scholars in this area.

A third area of research limitation lies in the timeframe selected. Eleven years represents but a small portion of the total life of the information systems discipline, the advent of which is estimated by some to be during the mid 1960s (Holsapple and Johnson 1994). While focusing on such a small timeframe does allow for more microscopic analysis, the study misses a substantial amount of previous information systems research. The study would no doubt benefit from the inclusion of this sizeable period: it is anticipated that future work should bring this to fruition. This particular time period presents another source of limitation and potential error, in that the period has been witness to terrific organisational growth and unorthodox structure and business process. The effect of this is unknown and, without a larger time frame to moderate this period, the true nature of the size indicator will remain, at least partly, a matter of some scholarly conjecture.

5.7 Discussion

This study has made a number of findings. First, and arguably most importantly, the results show that while many studies are employing organisational size in their analysis, the justification behind that employment appears to vary widely. Researchers appear to lack a reliable understanding of the meaning and nature of organisational size. Further to this, many researchers fail to disclose any argument as to organisational size whatsoever. This finding comes despite (or perhaps because of) a possible tacit understanding of the term, "organisational size".

The second finding is that there appears to be some convincing weight behind the contention that organisational size is either a single multidimensional construct or many constructs. This would be consistent with the arguments of Rogers (1995). To paraphrase Delone and McLean's (1992) work on IS success, "It is unlikely that any single, overarching measure of [organisational size] will emerge, and so multiple measures will be necessary, at least in the foreseeable future". This has further implications for how organisational size and its underlying dimensions are measured: each of the constructs presented here may need to be measured in different ways. However, under the "surrogate" (Yap 1990) of organisational size, they could be measured in the same way, possibly resulting in incorrect findings.

One important implication of this is that authors do not consider different types of organisations in their research. Virtual organisations, newer online organisations and more traditional firms each appear to be treated with the same size indicators. The findings presented in this study suggest that researchers appear to lack the precise approaches to measurement that might afford more accurate analysis.

The findings, while moderated to some degree by the limitations discussed above, have several implications. First, researchers appear to have varied impressions of what organisational size means. These differing interpretations of the construct jeopardise its application in research environments. In particular, this disagreement undermines the validity and reliability of the studies that use the concept. The term appears to be a convenient handle, an umbrella that in fact masks several supporting constructs. However, studies appear to give scant consideration to these foundational concepts. This calls into question the use of organisational size indicators thus far. Studies could benefit from applying greater scrutiny to their use of the term.

Of concern is that number of studies that offer no justification or discussion with regard to their use of the organisational size construct. It is unclear whether this is a cause or an effect of the confusion surrounding organisational size. Nevertheless, this somewhat reckless approach severely limits the usefulness of the studies in question. Ultimately, such an approach erodes the research pedigree of the information systems discipline.

There is also no guarantee that each dimension in the list is of equal importance or weighting in the final construct makeup. The frequency of appearance in the list is also not necessarily any indication of relative importance. For instance, while "economics of scale" is frequently mentioned in conjunction with organisational size, the dimension may not explain what size means or how it could be adequately measured.

5.8 Preliminary Assessment of the Size Construct

The analysis presented here has shown 21 dimensions to the size construct. Additional analysis has shown that these dimensions can be shown to exhibit some relationships between each other, however these are still largely disaggregated. Further, a more holistic view of the size construct cannot be based on frequency of appearance alone: more popular dimensions are not necessarily good indicators of correctness or validity. In Loevinger's terms, the collection does not yet possess a mix reflecting "life-importance". Hence, while economies of scale, complexity and resources are more frequently related to the discussion of size in the research literature, measuring just these constructs alone might not yield a complete impression of organisational size.

Based on the dimension generation process undertaken here, some initial assessment of the organisational size construct can be made. First, there appears to be some divergence between meaning and measurement in the literature. The identified indicators may measure some aspects of what researchers think size means, and likewise, some construct dimensions are reflected in some of the indicators. There is no obvious relationship between the two and no obvious coverage of meaning with measurement. The evidence presented here suggests that these indicators may not be a good way of quantifying organisational size because they do not capture all of the dimensions of the size construct. Perhaps, data for these indicators are easy to acquire and this may explain their use.

The analysis of researcher understanding conducted so far has yielded a broad conceptual map of organisational size, however the picture is unrefined. The evidence suggests that organisational size is more complex than individual researchers might have initially thought. In order to achieve a more homogenous profile of size, the list of dimensions still requires further refinement.

5.9 Conclusions

This first study into the size problem led to a number of important findings. The concept of the "size of the organisation" is frequently seen in the research literature, however it seems very few studies deliberately delineate this concept of the organisation and there appears to be very little ongoing debate about its meaning.

This is important, as it suggests that researchers may have a tacit understanding of the size construct and the domain to which it applies. Possibly, this understanding is generally so broad that it doesn't substantially conflict with those of other researchers in the published form. In other words, this tacit understanding of the size construct may not be so rigidly exclusive as to encourage debate in the literature when it is used. This debate extends to the relationship between size and structure.

The study's literature review has revealed 21 separate constructs comprising the organisational size construct. Researchers appear to have differing interpretations of what size means. These constructs, however, require further interpretation in order to develop a more holistic view of the size construct. There is little agreement between measurement and meaning. This may constitute another explanation for the discrepancies evidence in the research literature.

A revision of the research literature has revealed 25 indicators for measuring the organisational size construct. Broadly, these can be categorised into resource, revenue and other indicators. The main indicators in use include *Number of Employees* and *Annual Sales*. There also appears to be very little agreement as to the correct indicator to use in organisational research. Researchers may instead base their indicator selection on their tacit understanding of the construct or data availability. The lack of agreed indicator may in part explain the research variance observed in the extant literature. Further analysis of the research in this area suggests little homogeneity of approach and a dearth of supportive discussion. This finding suggests that researchers in the information systems discipline are unsure as to the ideal indicator to use.

The results also show that while many studies are employing organisational size in their analysis, the understanding behind this use varies widely. Researchers appear to lack agreement as to the meaning and nature of organisational size. Further, many researchers fail to disclose any argument as to organisational size whatsoever. This finding comes despite (or perhaps because of) an apparent tacit understanding of the term, "organisational size".

CHAPTER 6

STUDY 2: DETERMINING THE RELATIONSHIPS AMONG SIZE DIMENSIONS

This chapter constitutes the thesis' second study into the size problem and relates to the third part of stage 1 of Churchill's paradigm, where content validity is assessed. In this phase, dimensions developed in the previous phase require refinement and editing. This phase is important, as it satisfies several requirements of the study. First, the stage further develops understanding of the construct and its constituency. Second, the stage supports the development of a parsimonious version of the construct. This is particularly valuable, as it will serve to improve the efficiency of data collection in later stages. Finally, such approaches "ensure the correspondence between the definition of the concept and the domain covered by the chosen pool of dimensions" (Venkatraman and Grant 1996:82).

This chapter is structured as follows. The next section presents the overall rationale for this study. This is followed by a discussion of the method itself, including the unit of analysis, the procedures and materials, the administration, making particular mention of control and then ethical approval. The experimental data are then analysed, followed by an exploration of potential threats to validity.

6.1 Rationale

This chapter describes the second of three studies into the meaning and measurement of the organisational size construct. The goal of this second study is to determine how the organisational size construct could be refined in terms of content validity. The focus of this study was to determine the relationships between the constructs identified in the previous study (discussed in Chapter 5). The study corresponds to stage 1c of Churchill's measure development paradigm.

Whereas the earlier stages of Churchill's process may be conducted through a close reading of the literature sources alone, the analysis of content validity benefits from an external viewpoint. Nunnally (1978) argues that groups of analysts should be used in order to make sure that the construct's domain has been adequately addressed. These groups should constitute panels of experts (Snow and Hambrick 1980, Hambrick 1982) such as scholars or executives (Hambrick 1981).

As discussed in Chapter 4, there are a number of ways of exploring this content validity. The concept map method was selected as the most suitable approach for this purpose as it allows the researcher to determine relationships between a large number of constructs, the results can be analysed statistically and the opinions of human participants can be gathered in a systematic fashion. A prescriptive scientific method was used in order to maintain control over the experiment: it is important to make sure that the phenomenon under examination is as pure as possible (Townsend 1953).

6.2 Method

Construct refinement was undertaken using the concept map method whereby participants sort cards into categories. Despite not being a pure laboratory experiment as such, the literature often discusses the concept map approach in terms of experimental procedure and terminology in the literature. Examples of this discussion include Chularut and DeBacker (2004), Oxman (2004) and Ewing et al. (2003) and, in an information systems context, Hoeft et al. (2003), Roussinov and Zhao (2003), Potelle and Rouet (2003) and Elliot et al. (2002). Trumpower and Goldsmith (2004) discussed the development of a spatial-semantic display in an experimental context to explore learning behaviour. Zelazo et al. (1996) used a general card sort method in an experimental context, as did Brooks et al. (2003). Bristow et al. (2004) used an experimental approach where participants sorted photographs.

The process of this study is discussed with respect to the prescriptive advice of Perry (1998) in terms of layout and content. Perry argued that the discussion of this approach should follow a clear line of development: authors should first discuss the study's unit of analysis, then the procedures and materials, then control, administration and, finally, ethical approval. Each of these steps is discussed below.

6.2.1 Unit of Analysis

The unit of analysis for Study 2 was a group of human participants. Participants were selected on the basis that they satisfied three criteria. First, participants had to be involved in business-related academic research, such as information systems, business management, accounting, auditing or organisation science. It was felt that researchers in these areas would be in frequent contact with organisational research and would have a readily available tacit understanding of organisational size. A similar selection was used by Bruce (1983), Turner and Turner (2001), Panteli (2002) and Elliot et al. (2002) among others. While researchers in other areas may also have an understanding of organisational size, this understanding may be less frequently employed in their research. For these researchers, the study may feel more contrived and this may distort findings.

The second requirement placed on participants was that the researcher had to have physical access to the participant in order to administer the exercise. To some extent, the selection of these participants is similar to that of "convenience sampling", whereby participants are selected not only for their suitability to the experiment's universe of application but also because of their proximity to the researcher. Such a pool is favourable in terms of cost, and it allows the researcher to "economically exploit for researcher purposes the broad spectrum of already formed groups which may be organised along some principle of direct substantive applicability to the investigation" (Webb 1968:24).

This participant selection process may be open to three main biases. First, there is no guarantee that this participant group is representative of the wider research population. Respondents have a range of backgrounds, however the effect of this potential bias is unknown. Second, the process may be subject to "interviewer effects" (Webb 1968) whereby participants already knew the researcher or were otherwise amenable to participating in the study (Meyer and Grossen 1975). Importantly, it is difficult to gauge personal differences between these participants and those who didn't know the researcher, or did not feel compelled to participate in the study. The selection process, in this regard, may also be open to participant acquiescence effects, as discussed later.

Third, the process assumes group homogeneity across membership and time (consistent with Webb 1968). The process does not take into account changes in the underlying phenomenon over the period of participant selection (or, indeed, the card sorting exercise itself). For instance, a critical environmental event may have changed participant perspective on organisational size or their desire to participate in the study. A survey of the popular and published academic literature over the exercise period revealed no significant events in this regard, however the possibility cannot be discounted.

6.2.2 Procedures and Materials

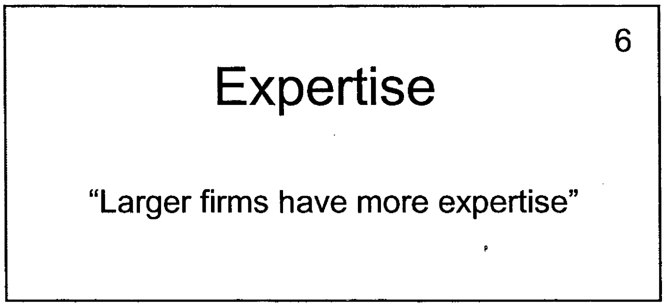
Two materials were used in this experiment. The first set of materials was a set of index cards used to represent each construct. The index cards consisted of pieces of plain white card measuring six inches by four inches. Each card showed a number, a construct dimension identified in Study 1 and a corresponding example description of that construct. Example descriptions were taken from literature works which used the construct. Table 6.1 gives a breakdown of the labelling on the set of cards, describing each construct with reference to the literature use of the construct.

Table 6.1 Definitions and Citations for Index Cards

No.	Dimension	Literature Definition	Citation
1	Need for Co-ordination	"Larger firms have greater requirement for co-ordination"	Leifer (1988)
2	Resources	"Smaller firms have fewer resources"	Lang et al. (1997), Yao et al. (2002)
3	Competitiveness	"Smaller firms are less competitive"	Wolfram (1998), Mason and Phillips (2000), Brunekreeft (2001), Peterson (2003)
4	Need for Communication	"Larger firms have greater need for communication"	Rai and Bajwa (1997)
5	Organisational Levels	"Smaller firms have fewer levels"	Hart and Banbury (1994), Brouthers et al. (2000)
6	Expertise	"Smaller firms have less expertise"	Russell et al. (1998)
7	Need for Control	"Larger firms have greater need for control"	Blau (1970), Rai and Bajwa (1997)
8	Slack Resources	"Larger firms have more slack resources"	Pearce et al. (1982), Rogers (1995), Bowen (2002)
9	Risk Aversion	"Smaller firms are more risk averse"	Arrow (1962)
10	Risk Tolerance	"Larger firms are more risk tolerant"	Woo (1987)
11	Scale	"Larger firms have greater scale"	Hitt et al. (1997)
12	Flexibility	"Smaller firms are more flexible"	Fiegenbaum and Karnani (1991), Hitt et al. (1997), Kalantaridis (2004)
13	Economies of Scale	"Larger firms have greater economies of scale"	Orlitzky (2001)
14	Expenditure	"Smaller firms have lower expenditure"	Chen and Hambrick (1995)
15	Capability	"Larger firms have greater capacity"	Barnett and Amburgey (1990)
16	Investment	"Larger firms have greater investment"	Gale (1972)
17	Structure	"Smaller firms have different structure"	Mintzberg (1979), Miller and Droge (1986)
18	Complexity	"Larger firms are more complex"	Hall et al. (1967), Gerhart and Milkovich (1990)
19	Market Power	"Larger firms have more market power"	Schumpeter (1942), Timmons (1990)
20	Distribution	"Larger firms have greater geographic distribution"	Rai and Bajwa (1997), Kalantaridis (2004)
21	Employment	"Larger firms have greater employment"	Yao et al. (2002)

Each index card was the same size, with writing on one side only. Figure 6.1 gives the layout of a typical card.

Figure 6.1 Example Index Card



The second aspect of material was an index sheet that was used as an introduction to the study. The sheet contained brief information concerning the purpose of the study, a description of the appearance of the index cards and broad directions for undertaking the card sorting exercise. At the start of each exercise, the content of the index sheet was read to the participant so that they understood what was required in the exercise. The use of a standard information sheet meant that each participant in the study received identical preparatory direction. A copy of this information sheet appears in Appendix B.

With regard to procedure, the concept map process was followed. This concept map method comprises six steps, the structure of which is as follows.

6.2.2.1 Program Preparation

Preparation for the exercise falls into two stages. First, the researcher decides on the topic or concept to be examined: studies such as Johnsen et al. (2000) termed this the 'focal question'. In the second stage, the researcher must determine who will participate in the concept map exercise. These participants, or focus group members, will apply their knowledge to the problem as specified by the researcher.

The size of these groups is generally similar across studies. Johnsen et al. (2000) nominate 10 – 20 participants, and Khalifa and Kwok (1999) used groups of approximately 20 members. Van Boxtel et al. (2000) used 40 participants.

6.2.2.2 *Statement Generation*

In the second stage of the process, the researcher gathers a list of dimensions that reflect or are related to the concept under examination. These dimensions should reflect the focal question (Johnsen et al. 2000). Generally, the researcher gathers these dimensions from a variety of sources. Khalifa and Kwok (1999) used a literature review process.

6.2.2.3 *Structuring of Statements*

In this stage, the researcher sorts the statements, variables or items into conceptually similar groups, perhaps by way of a card sorting method (Trochim 1989). The researcher writes each item on an index card and then gets a series of research participants to sort the cards into as many conceptually similar piles as the participant deems appropriate (Rosenberg and Kim 1975).

Depending on researcher requirements and problem complexity, this stage may also require participants to rank the items in each group. According to Trochim, this allows the researcher to determine the average importance of each item (and, indirectly, each dimension) within the concept. The use of both association and ranking exercises, however, is not mandatory. For instance, Biegel et al. (1997) required respondents to rank but not sort their items. Khalifa and Kwok (1999) required participants to both sort and weight items.

6.2.2.4 Statement Representation

This stage of the process required the researcher to translate the categories developed in the previous stage into a model of the conceptual domain (Trochim 1989). A variety of methods were available for addressing this task (Johnsen et al. 2000), such as statistical cluster analysis (such as Anderberg 1973 and Everitt 1980) or a more qualitative approach (as in Trochim 1993).

The use of cluster analysis or multidimensional scaling allows for a statistical appraisal of the number of clusters in the group. This can be significant, as for *n* statements there may be *n* candidate clusters (Trochim 1993). Second, the approach can result in more "sensible and interpretable solutions than other approaches" (Trochim 1993). Third, for large numbers of items, a cluster or multi-item approach may be more computationally efficient. Within these methods, however, Trochim argued that multidimensional scaling is superior to cluster analysis as the former allows the researcher greater flexibility of interpretation. This is valuable in the early stages of exploratory research when multiple perspectives may be valid (Walsham 1993).

6.2.2.5 Concept Map Interpretation

The final stage of the concept map process requires the researcher to make some sense of the resulting map. This stage may involve input from various groups, however the researcher alone may determine cluster descriptions and implications without these groups (Johnsen et al. 2000). This stage of the process requires the researcher to develop appropriate names for the groups and, if necessary, to group conceptually similar clusters together in the interests of concept refinement.

6.2.3 Control

The principle of control is that the experimenter should have command over all the factors present in an experiment (Anastasi 1982). In social research, however, it is understood that some factors may be out of the researcher's grasp. Accordingly, it is sufficient to exert "a degree of control over the known relevant factors" (Townsend 1953:59). An analysis of the research literature in the area may assist the researcher in dealing with these factors (Townsend 1953), and should be framed in terms of pre-experiment, during-experiment and post-experiment control. The social psychology and interview literature were deemed good sources for direction in this area.

Pre-experiment elements of control were determined in the following ways. First, in the interests of consistent presentation and conditions across participants, a list of potential questions and prepared answers was developed so that each respondent would be given the same information about the study (after Dillman 1978). Additionally, all index cards in the card group had the same appearance and size so that participants would not bias individual cards based on card size alone. Respondents were reminded that this was an independent study being sponsored by an established academic institution (Schneider and Johnson 1995, Bruvold and Comer 1988), and care was taken to avoid leading respondents or otherwise biasing their replies (Klassen and Jacobs 2001).

Anderson (1987) noted that participants may give greater weight to some test dimensions because they appear towards the beginning of the research instrument (or appear first in an experiment). This "order of presentation" effect may mean that participant responses could be biased or inconsistent. Hence, the index cards were thoroughly shuffled before each exercise.

Within experiment elements of control were determined in the following ways. First, the researcher was aware of removing the phenomenon from its natural environment. That is, it was felt that researchers would ordinarily be dealing with size in the context of their own research; requesting participants to articulate their implicit or tacit understanding of the construct may have biased or distorted the results. Hence, the researcher aimed to maintain a stable environment for the duration of the exercise.

Second, Cook and Campbell (1979) observed that, in natural settings where the experimenter has no control over a significant number of environmental variables, the experiment should use systematic randomisation. Because exercises were to be conducted in offices and other busy work areas, it was deemed difficult to control for all environmental variables (such as interruptions or noise). Accordingly, experiments were held on different days at different times in order to attempt to ameliorate these confounding environmental effects.

The researcher was also aware of the potential for participant acquiescence during the exercise: "When subjects do not know the answer to certain items or when the test is otherwise unstructured for them, there is a demonstrable tendency for them to favour certain options which indicate acquiescence such as 'true', 'agree' or 'like' as opposed to negative options such as 'false' or 'disagree'" (Furnham 1986, Holden et al. 2003). In order to at least partially alleviate this acquiescence, the researcher left the room for the duration of the exercise as part of a "method of removal" (Cook and Campbell 1979).

Finally, Meyers and Grossen (1974) observed that, in order to obtain a reliable assessment from an exercise across participants, the task requirements should ideally be invariant. With this in mind, task activities were held constant across exercises in order to control for variance.

Next, the researcher was aware of the possibility of response bias and guessing effects, where participants simply guess an answer instead of giving deeper analytical consideration to the problem. Hence, after the card sorting exercise the participant was asked to give explanations for the categories chosen. This served the dual purpose of forcing the participant to explain their decisions and also allowed the researcher to gain greater insight into the size construct. Also, in order to control for the possibility that the participant had misunderstood or had not properly completed the exercise, they were also asked if they had any further questions or suggestions upon conclusion.

6.2.4 Administration

The experiment was conducted using the procedure discussed above in Section 6.2.2. The pool of participants was taken from a "judgement sample of persons who can offer some ideas and insights into the phenomenon", as advocated by Churchill (1979:67). As in Smith et al. (1996), participants were engaged to perform the exercise over a range of dates and times. Table 6.2 lists these dates, using similar notation to Smith et al. (1996).

Table 6.2 Sample Membership and Dates

Group	N of sample	Sample composition	Date collected
A	9	Academics at ANU School of Business and Information Management	November 2002
B	16	Attendees at the Australasian Conference on Information Systems	December 2002
C	16	Academics at ANU School of Business and Information Management	August 2004

The conduct of each exercise was as follows. At a time convenient for the participant, the researcher met with the participant (in their office for respondents in groups A and C and in a secluded room of an office building for participants in group B). At the start of the exercise, the researcher read the introductory card to the participant. The participant was then shown the cards and asked if they had any further questions before beginning the exercise. Once the exercise had begun, the researcher left the room (in the case of groups A and C) or moved to another part of the room (for group B). Participants were then allowed to complete the exercise in their own time and notified the researcher when they were finished.

At the conclusion of the exercise, the researcher returned to the participant and first wrote down each group of cards by number. Then, the researcher directed the participant to explain their reasons for sorting the cards into their chosen piles. These responses were recorded in short-hand for transcription at a later time. The researcher then thanked the participant participating in the exercise and asked the participant if they had any further questions. If participants did have further questions, they would have been directed to the information sheet or the researcher would have answered the question directly. Five respondents asked about when the results of the study could be made known. No other participants had further questions.

6.2.5 Ethics Approval

Ethical clearance was obtained for this stage of the research as it involved interaction with human participants. The university ethics committee deemed the exercise to be of low risk and only minor changes were required to the initial ethics application. The committee stipulated that each participant was to complete a consent form. This consent form contained brief information as to participation requirements, consent and data retention procedures. A copy of this consent form appears in Appendix C.

6.3 Data Analysis

Once all participants had completed the exercise, the next stage involved analysing the data. The concept map method prescribes a statistical method to use for data analysis, and this section describes these methods. This section first discusses broad participant demographic information as directed by Grover et al. (1994). The section then discusses the method used to create the response matrix to be used in multi-dimensional scaling. This is followed by a discussion of the scaling method and the Euclidean distance model approach. Finally, the section discusses additional model suitability testing in the form of Stress/scree tests.

6.3.1 Participant Demographics

Participant demographic information was derived for the 41 participants. Table 6.3 shows this demographic information.

Table 6.3 Participant Group Demographics

Demographic	Category	Frequency	Percentage
Discipline area	Information Systems	22	53.7
	Accounting	7	17.1
	Auditing	5	12.2
	Business	4	9.8
	Management	2	4.9
	Commercial Law	1	2.4
Gender	Male	25	61.0
	Female	16	39.0
Academic Rank	Associate Lecturer	8	19.5
	Lecturer	15	36.6
	Senior Lecturer	11	26.8
	Associate Professor	5	12.2
	Professor	2	4.9
Highest Academic Qualification	Undergraduate Degree	3	7.3
	Honours Degree	4	9.8
	Masters Degree	13	31.7
	PhD	21	51.2

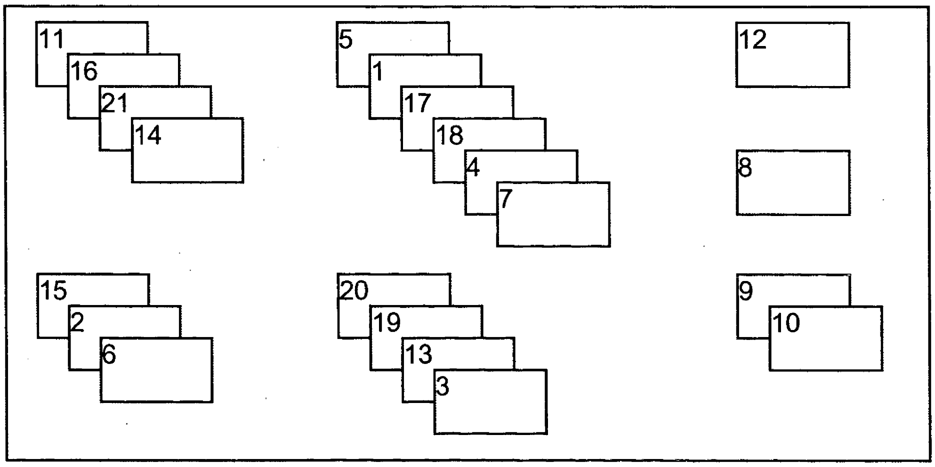
Table 6.3 shows that, consistent with the study's goals, all 41 participants were involved in some type of organisational research, however emphasis was placed on researchers in the information systems discipline (53.7%). Further, academic qualifications were mostly spread between Masters and PhD degrees (31.7% and 51.2% respectively). A small number of participants (7.3%) only had undergraduate degrees.

6.3.2 Statistical Analysis

6.3.2.1 Matrix Development

Matrices were developed by coding each participant's responses as follows. A list of the card groups for each participant was obtained from the data gathering process. For each response set, an individual matrix was developed. This matrix had *n* columns and rows, where *n* was equal to the number of constructs (and, consequently, index cards) in the study. Where cards were grouped into the same category, a number "1" was placed into those cards' columns across the matrix. All other cells contained zeros, to reflect no perceived relationship between construct dimensions for that participant. An example of this coding process follows. One participant grouped cards as appears in Figure 6.2.

Figure 6.2 Example Card Sort Groups



In the case of the first card group, a "1" was inserted into rows 11, 16, 21 and 14 for each of these columns. This also results in a "1" along the matrix diagonal, as each card is deemed to be a member of its own group (Trochim 1989). This process, repeated for each card group, resulted in the matrix which appears in Figure 6.3.

Figure 6.3 Example Individual Similarity Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0
4	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
5	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
6	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	1
12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
13	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0
14	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	1
15	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	1
17	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
18	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
19	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0
20	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0
21	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	1

One matrix was developed for each participant in the group. In total, 41 individual matrices were obtained, which were added together in order to produce a "group similarity matrix" (Trochim 1989). This group similarity matrix reflects the participant group's responses in aggregate, and the diagonal reflects the total number of participants in the study. The largest value that could feature in any cell is equal to the number of participants in the study. This would reflect circumstances where all participants in the study grouped those constructs together. Figure 6.4 shows the resulting group similarity matrix.

Figure 6.4 Group Similarity Matrix

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
1	41	11	8	32	22	8	34	10	10	11	11	11	8	9	7	10	21	22	8	12	11
2	11	41	10	7	10	20	9	29	9	10	18	8	14	26	17	25	11	10	14	15	21
3	8	10	41	7	8	14	9	13	15	13	11	18	21	11	22	11	8	10	30	16	9
4	32	7	7	41	22	13	30	10	9	10	11	16	9	10	10	9	18	20	9	9	13
5	22	10	8	22	41	10	19	11	10	10	17	17	12	9	8	7	36	29	9	14	17
6	8	20	14	13	10	41	9	18	9	10	12	15	10	17	25	15	9	11	10	10	23
7	33	9	9	30	20	9	41	10	11	10	9	15	7	9	9	10	21	20	8	10	9
8	10	29	13	10	11	18	10	41	13	10	14	14	15	21	17	20	9	11	13	11	19
9	10	9	15	9	10	9	11	13	41	36	10	14	14	13	11	13	10	10	14	9	8
10	11	10	13	10	10	10	10	10	36	41	12	15	14	11	12	15	10	11	13	9	8
11	11	18	11	11	17	12	9	14	10	12	41	13	24	16	11	16	16	16	15	17	17
12	11	8	18	16	17	15	15	13	14	15	13	41	12	9	20	10	16	24	12	9	9
13	8	14	21	9	12	10	7	15	14	14	24	12	41	17	13	17	13	11	26	14	12
14	9	26	11	10	9	17	9	22	13	11	16	9	17	41	13	32	11	8	17	17	18
15	7	18	22	10	8	26	9	17	11	12	11	20	13	13	41	12	8	11	17	13	12
16	10	25	11	10	7	15	10	20	13	15	17	10	18	33	12	41	11	7	16	17	15
17	22	11	8	19	36	10	21	9	10	10	16	16	13	11	8	11	41	28	11	17	15
18	23	10	10	21	30	12	20	11	10	11	16	24	11	8	11	7	28	41	8	12	15
19	8	14	29	9	10	10	8	13	14	13	15	12	26	17	17	15	11	8	41	19	11
20	12	16	16	9	15	11	10	11	9	9	18	9	14	18	14	16	18	13	19	41	14
21	11	21	9	13	17	23	9	20	8	8	17	9	12	19	13	16	15	15	11	13	41

6.3.2.2 *Multidimensional Scaling Method*

Multidimensional scaling was selected as the most appropriate method for statistically analysing the construct groupings. The method was deemed suitable for four reasons. First, Trochim (1993) recommended the approach as part of the concept map method of conceptual modelling. Second, the method allows the researcher to analyse groups of constructs in terms of proximity: its "primary purpose is a parsimonious spatial representation of objects" (Dunn-Rankin 1983:190). Third, the method makes few assumptions about the underlying constructs and the data set. For example, whereas Davison used the example of quantitative metric data (such as temperatures or physical distance), the data items may also be non-metric (such as consumer attitudes or product rankings) (Kruskal 1964b). This contrasts with the requirements placed on data by factor analysis and other approaches. Finally, the method has a rich field of prior use in the research literature (Davison 1983), in studies of historical sociology and marriage (Kendall 1971), literature analysis (Wainer and Berg 1972), marketing and consumer preference (Cooper 1973).

This method uses theory developed by Kruskal and Wish (1978), Kruskal (1964a, 1964b) and Dunn-Rankin (1983) and proceeds in five steps as follows. The first two steps have already been discussed above. First, the researcher gathers a set of *n* items (factors, statements, concepts, or constructs) for analysis. Second, the researcher develops "some measure or function of proximity" (Dunn-Rankin 1983:190) for each pair of items. This is analogous to Davison's "quantitative observation profile of dissimilarity". In other words, the researcher requires a measure of the similarity or distance between each two items, possibly by way of a correlation matrix. It is understood that if two items are conceptually similar, then they will have a smaller distance between them than two items that are conceptually different. If items *e* and *f* are similar (s), and items *g* and *h* are different (d), then in Dunn-Rankin's terms:

$$d_{ef} < d_{gh}$$

$$\text{and } s_{ef} > s_{gh}$$

Analysis to this point gives an indication of conceptual similarity between collections of paired items. While such an analysis is useful for small groups of items, it is impractical for larger item groups. Additionally, it would be useful if we could gauge conceptual similarity across the entire group of constructs and not just two points at a time.

The third stage requires the researcher to select the number of dimensions in which the data will be represented. Terms vary, however this thesis will use *k* dimensions, following Davison's (1983) notation. The selection of dimensions is usually determined by the researcher's best guess. Davison recommends using an *a priori* theoretical approach to determine *k*, but then advocates also exploring $k\pm3$ dimensions. Some authors also advise researchers to carefully evaluate the fit of the dimensional breakdown. Kruskal and Wish (1978) argued that a Stress test (or 'scree' test using Lee's 2001 nomenclature) should be used to determine goodness-of-fit. Once the number of dimensions has been determined, the items are placed randomly into the dimensional space.

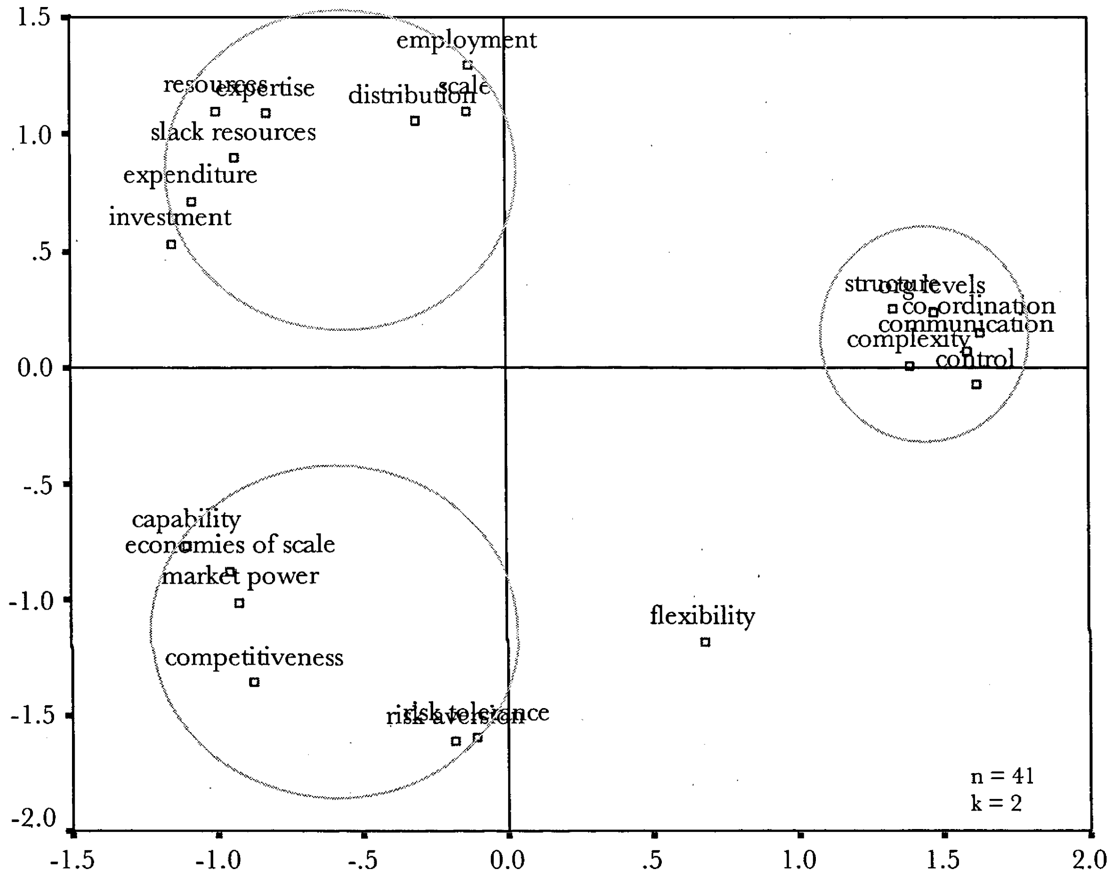
The fourth step in the process is to move the items into the dimensional space such that the distance between pairs of objects in the plot are related to their measure of proximity. Kruskal (1964a) proposed a method of stepwise refinement whereby items are moved inside the dimensional space until the principle of monotonicity is compromised. Dunn-Rankin (1983) discussed this process in terms of squared deviations, where distance measures between items are taken before and after they are moved. Deviations are taken between these two measurements for each item and then squared. In an ideal scale model, the sum of squared deviations will be minimized.

The final step is to interpret the resultant scale diagram. The literature appears to argue that this interpretation is largely a matter of researcher discernment. This step should be conducted with reference to the research literature or analytical argument.

6.3.2.3 Euclidean Distance Model

Figure 6.5 shows the results of multidimensional analysis scaling.

Figure 6.5 Two Dimensional Euclidean Distance Model



The model in Figure 6.5 shows a number of interesting points. First, the most striking outcome of the multidimensional scaling analysis is that the dimensions appear to cluster into three distinct groups. The first group, including *expenditure*, *investment* and *employment*, could be described as 'descriptive dimensions'. This group appears to contain construct dimensions which are directly observable based on physical characteristics (or organisational structure). For this group alone, indicators such as *Number of Employees* and *Total Assets* may be appropriate. The second group, including *need for control* and *need for communication*, could be described as "behavioural dimensions". This group may reflect the managerial or behavioural requirements necessary to maintain the first cluster: for instance, a larger pool of resources may require increased co-ordination and control. The third group, containing *capability* and *competitiveness*, could be described as "resultant dimensions". This group could reflect those construct dimensions that result from the combination of the first two groups. However, the flexibility construct does not appear to cluster as closely with the third main grouping.

Interestingly, these groupings were reflected in the comments of some exercise participants. The individual dimension groupings for these participants, however, did not necessarily reflect those that appear in Figure 6.5. For instance, one participant created a group that was said to reflect "behavioural factors or factors that drive behaviour". All of the dimensions placed into this group, however, only appear in the third cluster shown in Figure 6.5. This participant also described two other clusters, the first comprising "the presence (as opposed to the potential) of the organisation" and the second describing "issues involved in managing structural complexity and ability". Another participant also created two groups which reflected "consequences for the firm of being large" and "consequences for the market of being large". These groups included *capability*, *competitiveness* and *market power*.

Second, a number of dimensions are situated in close proximity and are thus closely associated. Participants saw *risk aversion* and *risk tolerance* as closely related concepts. A number of participants placed these two dimensions in a group on their own, describing them as an organisation's "risk preference set" or "risk/return profile". Similarly, *structure* and *organisational levels* were also closely situated. One participant described these two dimensions as being heavily dependent on human resources. Without human interaction, these two dimensions may not be so closely related. Interestingly, another participant argued that these constructs, along with *complexity*, *expertise*, *need for co-ordination* and *need for communication* reflected the internal requirements of the firm, without external intervention. Finally, *expertise* and *scale* were also closely aligned. One participant discussed these in terms of "outright implications of size" and that in certain circumstances these could be proxied for by purely structural indicators. The other participant described these dimensions as "aspects of being large".

6.3.3 Sensitivity Testing

As noted above, the number of appropriate analytical dimensions to use when conducting multidimensional scaling is a matter of some conjecture. This is an important problem, as the researcher must find a balance between raising the number of dimensions in order to capture conceptual complexity and reducing the number of dimensions in order to support conceptual simplicity.

The literature proposes two methods for determining the appropriate number of dimensions to use in scaling analysis, in the interests of delivering an easy to explain model. The study first used Kruskal and Wish's (1978) method of qualitatively inspecting the number of dimensions for face validity. The second method, Cattell's (1966) scree/Stress test, affords some quantitative assessment of the number of dimensions to use. The scree test constitutes the sum of squared differences of observed and reproduced distances. Explicitly:

$$\text{Phi} = \Sigma[\text{def} - f(\delta_{ef})]^2$$

The lower the value of squared differences (Phi), the lower the Stress value and the better the model to data fit. The Stress value is calculated and plotted for each number of dimensions. The researcher may assess the suitability of each dimensional model based on the magnitude of the corresponding Stress value. The scree test alone does not provide a complete indication of the number of dimensions to use: it should be noted that, for *n* items, a perfect Stress value can be obtained by modelling the items along *n* dimensions.

Table 6.4 Stress and R^2 Values for Dimensions

Dimensions	Stress	R^2
1	0.25386	0.82086
2	0.12364	0.92876
3	0.05705	0.97804
4	0.02915	0.99305
5	0.02439	0.99456

Table 6.4 shows the results of scree testing the scaling model for each of five dimensions. The low Stress levels suggest that most of the variance in the model has been accounted for: the declining Stress values suggest that the model accounts for less variance as dimensions are added. The study selected two dimensions for representing the size construct for three reasons. First, while there is a marked increase in R^2 model suitability between one and two dimensions (R^2=0.82086 and R^2=0.92876 respectively), the difference between two and three or more dimensions is somewhat lower (R^2=0.92876 and R^2=0.97804 respectively). This is also reflected in the values for the scree/Stress test (Cattell 1966). While three dimensions could still be used in these circumstances, it was felt that the additional interpretability did not warrant the increased model complexity. *A priori* theoretical requirements and ease of

interpretation, in this case, favoured model parsimony (consistent with Kruskal and Wish 1978 and Schiffman et al. 1981).

6.4 Validity Analysis

Despite following an established research method and given the experienced direction from the research literature, the study may be open to some degree of research bias. This bias may act in a variety of ways to obscure or distort the study's findings. Giddens (1987:19) observed, "in the social sciences, there is no way of keeping the concepts, theories and findings of the researcher free from appropriation by lay actors". However, the discussion of such effects may assist readers and future researchers in more accurately assessing the results presented here.

Discussion presented in Chapter 2 contextualised the size construct in terms of validity and reliability. It was held that validity and reliability are core aspects of scientific research and that research should be undertaken with this in mind. Accordingly, this study has developed the size construct using Churchill's measure development paradigm on the grounds that the approach takes validity and reliability into account. Cook and Campbell (1979) presented a framework for analysing research bias in terms of "threats to validity". This framework is deemed to be a good basis for exploring this empirical stage of the study. The discussion presented here comprises those threats to validity which are relevant to this study only. The list is hence not exhaustive.

6.4.1 Threats to Statistical Conclusion Validity

The first threat to statistical conclusion validity is low statistical power, whereby statistical relationships lack strength of inference. This study used scree testing to verify the number of dimensions to use in modelling the construct. A map of two dimensions was deemed to be an adequate explainer of the model, with three dimensions adding little explanatory power. An R^2 of 0.92876 was also seen as an indicator of good statistical power.

The next two threats to validity were dealt with in a similar fashion. These involve the reliability of measures and the reliability of the treatment approach. If these vary within individual exercises or over the entire exercise program, it is difficult to make binding inference from the study. Accordingly, the researcher wrote all instructions down before the exercise. Each participant received the same index cards so as to maintain presentation invariance. These cards and instructions were used for the entirety of the empirical study.

The next two threats to statistical power concern the effects of random occurrences during the exercise. The first concerns irrelevancies during the experimental setting. In order to alleviate this problem, the researcher monitored the environment immediately prior to and during the exercise in order to note any substantial variation in conditions. The second concerns the random heterogeneity of participants, whereby different people have different perceptions of the exercise and treatment. Variance between participants was at least partially controlled for by restricting the participant groups to research academics. In addition, the elapsed time between the first and final stages of Study 2 may have been subject to bias in this regard. As observed by Cook and Campbell (1979), these experimental issues may reduce random response variance, but could also restrict result generalisability.

6.4.2 Threats to Internal Validity

The first threat to internal validity is that of maturation, whereby respondents become more adept at completing the exercise as experiment progresses. Cook and Campbell (1979) discussed this threat with respect to pre- and post-test conditions, however the threat may also apply to single instance test conditions. The effect of this is unknown, however, respondents were asked at the conclusion of the exercise whether they were happy with their card groupings.

The second threat to internal validity is that of participant selection, whereby exercise participant groups may possess internal differences. In this study there may have been differences between disciplinary groups (such as information systems and accounting), even though these disciplines are frequently grouped in the same school or faculty (Klein et al. 1992). The possibility of differences in organisational perspective cannot be discounted.

The third threat involves the diffusion of treatments, whereby participants can communicate with each other and thus reveal exercise requirements. This could occur because exercises were conducted individually and at different times. It would be unfeasible to restrict the movements and discussion of participants, as observed by Cook and Campbell (1979). The magnitude and effect of this threat are hence unknown.

6.4.3 Threats to Construct Validity

The first threat to construct validity concerns the effect of inadequate pre-operational explanation of the construct. Cook and Campbell (1979) argued that items should be clearly described to participants so that they understand what the item means. Part of the study required respondent reactions to and interpretation of the items with respect to the construct. Hence, participants were given broad guidance about individual items, consisting of a line of text similar to passages in the research literature, on each index card (shown in Figure 6.1). It was felt that this type of explanation would be most clear and familiar to the participant.

The second threat concerns the selection of only a single operationalisation of the test items. Here, the results of the exercise may depend on the way in which the exercise was operationalised or presented. Cook and Campbell (1979) advocated substantially varying treatment conditions at the expense of statistical construct validity. In order to alleviate this threat, the index cards were shuffled before each exercise began. Additionally, the exercise was conducted at different times of the day in order to vary test conditions.

The third threat involves the possibility of outcome guessing. Here, participants give different responses based on their own guesswork. This threat may be substantial and it is discussed in greater detail using Nunnally's response bias discussion. These response biases were developed for the analysis of psychological "tests", however they are considered relevant here.

The effect of "guessing" concerns the degree to which respondents will guess or invent a response. They may do this for two reasons. First, they may guess because they are in doubt and do not know the correct answer (or, at least, believe that there is a correct answer which they do not have). Second, respondents may guess in order to be in agreement with either another respondent or the test administrator". Nunnally (1978:667) observed that, in situations where opinions are required, it is possible that "people will agree with the opinions and decisions of other people rather than curry their disfavour".

While the researcher may take steps to preserve order in the study, the effect of researcher and respondent error cannot be discounted. Nunnally described this as the effect of "carelessness", whereby results are biased due to mistakes in the experiment. The magnitude of this error is believed to be small, as each experiment was run according to an information sheet which clearly specified what was required. Also, each participant was asked to discuss the placement of their cards following the experiment. Had the participant made a mistake, they might observe and seek to correct it during this stage.

The effect of "demand characteristics" concerns the degree to which a researcher calls for unnatural behaviour on the part of respondents. That is, the observation of participants for the purposes of experimental testing in contrived circumstances may deliver exaggerated results. The card-sorting activity could not easily be classed as "natural behaviour", however the analytical process required of each respondent during the experiment was not deemed to be too unfamiliar. Further, each experiment used a generally natural setting (such as an office room). In the case of experiments run during the ACIS conference, an empty, quiet room was found for this purpose. However, the potential degree and effect of requirements for unnatural behaviour cannot be discounted.

The effect of "random or extreme responses" concerns the degree to which participants deliver responses without due consideration. In some ways, this is related to the guessing effect noted earlier. On the advice of Patzer (1996), the researcher went through the test results with respondents to ascertain the reasons for those responses and hence make sure that responses were not made on a random basis.

The fifth threat to construct validity concerns the effect of evaluation apprehension, whereby participants resist being tested on competence or knowledge. Participants were informed in the protocol that there were no correct or incorrect answers to the exercise, and that they should give responses that they believed to be correct. Further, participants were told that their responses would not be shared with other participants. Finally, care was taken to refer to the treatment as an "exercise" or "game" as opposed to a "test" or "experiment".

The sixth threat concerns the effect of experimenter applications, whereby the researcher inadvertently biases participant responses by leading participants towards a solution that the researcher is expecting or wishes to occur (Straub 1989). In order to alleviate this threat, the researcher left the room for the duration of the exercise. Further, participants were asked to explain their choices at the conclusion of the exercise. It was noted that participants could possibly change their grouping decisions as they explained card groups after the exercise. However, this only occurred twice and the change in both cases was minor, consisting of moving a solitary card into another grouping.

The seventh threat to the study is the effect of construct level relevance, whereby participants have differing interpretations of the construct as their level of perspective changes. Participants may see concepts in a different light depending on their individual point of view, yielding mixed or conflicting results. In order to partially alleviate possible confusion, participants were informed before the exercise that the study was exploring commercial organisations and that this should be their focus. However, because this study aimed to determine participant views of the construct, the varying participant understanding of the construct lent richness to the study. The effect of this threat may be significant as a result, and the researcher cannot guarantee that the results obtained do not merely constitute a haphazard collection of participant perspectives at different levels of relevance.

The final threat to this study concerns the interaction of testing and treatment conditions. Here, the activity of undertaking the exercise itself may influence the outcome of the treatment. For the contrived conditions of the test, participants may feel compelled to deliver a different response to those given in their own research. Participants were informed that that there was no correct or incorrect solution to the exercise and that the researcher was simply interested in the participant's own interpretation of the concept. It was hoped that this would compel the participant to give a more natural response, however the actual effect of this threat is unknown.

6.4.4 Threats to External Validity

The first threat to external validity concerns the possible interaction between participant selection and treatment. Here, test participants may possess differing characteristics to those who did not participate in the study. Further, the results of the study may only be applicable to those who participated in the exercise. The researcher cannot guarantee that the exercise participants used in this study were not unique. Participants from different geographical locations with different academic positions and qualifications were selected to participate in the exercise and this may have ameliorated the risk of this threat.

The second threat to external validity involves the potential interaction between the experiment's setting and the experiment's treatment. This threat means that the exercise's results may be influenced by the environment in which the exercise was conducted. The results may also only be relevant to this study's particular setting. As noted earlier, exercises were conducted over a range of locations and times in order to alleviate potential environmental threats, however these adverse effects remain a confounding possibility.

The final threat to the external validity of this study is the interaction of history and treatment. Here, the results of the study may only be relevant to the particular time period during which the study was undertaken. The study was carried out over a range of dates, and this may have alleviated intervening effects which changed participant perspective of the construct.

Nunnally (1978) also warned potential response biases which, while developed for the analysis of psychological "tests", are relevant here. First, Nunnally warned of the potential for guessing when in doubt or for agreement (similar to acquiescence). This is where the participant does not wish to appear unknowledgeable or uninformed and guesses an answer instead of thinking through the problem.

6.5 Discussion and Conclusions

This section of the thesis involved refining and editing the size construct's components and determining the relationship between the dimensions of size. This second study into size involved a deeper exploration into the meaning of size. A card sort exercise was deemed an appropriate way of exploring this meaning. The psychology literature was particular with regard to the process of these exercises. Given the wealth of experience exhibited in that literature, it was deemed prudent to follow the advice of these authors. This stage of the research has made a number of findings.

This chapter provides further evidence for the contention that organisational size is a second-order or multidimensional construct. The results presented herein support three main groups underpinning the organisational size construct, which were tentatively described as descriptive aspects, behavioural aspects and resultant aspects. The measurement of structural aspects alone may not explain organisational size and other aspects of the organisation may also require analysis.

CHAPTER 7

STUDY 3: SURVEY FRAMEWORK

Whereas most studies found in the literature search conducted in Chapter 5 used a single indicator to proxy for size, the analysis presented in Chapter 6 contends that the construct might have three main dimensions, suggesting a multi-item or second-order construct.

This is the third study into the problem of organisational size, approximating to Stage 2 of Churchill's measure development paradigm. As discussed in Chapter 4, information systems research provides a selection of methods for undertaking empirical analysis and data collection. Of these, the survey was deemed most suitable to this stage of the study. This chapter discusses the development and administration of the survey instrument.

This chapter proceeds as follows. The next section presents the rationale for the study. Then, research method is discussed. First, the unit of analysis is discussed, including population parameters and sample selection. The instruments and materials are detailed, including the indicators used for each of the constructs extracted from the literature in Chapter 5 and organised in Chapter 6. Validity and usability are discussed, followed by administration and, finally, ethical approval.

7.1 Rationale

Evidence in the previous chapter showed three principal groups underpinning researcher understanding of the organisational size construct. Larger firms, for instance, may have greater economies of scale, more resources and greater complexity. Earlier work in Chapter 5 also showed that there are many methods for measuring organisational size. *Number of Employees* was the most common indicator, however indicators such as *Total Assets*, *Gross Revenue* and *Annual Profit* also receive considerable use in the literature. However, there was little evidence to suggest that these indicators are actually well related to the dimensions underpinning the organisational size construct. Further, there is little agreement as to which measurement methods might be the most telling indicators of size.

This chapter describes the framework for the third of three studies into the meaning and measurement of the organisational size construct. The goals of this study are to improve understanding of the size construct and to see how it might be measured. The focus of this study was to develop indicators for each of the constructs identified in Study 1 and refined in Study 2, to operationalise these in an instrument and to administer this instrument to a sample. The study corresponds to stage 2 of Churchill's measure development paradigm.

7.2 Method

Of the available research methods in information systems discussed in Chapter 4, the questionnaire survey was selected for use in this study. The rest of this chapter discusses the conduct of this survey. As with Study 2 of this thesis, this study followed a prescriptive scientific method based on the advice of Perry (1998). The following sections discuss the study's unit of analysis, the instruments and materials, control, administration and ethical considerations.

7.2.1 Unit of Analysis

The unit of analysis in Study 3 was a group of Australian businesses. This subsection describes the population of these businesses from which the survey sample is drawn. Consistent with the definition of organisation size used in Chapter 5, the organisations within the population had to be of a business nature. This included companies, partnerships and sole traders. Government agencies and departments were excluded from the population for two reasons. First, Bretschneider and Wittmer (1993) and Yetton (1994) showed that governmental organisations exhibit differences in structure, operation and use of information systems that make them significantly different to commercial businesses. Second, in Australia, government policy mandates the use of some technology, such as the World Wide Web, by government bodies and departments.

The type of firm and industry also posed an important problem in this stage of the method. Kimberly (1976) proposed two approaches to the analysis of size in this regard. The first, intra-typical analysis, holds the organisation's type and industry constant and allows the researcher to examine the variability of size within that frame. This approach has been used by researchers such as Blau (1970, 1972) and Blau and Schoenherr (1971). The second approach is inter-typical analysis, where the organisational type and industry are allowed to vary across sample members. This approach was used by Hall et al. (1967), Pugh et al. (1963, 1968) among others.

Inter-typical analysis has a number of advantages over intra-typical analysis. First, the method relaxes assumptions about the type of organisation under analysis. Firms which have changed or expanded their business focus over the survey period need not be excluded from the sample. Second, by examining a group of organisations, the researcher can test the suitability of different methods for measuring organisational aspects such as size.

The application of inter-typical analysis, however, is not without the possibility of error. There is no guarantee that size will have the same effect across all organisations in the sample. Similarly, it may be difficult to quantify the effect of size in these circumstances. Despite these shortcomings, it was decided that a range of organisational types would be included in the survey.

The population was hence deemed to be all commercial, non-government firms in Australia. However, a survey of the entire population would have been prohibitively costly. In such circumstances, it is common to select a representative sample of that population for testing (Adams and Schvaneveldt 1991). This enables the researcher to obtain an understanding of the population based on inference from data in the sample (Newbold 1993).

The selection of sample businesses was conducted using random selection from the Telstra Yellow Pages business telephone directory. A copy of the directory was obtained for each of NSW, Victoria, Queensland, South Australia, Western Australia and the ACT. Businesses were selected using the following method. A set of random numbers between 0 and 1 was generated using Microsoft Excel's "RAN" function. This figure was then multiplied by the number of pages in the telephone directory (for example, 1547 in the case of the ACT Yellow Pages). This procedure effectively produced a random page number in the directory. The ninth business listing on each page was selected as a candidate for the sample. Graphical display advertisements were ignored in case they biased the sample towards particular business types (for example, older businesses may be able to afford larger advertisements). If the business had already been selected in either the current sample or that of another state, the next business was selected (this occurred three times for the ACT and Victorian Yellow Pages, and four times for the New South Wales Yellow Pages). If a page fell between those pages not containing business addresses or telephone numbers (0 and 93 in the case of the ACT Yellow Pages), another random page number was selected instead. A selection of 1,000 businesses was made. For each business, the postal address was selected in preference to the street address wherever possible. Table 7.1 shows the breakdown of sample members by state.

Table 7.1 Breakdown of States for Sample Members

State	Sample Size
Australian Capital Territory (ACT)	262
New South Wales (NSW)	313
Victoria (VIC)	214
Queensland (QLD)	112
South Australia (SA)	50
Western Australia (WA)	48
Tasmania (TAS)	1
Total	1,000

The selection of businesses from the Telstra Yellow Pages was subject to two important limitations. First, the listing of businesses in the directory is restricted to those businesses that had paid for advertising space in the directory and existed when the directory was created. The second issue concerns the degree to which the Telstra

Yellow Pages directory is a substitute advertising technique for "smaller" businesses with fewer financial resources. These businesses may have to choose between either an advertisement in the Telstra Yellow Pages or another medium such as the World Wide Web. It was felt that the representativeness of this source was high despite these weaknesses.

7.2.2 Instrument and Materials

The construction of the survey instrument played an important role in the general research approach. Straub (1989) and Grover et al. (1993) argued that poorly constructed surveys can compromise otherwise sound research. In particular, issues concerning number and type of questions, appearance, overall length and pilot testing are of importance.

Following advice from Berenson and Levine (1993) and Miller (1983), the design and construction of the survey instrument followed the following format. In Section 1, the survey solicited general demographics from respondents, including some important questions regarding the nature and organisation of the business. Section 2 contained questions about general IT adoption and use. Section 3 contained questions regarding operationalised versions of each of the constructs identified in Chapter 5. Development of these question items is discussed in the next section. Section 4 solicited financial demographics from respondents. Section 5 contained space for respondents to add any additional comments that they felt were relevant. Sections were arranged so that respondents had to read as few questions as possible, and more sensitive questions involving financial indicators were placed towards the end of the instrument.

Indicators were found in the literature for each of the 21 constructs that were identified in Chapter 5 and shown in Table 7.2 below. These indicators were then developed into question items that reflected the organisation's operational and structural characteristics.

Table 7.2 List of Size Dimensions

Need for Co-ordination	Slack Resources	Capability
Resources	Risk Aversion	Investment
Competitiveness	Risk Tolerance	Structure
Need for Communication	Scale	Complexity
Organisational Levels	Flexibility	Market Power
Expertise	Economies of Scale	Distribution
Need for Control	Expenditure	Employment

Where possible, questions were adapted from existing instruments in the literature that had already undergone testing. Where no such questions were available, new questions were constructed and pre-tested. The discussion below shows how each construct was explored in greater detail with the aim of finding indicators for each in the literature.

7.2.2.1 *Need for Co-ordination*

There appeared to be few published instruments examining this concept. However, there was evidence that the firm's industry may affect the type of co-ordination required. Co-ordination in manufacturing firms is likely to be "handled centrally by middle-managers and corporate staff" (Segelod 2002:67). However, in professional and service firms, the same will be "handled both centrally by executive teams, and decentralised through both formal (Intranet, cross-unit groups) and informal (personal networks) means of knowledge transfer" (Segelod 2002:67).

In order to minimise instrument length, and given the lack of other suitable indicators, this study used an indicator adapted from Bisantz et al. (2003), which asked respondents to rate the amount of resource or personnel co-ordination required within their organisation on a Likert scale.

7.2.2.2 Organisational Resources

This construct was by far the most common in the discussion of organisational size. Ein-Dor and Segev (1978) posited significant interactions between organisational size and organisational resources. Howorth and Westhead (2003) observed size as "a surrogate measure of resource availability", as did Westhead et al. (2002) and Young et al. (2000). However, some authors treated size as a proxy for resources, such as Kowtha and Choon (2001) and Winklhofer and Diamantopoulos (2002).

The construct is subject to disagreement in the literature. Resource-based views of firms are relatively new in the information systems literature (Wade and Gravill 2003), limited in part by the lack of good resource measures (Priem and Butler 2001) and the effect of intangible resources (Godfrey and Hill 1995). Some authors even observe resources as measures of other constructs in this study's model of size, such as organisational complexity (Whitmire 1992) and flexibility (Dreyer and Grønhaug 2004). Further, Young et al. (2000) argued that reliable and comprehensive firm-market level resource data are simply not available. The disagreement surrounding the *meaning* of resources as a construct may be due to differing disciplinary perspectives (Barney et al. 2001).

Given this, there is also debate about an appropriate way to measure resources. Henderson and Cockburn (1994) used both qualitative and quantitative measures. Evidence from Barney and Zajac (1994) suggested that the measurement of resources may be idiosyncratic to the firm: "the literature contains many generalizations about the merits of some resources, conjectures that often fail to consider the contexts within which these resources might be of value to an organization" (p. 539). Laitinen (2002) argued that "the traditional income statement" is one effective way to measure resource allocation. In this vein, Jayaratne and Wolken (1999) measured resources using *Total Assets*, and Markman and Baron (2003) used a similar approach when measuring human resources in the firm. This study will use *Total Assets* as a proxy for resources.

7.2.2.3 Competitiveness

Ivancevich et al. (1997) defined this construct as "the degree to which a firm can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its employees and owners".

The measurement of this construct is complex. Oktemgil et al. (2000), Laitinen (2002) and Casper and Matraves (2003) related the construct directly to 'market share'. Bhatnagar and Sohal (2005) also incorporated plant flexibility into their measure of competitiveness.

Shen et al. (2003) used a comprehensive measure, incorporating 27 items including 'equipment depreciation rate', 'bank credibility grade' and 'number of technical patent transfers'. However, as with the market power construct below, indicators for competitiveness either require intimate knowledge of internal organisational cost structures or an accurate understanding of industry-wide production levels. This information may be difficult to acquire, especially for firms which are highly competitive or are in niche industry sectors.

7.2.2.4 *Need for Communication*

As with the 'need for co-ordination' construct, an indicator for this construct was adapted from Bisantz et al. (2003). It required respondents to indicate the level of communication/information transfer that they felt was required within their organisation using a Likert-scale response. This was similar to an indicator used by Nahm et al. (2002).

7.2.2.5 *Organisational Levels*

Many studies related organisational size to the number of management and staffing levels in the firm. Typically, such studies argued that organisations with more levels of management were "larger", while those with fewer levels were "smaller". Kivijarvi and Saarinen (1995) argued, "Because of the many organisational levels, large organisations have an extensive need for communication and information exchange". In some ways, the importance of levels within an organisation echoes the arguments of earlier authors such as Caplow (1957) and Hall et al. (1967), that "large organisations are, by definition, more complex…than small organisations".

Swanson's (2003) straightforward way of measuring this construct is to simply count the number of levels in the organisation between the very bottom (the shop floor) to very top (top management). Colombo and Delmastro (1999) used a similar approach.

7.2.2.6 *Expertise*

Many studies focus on the expertise and experience of the individual, rather than that of the organisation. Evidence from the behavioural psychology literature suggests there are many dimensions to this construct (van der Heijden 2000), and these can take entire instruments to measure (see Masunaga and Horn 2000).

Expertise is not dichotomous and can apply between or within domains (Schunn and Anderson 1999). Further, an element of social desirability bias may exist, such that respondents wish to make themselves appear more experienced or innovative (Jones 2003)

Measurement of this construct is also difficult. Self-reported measures are common (Wagner et al. 2003), especially in research involving consumer product appreciation (e.g. Johnson and Russo 1984 and Gourville and Moon 2004). Further, there is evidence of convergence between self-reported and objective measures of expertise (Mitchell and Dacin 1996). Shanteau et al. (2002) used certification and professional group membership as a signal of expertise. However, the authors acknowledge that one problem with this is that people may move up the certification ladder, but rarely do they move down.

Marchant (1990) and Hoffman et al. (2003) used self-reported "years of experience". While there is not necessarily a relationship between years of experience and ability or accuracy (Goldberg 1968), this indicator was deemed appropriate for use.

7.2.2.7 Need for Control

As with the 'need for co-ordination' construct, an indicator was adapted from Bisantz et al. (2003). It required respondents to indicate the degree of resource control/management required within their organisation using a Likert scale response.

7.2.2.8 Slack Resources

This construct also appears to be in debate. Bourgeous (1981) defined it as "that cushion of actual or potential resources which allows an organisation to adapt successfully to internal pressures for adjustment or to external pressures for change in policy, as well as to initiate changes in strategy with respect to external environment". While authors such as Joo and Kim (2004) offered firm definitions ("the degree to which a pool of resources is perceived to be in excess"), the deeper implications of this construct are more complicated. Conflicting empirical results abound (Greenley and Okemgil 1998), the construct having both a positive (Cyert and March 1963) and negative (Jensen 1986) relationship to performance.

Daniel et al. (2004) observed much disagreement and measurement inconsistency in the literature. Their literature meta-analysis observed one definition of "slack" as "firm resources" (Cyert and March, 1963) and another as "inefficiency" (Jensen 1986). The former, the authors postulated, could have a positive effect on firm size, while the latter could have a negative effect. Tan (2003) offered corroborating evidence, finding that various forms of slack do indeed have different relationships with organisational outcomes.

Given the debate surrounding this construct, this paper will use two indicators. The first indicator was used by Burns and Wholey (1993), being total revenue minus total expenses for the firm. This is similar to that offered by Cyert and March (1963): "the difference between total resources and total necessary payments" (p. 42). The second was Joo and Kim's (2004) four-item Likert-scale question, which originally read as follows:

Our firm has sufficient financial resource slack for adoption and operation of e-Marketplaces
Our firm has sufficient human resource slack for adoption and operation of e-Marketplaces
Our firm has sufficient technical supporting capability for adoption and operation of e-Marketplaces
Overall, our firm has sufficient resource slack for adoption and operation of e-Marketplaces

This indicator was based on work from Iacovou et al. (1995) and Damanpour (1991), and this suggests a sound basis for use in this thesis. The item was modified to remove mention of "e-Marketplaces" and "adoption".

7.2.2.9 *Risk Aversion*

The risk aversion construct has received some attention in the financial management literature. Cramer et al. (2002) argued that the construct is difficult to measure. LeBaron et al. (1989) used a list of 72 items describing risky behaviour, with the respondent choosing the 20 items that they feel are most relevant to their decision making.

Schooley and Worden (1996) explored LeBaron's approach, deeming it to be somewhat lengthy. They instead offer a subjective question which aims to capture the respondent's attitude towards risk:

"Which of the following statements comes closest to the amount of financial risk that you (and your husband/wife) are willing to take when you save or make investments?
1. Take substantial financial risks expecting to earn substantial returns
2. Take above average financial risks expecting to earn above average returns
3. Take average financial risks expecting to earn average returns
4. Not willing to take any financial risks."

A variety of other studies have used this set of questions before, in both academic research (e.g. Yao and Hanna 2003) and practitioner environments (Kennickell 1997 and Weisbenner 1999). The indicator was deemed suitable in these circumstances.

7.2.2.10 *Risk Tolerance*

The literature observes that there are few direct measures of risk tolerance available (Hariharan et al. 2000) and most appear to be related to individual behaviour rather than organisational behaviour. Hariharan et al. (2000), for example, used a measure which requires the respondent to imagine that they were "the only income earner in a family with a good job guaranteed to provide their current family income" and then gauged respondent reaction to different hypothetical levels of income risk. Evidence from Schooley and Worden (1996) also suggested that many authors appear to confuse risk tolerance with risk aversion.

Gutter et al. (1999) used "an object measure of risk tolerance - whether or not the [business] owns risky assets". However, the nature of a "risky asset" may be difficult to measure. Waggle and Englis (2000) used a self-reported measure of individual risk tolerance, gauging the level of respondent agreement to two questions:

"It is wise to put some portion of savings in uninsured investments to get a high yield"
"I am willing to take substantial risks to realize substantial financial gains from investments."

Once modified to reflect businesses instead of individuals, this was deemed a suitable indicator to use in this study.

7.2.2.11 Scale

Reviewing the literature on "scale", it can be seen that a substantial number of studies treated organisational size and scale as the same thing (such as Burns and Wholey 1993), while others treated them as different concepts (such as Davis and Haltiwanger 1992). Several authors used the same indicators for scale that other authors use for organisational size. For instance, Bloom and Perry (2001) used *Annual Sales*. Burns and Wholey (1993) used *Total Revenues* and *Total Expenses*. Wareham and Gerrits (1999) used *Number of Employees*. If organisational scale is a multidimensional construct, as with size, then a univariate indicator may be unsuitable as it may not accurately reflect all of the underlying dimensions.

Hwang et al. (2004) instead used a method which calculates the relative scale of organisations in their sample. These authors calculate each organisation's number of employees and capital expenditure levels as Z scores. This method was used in order to give an understanding of relative scale in the respondent group. The authors then combine the averages of these two scores to be scale. This was deemed an acceptable approach to measuring scale.

7.2.2.12 Flexibility

Volberda (1996) observed that most studies of flexibility define it in terms of "ability". For instance, Gupta and Goyal (1989) defined it as "the ability of a...system to cope with changing circumstances or instability caused by the environment". Upton (1994) defined it as "the ability to change or react with little penalty in time, effort, cost or performance". Volberda (1996) defined it as the "degree to which an organisation has a variety of managerial capabilities and the speed at which they can be activated, to increase the control capacity of management and improve the controllability of the organisation".

However, Pagell and Krause (2004) argued that this construct is multi-dimensional, with application at different conceptual levels (Beach et al. 2000). Evans (1991) went so far as to argue that the construct is polymorphous, possessing different forms in different circumstances. Tienari and Tainio (1999) argued that it is "inherently paradoxical", at once requiring both control and autonomy. To this end, Slack (1987) observed, "the very word...is used by different managers to mean different things". Fitzgerald et al. (1991) described three types of flexibility, Gerwin (1993) cites at least seven types of flexibility, while Browne et al. (1984) discussed eight.

Golden and Powell's (2000) literature meta-analysis of the construct clearly showed the wide variety in terms of researcher understanding of this construct.

Due to the literature debate surrounding this construct, this study will use two indicators of flexibility. The first is from Lending and Chervany (2002) whose study explored the perceived flexibility of CASE tools and its effect on employee morale and effectiveness. The four item Likert-scale question reads as follows:

This CASE tool restricts my choice of ways to develop a system.
The procedures that I use in systems development are mandated by the CASE tool.
This CASE tool gives me freedom in choosing my techniques for developing a system.
The choice of approaches I use in systems development is determined by me not by the CASE tool.
This CASE tool encourages a single way to develop a system but allows me to choose other ways.

After replacing "CASE tool" with "business" in each statement, the question was deemed appropriate for use. The second indicator comes from Nahm et al. (2003), who operationalised formalisation in terms of flexibility using a series of Likert scale questions:

We have written rules and procedures that show how workers can make suggestions for changes.
We have written rules and procedures that describe how workers can make changes on their job.
We have written rules and procedures that show how workers can experiment with their job.
We have written rules and procedures that guide quality improvement efforts.
We have written rules and procedures that guide creative problem solving.

Given that Pagell and Krause (2004) also used Likert scale questions to measure flexibility in their questionnaire, these two groups of indicators were deemed acceptable for use in this study.

7.2.2.13 Economies of Scale

There appears to be no agreed definition of economies of scale in the research literature. Evidence from authors such as Diwan (1966) and Gropper (1991) suggested that the exact nature of economies of scale is largely unresolved, the dimensions of which are not "always analysed with sufficient care" (Silberston 1972:369). The construct is implicated in much empirical research, even though "statistical evidence bearing on the existence of economies of scale in industry is, for the most part, sketchy and incomplete" (Moore 1959:232) and it remains popular.

The literature seems to argue that economies of scale is the relationship between production inputs and production outputs, a condition whereby a proportionate increase in production inputs results in a greater than proportionate increase in production outputs (see Lancaster 1968). Discussion from Ang and Straub (1998) typified this theory with respect to organisational size: "Smaller organisations have more difficulty generating economies of scale in their IT operations that allows them to justify their internal operations".

Importantly, however, economies of scale is not simply a condition that might be easily measured using a single indicator. For instance, Winsten and Hall (1961), using *Number of Employees*, provide statistical evidence that shows productivity declining slowly as the organisation's size grew larger. One explanation of this is the pride and *esprit-de-corps* that a sole proprietor might have for delivering quality work. As the organisation grows larger, this individual enthusiasm is eroded, leading to a loss in productivity (resulting in falling economies of scale).

Rather, economies of scale appears to be a *relationship* that may change over time (Winsten and Hall 1961, Burns 1983), within specific industries (e.g. Silberston 1972), and requires knowledge of internal cost structures. If economies of scale is normally considered to be a relationship between production inputs and outputs, then ideally both of these should be measured in some way. In the words of Winsten and Hall (1961: 257), "measures of size by output would seem logically to have priority over measures of size by inputs". There is also evidence to suggest that firm and industry risk play a role in the measurement of scale economies (notably in Chambers 1983). Its measurement may also be heavily dependent on each individual firm's operating and regulatory environment (Mullineaux 1978). If this is the case, then the measurement of this construct might be prone to idiosyncrasy and substantial fluctuation. As with the competitiveness and market power constructs, this construct was omitted from testing.

7.2.2.14 Expenditure

This construct proved relatively easy for which to find an indicator. Williams (2003) advised determining the organisation's 'total expenditure' using numeric amounts, bandings or budgetary percentages. This study chose bandings as its indicator for expenditure on the grounds that respondent firms would be most inclined to disclose this information.

7.2.2.15 Capability

Morgan and Strong (2003) observed that capability measurement is difficult, despite the construct's popularity in the literature. Lee (2001) argued that there is "little empirical research on organizational capability...and most such work emphasizes case studies or small scale surveys. These gaps reflect the lack of reliable measures of the organizational capability between organizations."

Lee offered a four item Likert-scale approach to measuring the capability construct, as follows:

We have the ability to scan for the valuable knowledge in external organizations.
We have the ability to acquire the needed knowledge from other organizations.
We have the ability to assimilate the found knowledge in our organization.
We have the ability to exploit the gathered knowledge for our organization.

7.2.2.16 *Investment*

The measurement of this construct is also considered difficult, affected by "depreciation, obsolescence, purchasing at different price levels" (Jerome 1932). Some argued that no accurate methods exist, especially given the endogenous effects of government policy and risk exposure between firms (Cornwall and Cornwall 2002). As with the expenditure construct, measurement seems to require an understanding of internal organisational cost structures. Measurement is hence easier for listed firms and those that publish annual reports (Ho et al. 2004)

Authors such as Megginson et al. (1994), Ahn and Denis (2004) and Boubakri et al. (2004) used the ratio of capital expenditure to sales. However, this indicator may not apply well to organisations which do not make "sales", such as consulting firms which may instead use terms such as "revenue" to denote incoming funds. Similarly, Gaver and Gaver (1993) and Ittner et al. (2003) used the inverse of ratio of book value to market value. However, as noted in the discussion of the market power and competitiveness constructs, quantifying market value may be difficult for some firms (particularly those in diversified industries).

Alternatively, authors such as Van der Bauwhede et al. (1991) and Allen (1998) used the level of expenditure on capital or fixed assets (such as plant, machinery or equipment). This is similar to Lewis et al. (2003) and was deemed a suitable indicator for this construct.

7.2.2.17 *Structure*

Cotter and Peck (2001) observed that measures of debt and capital structure are common in the literature. However, given the broad definition given by Blau (1970), a wider approach to measurement may be better at capturing more parts of the organisation's structure. Nahm et al. (2003) used a series of Likert scale questions for this item.

7.2.2.18 Complexity

The management and organisational science literature appears generally agreed on the meaning and measurement of the organisational complexity construct. Several key studies in the area exist and these provide good starting points for analysis in the area.

Complexity appears to have two components, though authors discuss the concept quite broadly within these two divisions. The first is structural complexity, which refers to the number of divisions in the organisation (Blau and McKinley 1979). The second is environmental complexity, which refers to the activities and behaviour of the organisation (Perrow 1961, Lawrence and Lorsch 1967). Burns and Stalker (1961) and Hirsch (1975) also related this construct to the organisational flexibility construct. Caplow (1957) and Hall et al. (1967) also observed a positive relationship between an organisation's size and its degree of complexity. In the words of Aiken et al. (1980:634), "in broad terms, an organisation's structural characteristics may be placed on a continuum from small and simple to large and complex". Burns and Wholey (1993) and Galbraith (1972) made similar observations.

Perona and Miragliotta (2004) used "number of production orders issued per year", however this indicator may not suit firms which either do not engage in production or do not issue production orders. An alternative group of indicators was found in Choi and Hong (2002), who used 'number of suppliers', 'number of divisions' and 'number of departments' to quantify complexity. These were deemed good indicators for this study.

7.2.2.19 *Market Power*

Pleatsikas and Teece (2001) discussed the definition of markets and market power in the area of organisational analysis and conclude that there is no accepted method for defining a market in this area. The authors argue that further work is needed in order to develop theory about market power in this regard. Given this, the measurement of market power is also a complex task, and it usually requires accurate knowledge and assessment of internal firm cost functions and market behaviour (Azzam 1997). As with competitiveness and economies of scale, this construct was omitted from the study.

7.2.2.20 *Distribution*

This construct reflected the degree of the organisation's geographic distribution. Evangelista et al. (2001) advised counting the number of regions in which the organisation operates. This was seen as a suitable indicator for this construct.

7.2.2.21 *Employment*

This construct was understood to mean the number of staff in the organisation. As in Caplow (1957), this reflected the number of members in the group, on the premise that more members would imply a larger organisation. A number of authors include questions reflecting this construct in their surveys. Authors such as Kalleberg et al. (2003) and Kohli and Devaraj (2004) recommended asking respondents how many staff they employ. This was felt to be an appropriate indicator of this construct.

7.2.2.22 *Summary of Indicator Development*

Once useable indicators had been found for each construct, a research assistant then checked the list of indicators for completeness and *prima facie* appropriateness. This additional check supported the construct's face validity. Table 7.3 lists the constructs and the indicator questions to be used in the survey instrument.

Initial examination of the indicator list revealed a number of points. First, the market power, competitiveness and economies of scale constructs proved difficult to develop indicators for. Every indicator found for these constructs either required intimate knowledge of internal cost structures, or a good understanding of each industry's behavioural and competitive structure. It was decided to exclude these from the instrument. Second, many of the questions require Likert-scale responses and, consistent with the discussion presented earlier for Table 3.1, many of the constructs have more than one indicator. This would be consistent with the earlier contention that measuring an organisation's size could not be conducted in terms of structural aspects alone.

Table 7.3 Organisational Size Constructs and Indicators from the Literature

No.	Construct	Indicator
1	Need for Co-ordination	How much resource co-ordination is required within your organisation? [Likert]
		How much personnel co-ordination is required within your organisation? [Likert]
2	Resources	Total assets
3	Competitiveness	Not included.
4	Need for Communication	Communications are easily carried out among workers. [Likert]
		How much communication do you feel is required within your organisation? [Likert]
5	Organisational levels	How many levels of management does the firm have?
6	Expertise	For how many years has the firm been in this line of business?
7	Need for Control	Our supervisors or middle managers are supportive of the decisions made by our work teams. [Likert] Our workers are encouraged to make suggestions to change current rules and procedures. [Likert] Our workers are involved in writing policies and procedures. [Likert] Our workers are involved in developing standard methods. [Likert]
		How much resource control is required within your organisation? [Likert]
8	Slack resources	Total revenue minus total expenses
		Our firm... 1. has sufficient financial resource slack for adoption and operation. [Likert] 2. has sufficient human resource slack for adoption and operation. [Likert] 3. has sufficient technical and supporting capability for adoption and operation. [Likert] 4. overall, has sufficient resource slack for adoption and operation. [Likert]
9	Risk aversion	Which of the following statements comes closest to the amount of financial risk that your firm is willing to take when you save or make investments? 1. Take substantial financial risks expecting to earn substantial returns. 2. Take above average financial risks expecting to earn above average returns. 3. Take average financial risks expecting to earn average returns. 4. Not willing to take any financial risks.
10	Risk tolerance	"It is wise to put some portion of savings in uninsured investments to get a high yield" [Likert]

		"I am willing to take substantial risks to realize substantial financial gains from investments." [Likert]
11	Scale	Number of employees
		Volume of revenues
		Volume of expenses
12	Flexibility	We have rules and procedures that show how workers can make suggestions for changes. [Likert] We have rules and procedures that describe how workers can make changes on their job. [Likert] We have written rules and procedures that show how workers can experiment with their job. [Likert] We have written rules and procedures that guide quality improvement efforts. [Likert] We have written rules and procedures that guide creative problem solving. [Likert]
		This firm restricts my choice of ways to develop a system [Likert] The procedures that I use in systems development are mandated by the firm. [Likert] This firm gives me freedom in choosing my techniques for developing a system. [Likert] The choice of approaches I use are determined by me and not by the firm. [Likert] This firm encourages a single way to develop a system but allows me to choose other ways. [Likert]
13	Economies of scale	Not included.
14	Expenditure	Total expenditure
15	Capability	We have the ability to scan for the valuable knowledge in external organizations. [Likert] We have the ability to acquire the needed knowledge from other organizations. [Likert] We have the ability to assimilate the found knowledge in our organization. [Likert] We have the ability to exploit the gathered knowledge for our organization. [Likert]
16	Investment	What percentage of your total assets would you say is invested in capital assets? (buildings, machinery)?
17	Structure	There are many management layers between plant operators and the CEO (more than 6). [Likert] There are few layers in our organizational hierarchy. [Likert] We are a lean organization. [Likert] There are only few management layers between plant operators and the CEO. [Likert]
		Our tasks are done through cross-functional teams. [Likert] Our workers are assigned to work in cross-functional teams. [Likert] Our workers are trained to work in cross-functional teams. [Likert] Our workers are required to work in cross-functional teams. [Likert] Our managers are assigned to lead various cross-functional teams. [Likert] Our most important tasks are carried out by cross-functional teams. [Likert]
		Our work teams cannot take significant actions without supervisors or managers' approval. [Likert] Our workers have the authority to correct problems when they occur. [Likert] Our workers handle job-related problems by themselves. [Likert] Our work teams have control over their job. [Likert]
18	Complexity	Number of suppliers
		Number of divisions/departments
19	Market power	Not included.
20	Distribution	In how many Australian states does your firm operate?
		In how many countries does the firm operate?
21	Employment	How many staff do you employ?

Further questions were also added to the survey instrument in order to provide richer data analysis, and to allow for further research to be conducted at a later date. Lengthy survey instruments have been associated with poor response rates (Church 1993), so the instrument was limited to four pages. It was felt that this length would allow for sufficient data collection but would not appear too bothersome to the respondent.

7.2.2.23 Instrument Pre-testing

Dillman (1978), among others, advocated survey instrument pilot testing. This stage of the instrument development is important as it allows the researcher to examine the usability of the questions and the fluidity of the survey. It also allows the researcher to view the survey instrument in an operational context (Grover et al. 1994).

The first working version of the survey was tested on four junior academic staff members of the School of Business and Information Management at the Australian National University. This procedure addressed problems associated with grammar and structure, and an amended second version of the survey was produced.

The second version was tested on five senior staff at the same institution. This resulted in additional clarification of some items, however, fewer changes were required on this iteration. Doubts were raised about the degree to which respondents would understand or be willing to answer questions concerning financial operations. It was decided that these questions would be left in the survey until the pilot study in order to see if this really posed a problem.

The third stage of the pre-test program involved two cognitive interviews with candidate respondent businesses. Each interview followed the general program of cognitive interviewing outlined by Waldron (1986) and Scott et al. (1991). First, each survey question was related to the interviewee in terms of the information sought. The actual question was then read to the interviewee. If the interviewee so desired, the question was repeated for clarity. The interviewee's answer was then recorded on the sample survey instrument. The interviewee was then directed to confirm their understanding of the question and its meaning.

The first interview was with the Chief Project Information Officer at an agricultural firm. This interview was useful as it revealed three issues. First, the interviewee had difficulty answering questions concerning the number of departments and product modules/components in the firm (need for co-ordination construct) and "number of production orders per year" (complexity construct). Second, the interviewee didn't know what the firm's accounts receivable was and also remarked that she felt wary of divulging this information: "We get lots of contractors in, so costs vary…some firms are on the knife edge and can't or don't want to talk [about costs]". The interviewee also signalled that they would have to refer some questions to other staff due to a lack of knowledge in that area.

The second interview was with a senior networking consultant at a Canberra-based IT firm. This respondent had had substantial experience with requirements analysis and technology implementation in a range of client firms. The survey instrument benefited markedly from this particular cognitive interview. First, the interviewee was confused about the difference between "departments" and "divisions" (questions 10 and 11). In the interviewee's opinion, these two could be merged into a single question to reduce confusion without loss of information. Similar comments were made regarding "levels of management" and "operational levels" (questions 12 and 13).

As in the previous cognitive interview, the interviewee observed that few smaller firms would be inclined to divulge their internal cost structures. Candidate indicators for the constructs of competitiveness, market power and economies of scale were discussed: few such indicators could be found without probing for sensitive financial information (and hence risking response rates). The interview also noted that smaller firms may lack the knowledge to answer all of the questions, saying, "if you're surveying so many different types of firms, you won't be able to guarantee comparable domain expertise across each one".

Evidence from the cognitive interview process suggested that, first, questions requiring accurate and precise knowledge of internal cost structures were unlikely to be well answered and may deter some sample members from responding to the survey. Second, there is a possibility that individual respondents may not have enough knowledge about the firm to answer all questions, since they refer to so many different facets of the organisation. Firms with fewer full time staff ("smaller firms" in the research literature) may be better able to answer all questions as resource poverty forces more employees to know about the firm's function. Alternatively, it may be that smaller firms won't understand some questions due to the level of specialist knowledge required. If true, this could affect responses from these conceptually smaller firms.

A final version of the survey instrument was created based on the results of this pilot test. Importantly, the language in the survey was critically reviewed for ease of understanding and to remove potentially confusing jargon. This final version was shown once more to two senior staff members. No changes were deemed necessary and the survey instrument was ready for implementation.

7.2.3 Validity and Usability

Grover et al. (1993) emphasised the importance of assessing certain types of validity and usability *ex ante* to instrument administration. This provides additional verification that the instrument is measuring what it purports to measure. Consistent with these arguments, some brief analysis of the validity and usability of the instrument will be made. Additional *ex post* examination of the instrument's validity and reliability will be conducted in the following chapter.

7.2.3.1 Validity

Content validity relies on the extent to which the instrument measures those qualities that it purports to measure. Thorndike and Hagen (1971) argued that an instrument's content validity can be maintained by adhering to a pre-designed outline or plan. The instrument used in this research was based, where possible, on the questions used in previous research that have been found to be of a reliable and robust nature. Where previous questions were not available, original questions were constructed, taking particular account of their relationship to the variables to be examined. The instrument can, as a result, claim to have a high level of content validity.

Construct validity concerns the degree to which the instrument tells the researcher something meaningful and useful about the construct (Anastasi 1988). Thorndike and Hagen argued that this quality can be examined using experts' opinions and instrument pre-testing. During the instrument construction, input was sought from a variety of academic staff and literature sources. In addition, the instrument was pre-tested on academic staff and two senior staff members from businesses in the ACT area. Based on these procedures, the instrument can claim to have a high level of construct validity.

7.2.3.2 Usability

An instrument is deemed to be usable if it conforms to good formatting standards in terms of length and question design (Thorndike and Hagen 1971). The survey should be of an appropriate length, with clear questions arranged in order of difficulty and grouped according to format and question content. The survey instrument used in this research was four pages in length, with closed factual questions placed at the beginning of the survey and, where possible, historical and open questions placed towards the end of each survey section. Pre-testing improved the readability of the survey instrument, and instructions were placed in the attached cover letter. These factors allow the instrument to claim a high level of usability.

7.2.4 Administration

The final stage of the survey process involved implementing the survey instrument. Particular care was taken to follow the suggestions of other researchers in the field. Numerous studies in both the research methods and information systems research literature have discussed good survey implementation technique. Some studies have also shown that response rates are increased through the use of incentives that offer respondents some benefit upon completion of the survey. Dillman (1978) wrote of the inclusion of a small cash amount, while Berenson and Levine (1993) used a copy of the survey report.

These issues were taken into account when administering the survey instrument. Each business on the sample list was to receive one questionnaire, accompanied by a one page cover letter explaining the origin and purpose of the survey. Included with this letter was an addressed reply-paid envelope. As an incentive, businesses could request a copy of the final report by ticking a box at the end of the survey and enclosing a business card. Each survey was mailed using official Australian National University envelopes bearing the university crest.

Miller (1983) argued that the business-specific cover letters printed on paper bearing official letterheads and the inclusion of reply-paid envelopes improves response rates. Thorndike and Miller (1971) advocated the use of a senior staff member's signature on the cover letter, and argued that respondents should also be assured of confidentiality. Each letter was individually addressed, and included a clause assuring respondents of confidentiality. Each letter was printed on paper bearing the letterhead of the Australian National University and signed by the researcher.

7.2.5 Ethics Approval

Following construction of the initial survey, it was sent for approval to the university Ethics Committee along with a copy of the cover letter. Before approval was granted, the committee required some minor changes to terminology regarding respondent consent, anonymity and confidentiality. After negotiation, it was agreed that the return of the survey would constitute sufficient consent to participate on the part of respondents. The committee also required the words "as far as possible" to be added to the section assuring data and respondent anonymity. However, under no circumstances was any kind of response or respondent tracking acceptable: this meant that non-respondents could not be followed-up. These items were amended and the survey and cover letter were approved for use. A copy of the final survey instrument appears in Appendix D.

7.3 Conclusions

Research methods in information systems include mail and telephone surveys, structured interviews, case studies and laboratory experiments. Of these methods, the mail survey was selected for use in this stage of the thesis, on the basis that it afforded the acquisition of a sufficiently large data set from a correspondingly large population at relatively low cost. Following the decision to make use of a mail survey, the sample and survey instrument were developed.

Indicators were found in the literature for each of 18 size dimensions observed in Chapter 5 and organised in Chapter 6. These indicators were then operationalised in the form of a questionnaire survey. Three dimensions, *Market Power*, *Competitiveness* and *Economies of Scale* were not operationalised as they required in-depth knowledge of internal cost structures and industry behaviour. It was noted that the final survey instrument may be difficult for respondents to answer as it featured so many questions about different facets of the organisation.

The survey was sent to 1,000 private businesses across Australia. Government-affiliated businesses were excluded from the population of interest. Sample selection was conducted using a random selection of businesses from the business telephone directory for all regions.

CHAPTER 8

STUDY 3: SURVEY RESULTS AND ANALYSIS

This chapter presents the analysis of the data obtained from the survey. After one month, responses to the survey slowed. After a two week period in which no responses were received, a cut-off date was imposed. Each survey was vetted for completeness and suitability for analysis, and was coded into usable data. Following data coding, distance modelling and cluster analysis of items was conducted. Cluster analysis is used to see whether the constructs clustered in actual firms as they did in theory. Logistic regression was used to determine which constructs reflected how survey respondents saw the size of their own firms. Finally, two-step cluster analysis is used to determine whether the construct group could be used to distinguish between small and large firms.

This chapter first discusses the response rate obtained, data validation and analysis of response bias. The data are then inspected for missing items, normality and outliers. The thesis then presents the findings of item validation. Next, the chapter presents general descriptive statistics of the respondent group. Then, the chapter presents the four main areas of statistical testing, being an analysis of variable clustering, then case clustering and finally analysis of respondent self-classification.

8.1 Survey Response and Data Validation

In total, 179 responses to the survey were received during the mail-out period. Of these, 163 responses were usable, yielding an overall response rate of 16.3%. Table 8.1 describes the breakdown of the usability of the response set. Eight firms declined to participate. Six of these firms either wrote letters or made personal phone calls to this effect.

Table 8.1 Breakdown of Survey Responses

Response Type	Total	Percent
Complete, useable responses	163	16.3
Businesses declining to participate	8	0.8
Surveys returned blank	5	0.5
Surveys returned incomplete †	3	0.3
Total	179	17.9

†Surveys were treated as incomplete if they were missing more than 15% of the instrument.

8.2 Response Bias

The 16.3% usable response rate was disappointing, but is similar to other information systems studies in the Australian commercial sector such as Berrill et al. (2004) (112 responses or 19%), Choe (2004) (47 responses or 25%), Lin and Pervan (2003) (69 responses or 13.8%), Sohal and Ng (1998) (81 responses or 15.6%) and Low et al. (1995) (69 responses or 51%). Given this low response rate, it would be prudent to consider the effects of potential response bias.

Determining non-response bias to surveys is not easy, and often only approximations can be made (Dillman 1978). Grover et al. (1993) advocated the practice of comparing later respondents with earlier respondents, on the basis that later respondents may possess similar characteristics to those sample members who did not respond at all. However, the arguments of Filion (1975) suggested that this method of using respondent data to examine non-respondents is flawed. First, it assumes that some non-response bias actually does exist and, second, it can neither prove nor disprove the existence of such a bias on all research variables at once. While the usefulness and accuracy of such a method is open to question, such an analysis was conducted nevertheless.

The receipt date of each returned questionnaire was noted. The respondents were split into two groups, according to the date of their response in relation to the mean response date. A Mann-Whitney analysis of *Number of Employees*, *Respondent Years with the Firm* and *Business Age* revealed insignificant differences between earlier and later respondents. Table 8.2 and Table 8.3 show the results of the Mann-Whitney analysis.

Table 8.2 Mann-Whitney Ranking of Response Differences

	Date Received	N	Mean Rank	Sum of Ranks
Number of Employees	1.00	78	75.65	5901.00
	2.00	85	87.82	7465.00
	Total	163		
Firm Age	1.00	78	83.80	6536.50
	2.00	85	80.35	6829.50
	Total	163		
Years With Firm	1.00	78	83.98	6550.50
	2.00	85	80.18	6815.50
	Total	163		

Table 8.3 Mann-Whitney Analysis of Response Differences

	Number of Employees	Firm Age	Years With Firm
Mann-Whitney U	2820.000	3174.500	3160.500
Wilcoxon W	5901.000	6829.500	6815.500
Z	-1.646	-.467	-.514
Asymp. Sig. (2-tailed)	.100	.640	.607

Grouping Variable: Date Received

If the analysis of return dates does provide some indication of response bias, the analysis in Table 8.2 and Table 8.3 would suggest that little bias, if any, exists. However, determining non-response bias is difficult, and the results of the response analysis presented above may be open to question. For instance, the spread of either the Employees variable or Firm Age variable may not be large enough to distinguish between responses in this way. In short, the bias due to non-response is not known for certain, but is estimated to be negligible.

8.3 Evaluation of Data Limitations

Before conducting factor analytical procedures of any type, it is important to assess the data with respect to conventional statistical limitations. While some limitations can be relaxed in cases where such analysis is exploratory (Tabachnick and Fidell 1989), it is still important to explore the data.

8.3.1 Size of the Dataset

The first stage in limitations analysis was to explore the size of the dataset. Comrey (1973) argued that, while the suitability of the dataset is likely to depend on the type of analysis conducted, 50 observations is seen as 'very poor', 100 is 'poor', 200 is 'fair', 300 is 'good' and 1000 is 'excellent'. This suggests that the data set obtained for this study of 163 observations is poor to fair. Kline (1994) argued that a 2:1 ratio of observations to factors is required. Tabachnick and Fidell (1989:603) noted that, "as a general rule of thumb, it is comforting to have at least five cases for each observed variable", though Green (1991) recommends up to 10 cases per variable. This suggests that 105 observations would be acceptable for the 21 variables observed in chapters 6 and 7 of this study.

8.3.2 Missing Data

The second stage of limitations analysis involved exploring the effect of missing data items. As discussed earlier, surveys were generally either returned entirely blank, or were returned complete (in that respondents answered every question or did not respond at all). However, in some cases, respondents indicated that they felt that some questions did not apply to their firm. For instance, one respondent wrote, "this is just a husband and wife team and probably isn't relevant to your study". Tabachnick and Fidell (1989:61) argued that the "pattern of missing data is more important than the amount missing" and, as a result, it is important to analyse the missing data pattern. Table 8.4 shows the results of the SPSS Missing Values analysis used to determine missing values across the variable set.

Table 8.4 Missing Value Analysis

				Missing	
Construct	N	Mean (All Values)	Mean (Listwise)	Count	Percent
Need for Co-ordination	155	3.9901	3.9552	8	5.0
Resources	159	5.4744	5.4104	4	2.5
Need for Communication	160	4.1656	4.1418	3	1.9
Organisation Levels	163	2.0000	2.0224	0	.0
Expertise	163	22.2969	21.8172	0	.0
Need for Control	163	16.0500	16.2164	0	.0
Slack Resources	161	3.5084	3.4465	2	1.3
Risk Aversion	163	2.7313	2.7388	0	.0
Risk Tolerance	156	2.4804	2.4925	7	4.4
Scale	157	.2219	.2267	6	3.8
Flexibility	163	3.7324	3.6561	0	.0
Expenditure	157	5.4805	5.7612	6	3.8
Capability	155	3.4474	3.4030	8	5.0
Investment	157	1038181477.272	1171819048.507	6	3.8
Structure	163	3.5444	3.5862	0	.0
Complexity	161	78.5538	89.6940	2	1.3
Distribution	163	3.8469	4.1604	0	.0
Employment	163	459.2531	503.7799	0	.0

A number of methods exist for handling missing values (Rummel 1970). The first involves case-wise or variable-wise deletion, whereby either observations or variables containing missing values are simply deleted from the data set. Given the already small size of the data set, this option was not attractive.

The second option for handling missing values was to estimate the missing data using prior experience. In circumstances where the researcher is wholly familiar with the research area and likely responses to questions, they may use their prior knowledge to impute appropriate values.

Everitt and Dunn (1991) described a process called "available case" analysis, whereby analyses are conducted using only cases for which observations are present in the particular variables under examination. Everitt and Dunn volunteered that this approach may lead to covariance and correlation problems. Additionally, the process results in varying means for different data subsets. The process was deemed unattractive for these reasons.

Alternatively, group means or item means may be inserted in place of the missing value. Everitt and Dunn (1991) argued that, in cases where missing items are scarce, the means of those values may be inserted instead. Mean imputation was used to remove missing variables in the data set as the overall number of missing values was considered small. This was consistent with the advice of Tabachnick and Fidell (1989).

8.3.3 Normality and Outliers

Conditions of normality are advised in situations involving factor analysis. Proper factor analysis prefers normality because those methods depend on being able to make judgments regarding deviations from central tendency. Less strict factor analytical methods, such as cluster analysis, do not require normality, however normality analysis may identify irregular variables and outliers.

Testing for data set normality can be conducted either using the Shapiro-Wilk test when observations are few, or the Kolmogorov-Smirnov (Lilliefors) test when more observations are available. The Lilliefors test compares the distribution of the sample across the relevant variables with the standard normal distribution (Iman and Conover 1983). It is important to note, however, that the Lilliefors test can only provide evidence of sample non-normality: it makes no claims about the wider population normality. It is possible, in this regard, that the population itself is not normal (resulting in a non-normal sample distribution).

Normality testing was conducted using the Kolmogorov-Smirnov (Lilliefors) test. Table 8.5 shows the results of this testing, involving the ratio-scale variables of *Number of Employees*, *Firm Age*, *Total Assets*, *Revenues* and *Expenses*.

Table 8.5 Kolmogorov-Smirnov Tests for Normality

	Statistic	df	Sig.
EMPLOY	.442	163	.000
FIRMAGE	.173	163	.000
ASSETS	.457	163	.000
REVENUES	.421	163	.000
EXPENSES	.435	163	.000

The Kolmogorov-Smirnov (Lilliefors) statistic was significant across all variables ($p<.005$), and the null hypothesis that the distributions are normal was rejected. The stem and leaf plots also showed substantial non-normality. This is not surprising, as there is significant supporting evidence for this in the literature: there are more small, young firms than large old ones in existence (consistent with Newbold 1991 and Hymer and Pashigian 1962).

Authors such as Tabachnick and Fidell (1989) argued that such non-normal plots can be normalised before commencing data analysis. Such normalisation could involve log transformation, which is a monotonic transform that preserves the order but not magnitude of observations. Accordingly, variables to be included in the analysis were normalised using a natural log transform.

The data set was also examined for the presence of outlier items which stood out from the rest of the data set (Iman and Conover 1983). These large values and "extreme observations" (Aczel 1993) may bias the testing, so it is important to give them special attention. Everitt and Dunn (1991) argued that the use of marginal data views of individual variables may assist in identifying cases of bias or outliers. Stem and leaf plots were used to identify data asymmetry for the variables. Scatter plots were used to inspect the data for significant outliers.

Figure 8.1 Stem and Leaf Plots for Raw and Log Number of Employees

```
EMPLOY Stem-and-Leaf Plot

 Frequency     Stem &  Leaf

    49.00        0 .  0111111122222233333444444
    38.00        0 .  5556677777777888899
    12.00        1 .  00222&
     6.00        1 .  56&
    10.00        2 .  0034&
     4.00        2 .  5&
     2.00        3 .  &
     4.00        3 .  8&
     1.00        4 .  &
     2.00        4 .  5
     2.00        5 .  &
     1.00        5 .  &
     2.00        6 .  0
      .00        6 .
     3.00        7 .  0
     2.00        7 .  5
     1.00        8 .  &
    24.00 Extremes     (>=90)

 Stem width:      10.00
 Each leaf:        2 case(s)
```

```
Log (Employees) Stem-and-Leaf Plot

 Frequency     Stem &  Leaf

     2.00       -0 .  66
      .00       -0 .
    15.00        0 .  000000000000004
    10.00        0 .  6666666666
    22.00        1 .  0000000002333333333333
    26.00        1 .  66666777777999999999999999
    23.00        2 .  00000000111133333444444
    11.00        2 .  57777889999
    11.00        3 .  00111122234
    10.00        3 .  5566668899
    10.00        4 .  0002223334
     2.00        4 .  89
     4.00        5 .  0224
     4.00        5 .  5689
      .00        6 .
     3.00        6 .  559
    10.00 Extremes     (>=7.2)

 Stem width:       1.00
 Each leaf:        1 case(s)
```

Figure 8.2 Stem and Leaf Plots for Raw and Log Assets

```
ASSETS Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

101.00 0 .  0000000000000000000000000111112244
 11.00 0 .  7777
   .00 1 .
   .00 1 .
   .00 2 .
   .00 2 .
 10.00 3 .  000
   .00 3 .
   .00 4 .
   .00 4 .
   .00 5 .
   .00 5 .
   .00 6 .
   .00 6 .
   .00 7 .
  6.00 7 .  55
 35.00 Extremes    (>=175000000)

 Stem width:  10000000
 Each leaf:       3 case(s)
```

```
Log (Assets) Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

37.00 11 .  7777777777777777777777777777777777777
18.00 12 .  888888888888888888
21.00 13 .  555555555555555555555
20.00 14 .  22222222222222277777
16.00 15 .  2222288888888888
  .00 16 .
10.00 17 .  2222222222
12.00 18 .  111111999999
 1.00 19 .  7
 5.00 20 .  44444
 5.00 21 .  88888
 4.00 22 .  7777
 1.00 23 .  4
 8.00 24 .  22222222
 5.00 Extremes    (>=25.0)

 Stem width:      1.00
 Each leaf:       1 case(s)
```

Figure 8.3 Stem and Leaf Plots for Raw and Log Revenues

```
REVENUES Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

81.00 0 .  00000000000000000000000000000111111111
 7.00 0 .  222
 7.00 0 .  444
15.00 0 .  7777777
  .00 0 .
  .00 1 .
  .00 1 .
  .00 1 .
  .00 1 .
  .00 1 .
  .00 2 .
  .00 2 .
  .00 2 .
  .00 2 .
  .00 2 .
18.00 3 .  000000000
35.00 Extremes    (>=75000000)

 Stem width:  10000000
 Each leaf:       2 case(s)
```

```
Log (Revenues) Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

 18.00   11 .  777777777777777777
 12.00   12 .  888888888888
 24.00   13 .  555555555555555555555555
 34.00   14 .  2222222222222222222222222227777777
 22.00   15 .  2222222888888888888888
   .00   16 .
 18.00   17 .  222222222222222222
  5.00   18 .  19999
  1.00   19 .  7
  3.00   20 .  444
  9.00   21 .  888888888
  5.00   22 .  77777
 12.00 Extremes    (>=23.4)

 Stem width:      1.00
 Each leaf:       1 case(s)
```

Figure 8.4 Stem and Leaf Plots for Raw and Log Expenses

```
EXPENSES Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

90.00   0 .  00000000000000000000000000001111111
 5.00   0 .  22
 9.00   0 .  4444
10.00   0 .  77777
  .00   0 .
  .00   1 .
  .00   1 .
  .00   1 .
  .00   1 .
  .00   1 .
  .00   2 .
  .00   2 .
  .00   2 .
  .00   2 .
  .00   2 .
15.00   3 .  0000000
34.00 Extremes     (>=75000000)

 Stem width:  10000000
 Each leaf:        2 case(s)
```

```
Log (Expenses) Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

 23.00  11 .  77777777777777777777777
 22.00  12 .  8888888888888888888888
 25.00  13 .  5555555555555555555555555
 25.00  14 .  2222222222222222222277777
 19.00  15 .  2222222228888888888
   .00  16 .
 15.00  17 .  222222222222222
  5.00  18 .  11999
  3.00  19 .  777
  5.00  20 .  44444
  6.00  21 .  888888
  7.00  22 .  7777777
  3.00  23 .  444
  5.00 Extremes     (>=24.3)

 Stem width:      1.00
 Each leaf:       1 case(s)
```

Figure 8.5 Stem and Leaf Plots for Raw and Log Expertise

```
Expertise Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

 14.00   0 .  12222233333344
 34.00   0 .  5555555555566666666667778888999999
 28.00   1 .  0000000000111122333334444444
 20.00   1 .  55556666667778889999
 16.00   2 .  0000111113334444
 11.00   2 .  55555567889
 13.00   3 .  0000000122334
  4.00   3 .  5669
  5.00   4 .  00114
  1.00   4 .  8
  4.00   5 .  0000
  2.00   5 .  67
 11.00 Extremes     (>=70)

 Stem width:     10.00
 Each leaf:       1 case(s)
```

```
Log (Expertise) Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

  1.00 Extremes     (=<.0)
  5.00 0 .  66669
  8.00 1 .  00000033
 24.00 1 .  666666666667777777779999
 26.00 2 .  00111111113333333333333344
 36.00 2 .  555556666666777777777778888889999999
 35.00 3 .  00000111111122222222233444444444444
 15.00 3 .  555566677789999
  6.00 4 .  002223
  7.00 4 .  5556667

 Stem width:      1.00
 Each leaf:       1 case(s)
```

Following the advice of Aczel (1993), outlier cases were also traced back to possible errors in data recording. Two such errors were found, where the firm's inception date had been inserted instead of the firm's age (resulting in readings of 1988 and 1991 instead of 16 and 13 respectively). Other outlier cases were alleviated as a result of the normalisation process undertaken above.

8.4 Respondent Demographics and Descriptive Statistics

Descriptive statistics were first derived in order to give a broad understanding of the data. Table 8.6 gives the main summary statistics of the group of respondent firms and Table 8.7 gives summary data about the respondents themselves. The largest single industry represented in the respondent group was that of Insurance and Financial Services, General Retail and Management Consulting and Recruitment. Industrial, Manufacturing and Electrical and Information Technology Consulting were the next largest groups.

The business age summary statistics show a reasonable spread of age across respondent firms, with most firms in the group being less than ten to fifteen years old. This suggests that the respondent sample was not biased towards older or younger businesses.

Most respondent firms employed fifteen or fewer equivalent full time staff. According to Australian Bureau of Statistics categories, this suggests that most respondents were small businesses (McLennan 1997). It is important to note that there may be a biasing effect for firms with more employees where respondents begin rounding their responses to the nearest centile or decile (consistent with McPherson 1983). This could result in spikes at larger numbers in these figures.

Table 8.7 shows that respondents were mostly directors, with managers almost equal to this in representation. The cover letter requested respondents to pass the questionnaire on to the staff member who was most knowledgeable about the business' characteristics and IT, and many respondents held diverse roles in the firm. These roles were included in the "other" category, which did not lend themselves easily to broad categorisation. These included a project officer, a principal consultant, a car mechanic, a marine electrician, a member of general counsel, a communications specialist and a managing geologist.

Table 8.6 Organisational Demographics

Demographic	Frequency	Percentage
Industry		
Insurance and Financial Services	22	13.75
Retail	22	13.75
Management Consulting and Recruitment	21	13.125
Industrial, Manufacturing and Electrical	15	9.375
IT Consulting and Services	12	7.5
Architecture and Landscaping	11	6.875
Mining/Exploration	10	6.25
Personal/Medical/Health Services	7	4.375
Logistics and Transportation	5	3.125
Automotive	5	3.125
Farming and Bioscience	4	2.5
Telecommunications	4	2.5
Real Estate and Property Services	4	2.5
Marketing and Advertising	4	2.5
Publishing and Printing	3	1.875
IT Retail	3	1.875
Tourism and Hospitality Services	3	1.875
Graphic Design/Photography Services	3	1.875
Gaming	2	1.25
Firm Age		
less than one year	1	0.625
2 - 3 years	11	6.875
4 - 5 years	15	9.375
6 - 9 years	21	13.125
10 - 15 years	26	16.25
16 - 20 years	23	14.375
21 - 25 years	17	10.625
26 - 30 years	12	7.5
31 - 40 years	13	8.125
41 - 50 years	6	3.75
51 - 75 years	9	5.625
76 - 100 years	4	2.5
100 years or more	4	2.5
Number of Employees		
0 - 2	27	16.875
3 - 5	28	17.5
6 - 15	45	28.125
16 - 30	19	11.875

31 - 50	9	5.625
51 - 75	9	5.625
76 - 200	7	4.375
201 - 1000	8	5
1001 - 3000	7	4.375
3001 - 5000	0	0
5001 - 8000	2	1.25
8001 or more	1	0.625

Table 8.7 Respondent Demographics

Demographic	Frequency	Percentage
Respondent Role		
Director	35	21.875
Managing Director	21	13.125
Manager	12	7.5
Other Managerial	11	6.875
CEO	9	5.625
General Manager	8	5
Office Manager	7	4.375
CFO	6	3.75
Owner	6	3.75
Financial Controller	5	3.125
Regional Manager	5	3.125
Admin Manager	4	2.5
Principal	3	1.875
Partner	3	1.875
Accountant	3	1.875
Managing Partner	2	1.25
HR Manager	2	1.25
Executive Director	2	1.25
Sales Manager	2	1.25
Other	15	9.375
Respondent Years With Firm		
less than one year	8	5
1 - 2 years	29	18.125
3 - 5 years	32	20
6 - 10 years	33	20.625
11 - 15 years	29	18.125
16 - 20 years	14	8.75
21 - 30 years	15	9.375
31 years or more	3	1.875

8.5 Data Analysis

8.5.1 Item Validation

In this study, eleven constructs were proxied for by more than one indicator. In such circumstances, it is common to conduct some analysis of the degree to which each indicator adequately captures the construct. One method of internal item validation that has received considerable use in the information systems literature is that of the Cronbach Alpha. This test performs a similar analysis to that of differences between two means, such as a T-test or the non-parametric Mann Whitney U-test (Tabachnick and Fidell 1989). The Alpha coefficient represents the differences between the sum of single respondent variances compared to the entire sample variance, and is presented as a value between 0 and 1. Explicitly:

$$r_{tt} = \left(\frac{n}{n-1}\right)\frac{SD_t^2 - \Sigma(SD_i^2)}{SD_t^2}$$

where r_{tt} represents the final calculated reliability coefficient of the item. Large discrepancies between the sum of individual answers and group answers indicate questionable levels of Alpha item reliability. The Cronbach Alpha is especially suited to large groups of scaled questions (such as Likert), where a better approximation of item variance is possible.

Cronbach Alpha analysis was conducted on constructs which comprised more than one item, using .7 as an acceptable Alpha coefficient after Nunnally (1978). Table 8.8 shows the results of this analysis.

Table 8.8 Cronbach Alpha Coefficients for Raw and Revised Variables

Construct	Raw Variables		Revised Variables	
	No. of Items	Raw Cronbach Alpha	Revised No. of Items	Standardised Alpha
Need for Co-ordination	2	.8255	2	.8255
Need for Communication	2	.1567	2	.1567
Slack resources	3	.6738	2	.7220
Risk tolerance	2	.5311	2	.5311
Scale	3	.8591	3	.8591
Flexibility	7	.6620	4	.7535
Capability	3	.9149	3	.9149
Structure	8	.5341	3	.7547
Complexity	2	.7759	2	.7759
Distribution	2	.3584	2	.6490

While Alpha values for variables such as *Capability* were acceptable, values for some other variables were initially low. In some cases, this was addressed by refining and reducing the number of items in the variable, following Ray (1972). Stepwise reduction of variables raised the Alpha coefficient for variables such as *Flexibility* and *Slack Resources* to acceptable levels. For *Distribution* and *Scale*, acceptable Alpha coefficients were obtained through normalising the items, consistent with Section 8.3.3.

Cronbach Alphas for the *Need for Communication* and *Risk Tolerance* variables are disturbingly low. Normalisation for these variables was inappropriate and items could not be removed as each variable only had two items. The *Need for Communication* variable was explored in greater detail, in light of the low Cronbach Alpha coefficient. The low Alpha coefficient indicated low item reliability. It was possible, in this regard, that the variable might be better captured using just one item and not two. Spearman correlation analysis showed that both items were significantly correlated (correlation coefficient of .221, p=.005). In light of this evidence, the *Need for Communication* variable was reduced to a single item.

Table 8.9 lists all research constructs, variable names, means and standard deviations.

Table 8.9 Overview of Constructs, Variables and Means

Construct	Variable	No. of Items	Mean	Std. Dev.
Need for Co-ordination	CORD	2	3.9816	.86939
Resources	RESO	1	15.6206	3.99690
Need for Communication	COMN	1	4.3006	.91715
Organisation levels	ORGL	1	2.0613	1.26048
Expertise	XPTS	1	22.6472	22.66074
Need for Control	CTRL	1	3.9448	.92464
Slack resources	SLKR	2	3.4417	.98975
Risk aversion	RSKA	1	2.7853	.98597
Risk tolerance	RSKT	2	2.3988	.96730
Scale	SCAL	3	.1891	.34831
Flexibility	FLEX	4	4.1457	.66772
Expenditure	EXPN	1	15.5773	3.58382
Capability	CPBL	3	3.4417	1.05076
Investment	NVST	1	14.0443	4.08227
Structure	STRU	3	3.5624	.79567
Complexity	CMPX	2	85.1227	481.14429
Distribution	DIST	2	1.6768	1.43810
Employment	EMPL	1	2.6699	2.08969

8.5.2 Cluster Analysis

The goal of this section is to examine how the research variables cluster in actual firms. Cluster analysis is a statistical technique for determining candidate groupings of items. The multidimensional scaling analysis method used in Chapter 6 is a cluster analytic method. Importantly, for exploratory research, cluster analysis is superior to other methods (such as factor analysis) as it makes no assumptions about the number of final groups, nor inter- or intra-group structure (Johnson and Wichern 1982). Cluster analysis was conducted using the SPSS statistical package and Microsoft Excel XP.

The cluster analysis approach works as follows. As in the multidimensional scaling performed in Chapter 6, the analysis is based on the observed distance or similarity between variables. Once values for all variables have been created, a correlation matrix is developed. The correlation values describe each variable's similarity, or otherwise, to each other variable (Johnson and Wichern 1982). Variables which are highly positively correlated are deemed to be conceptually similar. Conversely, variables which exhibit large negative correlations are deemed to be conceptually dissimilar. Figure 8.6 shows the correlation matrix for the variable set.

Figure 8.6 Correlation Matrix for Research Variables

	CORD	RESO	COMN	ORGL	XPTS	CTRL	SLKR	RSKA	RSKT	SCAL	FLEX	EXPN	CPBL	NVST	STRU	CMPX	DIST	EMPL
CORD	1.000	.113	.462	.095	-.062	.678	.129	-.087	-.053	.097	.239	.045	.235	.112	.040	-.100	.070	.106
RESO	.113	1.000	-.080	.536	.287	.133	.136	-.263	.142	.675	-.154	.751	.049	.965	-.075	.436	.393	.654
COMN	.462	-.080	1.000	-.182	-.142	.344	.120	.007	.020	-.166	.531	-.124	.264	-.057	.297	-.154	-.008	-.192
ORGL	.095	.536	-.182	1.000	.299	.056	.044	-.202	.160	.599	-.214	.601	.069	.511	-.120	.387	.225	.599
XPTS	-.062	.287	-.142	.299	1.000	-.017	.009	-.128	.104	.292	-.208	.294	-.069	.270	-.078	.290	.136	.333
CTRL	.678	.133	.344	.056	-.017	1.000	.176	.024	-.160	.135	.063	.128	.129	.142	.004	.002	.091	.148
SLKR	.129	.136	.120	.044	.009	.176	1.000	-.085	.170	.057	.076	.067	.311	.102	.141	-.084	.096	.062
RSKA	-.087	-.263	.007	-.202	-.128	.024	-.085	1.000	-.477	-.297	-.046	-.254	-.085	-.243	.016	-.104	-.219	-.266
RSKT	-.053	.142	.020	.160	.104	-.160	.170	-.477	1.000	.139	.156	.161	.218	.125	.108	.087	.163	.062
SCAL	.097	.675	-.166	.599	.292	.135	.057	-.297	.139	1.000	-.192	.889	.037	.616	-.193	.477	.405	.952
FLEX	.239	-.154	.531	-.214	-.208	.063	.076	-.046	.156	-.192	1.000	-.152	.329	-.175	.483	-.141	.047	-.255
EXPN	.045	.751	-.124	.601	.294	.128	.067	-.254	.161	.889	-.152	1.000	.036	.709	-.126	.461	.413	.797
CPBL	.235	.049	.264	.069	-.069	.129	.311	-.085	.218	.037	.329	.036	1.000	.026	.184	-.004	.108	.005
NVST	.112	.965	-.057	.511	.270	.142	.102	-.243	.125	.616	-.175	.709	.026	1.000	-.097	.431	.364	.601
STRU	.040	-.075	.297	-.120	-.078	.004	.141	.016	.108	-.193	.483	-.126	.184	-.097	1.000	-.048	.021	-.247
CMPX	-.100	.436	-.154	.387	.290	.002	-.084	-.104	.087	.477	-.141	.461	-.004	.431	-.048	1.000	.180	.489
DIST	.070	.393	-.008	.225	.136	.091	.096	-.219	.163	.405	.047	.413	.108	.364	.021	.180	1.000	.379
EMPL	.106	.654	-.192	.599	.333	.148	.062	-.266	.062	.952	-.255	.797	.005	.601	-.247	.489	.379	1.000

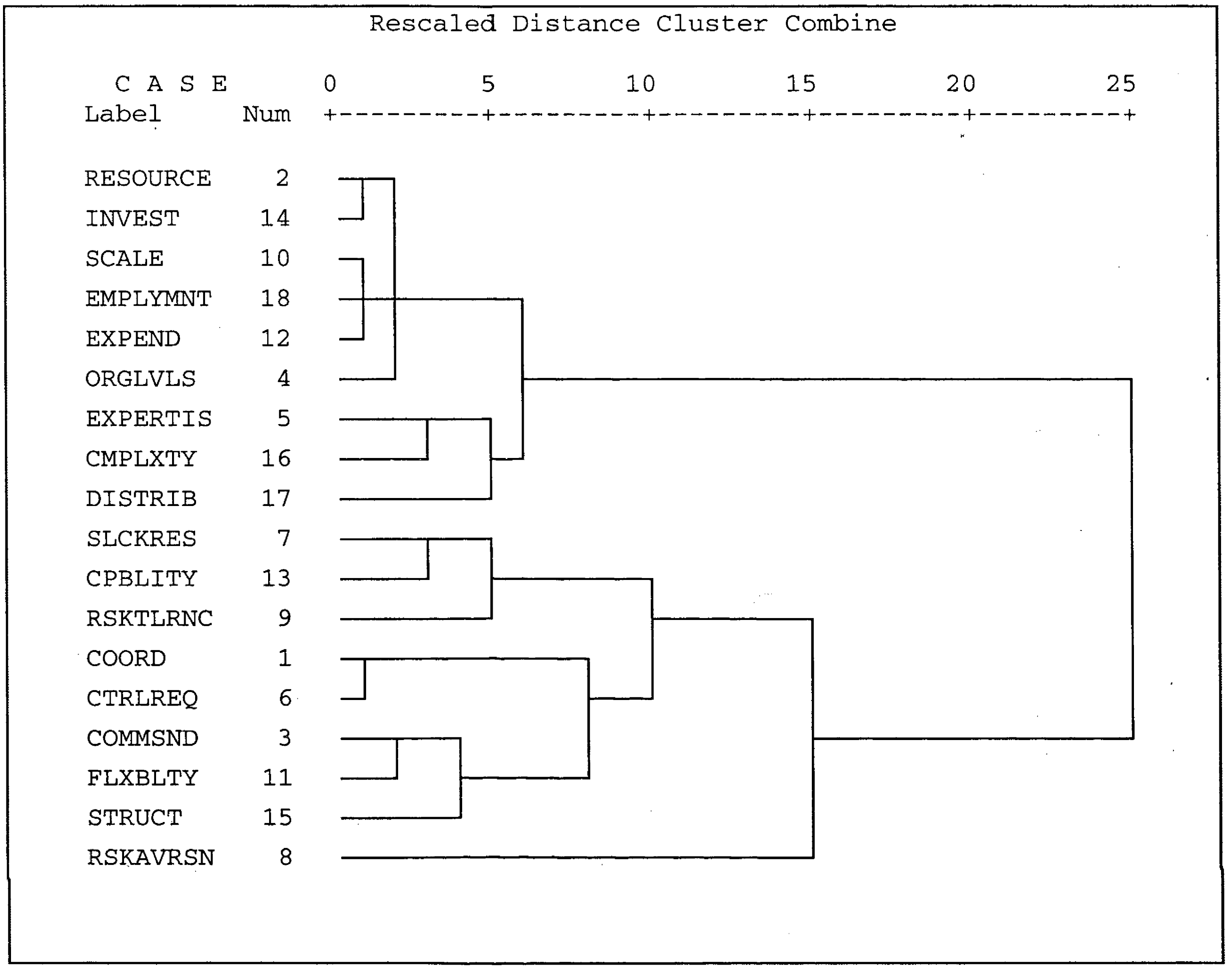
Initial inspection shows high positive correlations for variables such as *Employment* and *Resources* (.654) and high negative correlations for variables such as *Risk*

Tolerance and *Risk Aversion* (-.477). These coefficients suggest that these variables are conceptually similar and conceptually dissimilar, respectively.

The correlation values govern the way in which variables are grouped or "linked". There are several methods for prescribing linkages. For instance, the "single linkage" method describes linking variables according to the nearest neighbour variables. Alternatively, the "complete linkage" method groups candidate variables according to the maximum distance between cluster points or "furthest neighbours" (Johnson and Wichern 1982:543). There is published evidence that, while complete clustering is computationally inefficient, it is most effective in determining cluster membership (Willett 1988, Gibbons and Roth 2002). Hartigan (1975), Lance and Williams (1967a, 1967b) went so far as to blame much of the poor grouping in the literature on the popular use of single linkage (nearest neighbour) grouping. The complete linkages method was selected for use in this research.

A "dendogram" is then used to represent each variable's linkage in a two-dimensional tree structure. Similar variables cluster easily and so group together at the base of the tree. The top of the tree shows broader clusters, grouping variables which are most dissimilar. The branches of the dendogram hence show the clusters present in the data. Figure 8.7 shows the dendogram obtained using complete linkages and the correlation matrix shown in Figure 8.6 above.

Figure 8.7 Dendogram Using Complete Linkages



Examination of Figure 8.7 suggests two main clusters. The first cluster contains *Resources*, *Investment*, *Scale*, *Employment*, *Expenditure*, *Organisation Levels*, *Expertise*, *Complexity* and *Distribution*. It is important to note that this cluster grouping does approximately reflect the "resources" cluster obtained in the multidimensional scaling in Chapter 6. The second cluster is less easy to define, but appears to include *Slack Resources*, *Capability*, *Risk Tolerance*, *Need for Co-ordination*, *Need for Control*, *Need for Communication*, *Flexibility*, *Structure* and *Risk Aversion*. Interestingly, the clustering of *Risk Tolerance* and *Capability* reflect to some extent the "resultant" cluster of the earlier multidimensional scaling analysis. Similarly, the *Structure*, *Need for Co-ordination*, *Need for Control* and *Need for Communication* also group closely, reflecting the earlier "behavioural" cluster.

As predicted earlier, *Risk Tolerance* and *Risk Aversion* cluster very broadly, indicating significant dissimilarity. This may not be surprising, as firms which are tolerant of risk may not be averse to it. This, then, presents an instance where the conceptual understanding of the size construct is different to actual cases: these variables may be related *conceptually* (and so cluster together in theory) but are not observed together in practice (and so fail to cluster).

8.5.3 Goodness of Fit

Everitt and Dunn (1991) observed that, once a dendogram has been created, it is important to assess goodness of fit to the original correlation matrix input. Guidance in three types of robust fit is required. First, an assessment of fit between the dendogram and input similarities is needed. Second, an assessment of internal dendogram stability is needed. Third, guidance on the most appropriate number of clusters is required.

Global dendogram fit was conducted using Cophenetic Correlation Coefficient (CPCC) analysis. In Everitt and Dunn's words, this is the "product moment correlation between the entries of the dissimilarity matrix and those of the cophenetic matrix" (p. 108). The cophenetic matrix is a numeric array of the points at which pairs of objects cluster together for the first time. A larger CPCC indicates a better summary of the original similarity matrix. Rohlf and Fisher (1968) and Rohlf (1970) argued that CPCC values of .8 and above are acceptable. A cophenetic correlation of .87 was obtained for the dendogram in Figure 8.7, indicating a sound dendogram to cluster fit.

Earlier discussion noted that several methods were available for prescribing variable clustering policy. These included single linkages and complete linkages. On the basis of literature evidence, the complete linkages approach to variable grouping was selected. In the interests of confirmation, the analyses were repeated with single linkage specification. This resulted in a dendogram with an inferior cophenetic correlation of .79. This reaffirmed the use of the complete linkages policy.

Dendogram stability was then examined, for two main reasons. First, dendograms can be subject to input order instability (Backeljau et al. 1996), whereby the final cluster result is subject to the order in which variables are added to the cluster mix. Additionally, the cluster method does not allow for the "reallocation of objects that may have been 'incorrectly' grouped at an earlier stage" (Johnson and Wichern 1982:554). It is for these reasons that Johnson and Wichern (1982) stressed the importance of introducing small errors or "perturbations" into the cluster algorithm and repeating the analysis. The PermuCLUSTER function was then used to randomly seed the dendogram in order to check for these issues. One hundred permutations were run using the PermuCLUSTER function, with little change in the observed cophenetic correlation value. The dendogram was deemed to be a good fit to the original correlation matrix.

Appropriate cluster fit can be assessed in a number of ways. Everitt and Dunn (1991) argued that the researcher may select the dendogram that best describes the underlying theory. However, Everitt (1980) observed that this approach may be somewhat subjective. As an alternative, Mojena (1977) argued that researchers can explore the relative sizes of the item groups. Analysis in this way suggests reasonable cluster fit. As shown in the multidimensional scaling analysis conducted earlier, variables associated with resources appeared to cluster together. A second group contained almost all of the other variables in the set. Additional separation within this cluster was difficult to undertake. More observations may have made these differences more pronounced. From this perspective, the overall cluster fit was deemed to be generally acceptable.

8.6 Group Membership According to Variables

Having determined the layout of item groups, it is now necessary to determine whether the constructs can be used to differentiate between 'larger' and 'smaller' organisations. Importantly, the criteria for what constituted a 'large' and 'small' firm were not yet known.

Two-step cluster analysis is a relatively new technique for conducting cluster analysis. As with conventional hierarchical cluster analysis, the method aims to group conceptually similar cases across a range of variables (Johnson and Wichern 1982). However, the two-step approach does not require the researcher to specify *ex ante* the number of clusters. This allows the researcher to develop a natural interpretation of cluster membership. The two-step approach is especially useful when applied to large numbers of cases or variables (Zhang et al. 1996).

The two-step cluster approach works as follows. In the first step, preliminary sub-clusters are developed using a hierarchical, agglomerative clustering approach. This clustering appears as a "Cluster Feature Tree" (CFT), where each branch represents a cluster, and each leaf represents a data item that comprises that cluster. Data items are read sequentially, and analysed in order to see if a similar leaf or centroid has already been created (Chiu et al. 2001). If a similar leaf has not yet been created, a new one is made. The completed tree at the end of the first stage reveals "centroids" (Lawless and Finch 1989) or dense data centres for each grouping. This initial clustering is usually regarded as somewhat coarse (Chiu et al. 2001).

In the second step, each sub-cluster is then merged according to the degree of improvement in distance using a log-likelihood distance measure. On the assumption that the number of centroids is less than the number of original records (i.e. at least two records cluster), each centroid is then used as a "seed" for case membership (Lawless and Finch 1989). Finally, the procedure selects the cluster group which minimises distance (maximises similarity) between cluster members.

If the researcher has not specified the number of clusters to use in the final tree (and, hence, the required 'threshold' for cluster membership), then an additional analysis stage is undertaken. The number of natural clusters is determined using either the Bayesian Information Criterion (according to Fraley and Raftery 1998) or the Akaike Information Criterion. The Bayesian Information Criterion (BIC) is "penalized by...model complexity, which is measured by the number of parameters in the model" (Chiu et al. 2001:266). A lower BIC value indicates a superior model in this regard. The most appropriate clustering occurs when the ratio of BIC changes shows the greatest jump after the initial case merge commences.

A two-step cluster analysis was run using SPSS, without prescribing the number of clusters to use. Table 8.10 shows the results of this cluster analysis. Table 8.11 shows the distribution and membership of the cluster groups. Table 8.12 shows the centroids for both clusters for each of the constructs tested.

Table 8.10 Two-step Clustering and Bayesian Information Criterion Results

Number of Clusters	Schwarz's Bayesian Criterion (BIC)	BIC Change	Ratio of BIC Changes	Ratio of Distance Measures
1	2131.844			
2	1931.923	-199.922	1.000	3.404
3	2001.728	69.805	-.349	1.151
4	2086.261	84.534	-.423	1.036
5	2174.207	87.945	-.440	1.452
6	2291.456	117.250	-.586	1.370
7	2426.215	134.759	-.674	1.086
8	2564.709	138.494	-.693	1.051
9	2705.325	140.615	-.703	1.240
10	2853.942	148.617	-.743	1.115
11	3005.994	152.052	-.761	1.190
12	3162.826	156.832	-.784	1.005
13	3319.776	156.949	-.785	1.004
14	3476.821	157.046	-.786	1.076
15	3635.627	158.805	-.794	1.013

Table 8.10 shows that the lowest BIC value occurs at k=2 clusters. According to the two-step cluster analysis conducted, two natural clusters emerge from the data. This would be consistent for cases to the analysis conducted earlier in Section 8.5.2 for overall variable clustering.

Table 8.11 Cluster Distributions and Membership

		N	% of Combined	% of Total
Cluster	1	44	27.2%	27.2%
	2	119	72.8%	72.8%
	Combined	163	100.0%	100.0%
Total		163		100.0%

Table 8.12 Centroid Profiles for Cluster Testing

		Cluster		
		1	2	Combined
Need for Co-ordination	Mean	4.1136	3.9280	3.9784
	Std. Deviation	.64577	.93889	.87112
Resources	Mean	20.8633	13.6131	15.5823
	Std. Deviation	3.23132	1.88473	3.97921
Need for Communication	Mean	4.2955	4.2966	4.2963
	Std. Deviation	.73388	.98110	.91834
Org Levels	Mean	3.1818	1.6017	2.0309
	Std. Deviation	1.41869	.75266	1.20260
Expertise	Mean	37.0000	17.2331	22.6019
	Std. Deviation	34.05126	13.31837	22.72357
Need for Control	Mean	4.0682	3.8983	3.9444
	Std. Deviation	.72810	.99047	.92750
Slack Resources	Mean	3.5227	3.3983	3.4321
	Std. Deviation	.73891	1.06329	.98515
Risk Aversion	Mean	2.4091	2.9237	2.7840
	Std. Deviation	.75693	1.03078	.98888
Risk Tolerance	Mean	2.6818	2.2966	2.4012
	Std. Deviation	1.02917	.92966	.96979
Scale	Mean	.5527	.0443	.1824
	Std. Deviation	.47902	.05114	.33857
Flexibility	Mean	3.9830	4.2055	4.1451
	Std. Deviation	.69966	.65096	.66974
Expenditure	Mean	19.9800	13.8827	15.5387
	Std. Deviation	3.05904	1.95581	3.56088
Capability	Mean	3.5000	3.4096	3.4342
	Std. Deviation	1.09379	1.03629	1.04956
Investment	Mean	19.1764	12.0757	14.0043
	Std. Deviation	3.46219	2.12037	4.06271
Structure	Mean	3.4545	3.6045	3.5638
	Std. Deviation	.61038	.85618	.79793
Complexity	Mean	129.2045	26.9492	54.7222
	Std. Deviation	540.89571	39.58030	285.23540
Distribution	Mean	2.4063	1.3864	1.6634
	Std. Deviation	1.52774	1.29628	1.43233
Employment	Mean	4.9142	1.7808	2.6319
	Std. Deviation	2.18565	1.12872	2.03864

Table 8.12 shows the magnitude of each variable in the two clusters. It can be seen, for example, that variables such as *Resources, Scale, Expertise, Complexity and Employment* are larger in cluster 1 than in cluster 2. If the clusters do represent size,

then this suggests that clusters 1 and 2 may represent larger and smaller firms respectively.

For each of the two clusters, Figure 8.8 and Figure 8.9 below show the relative composition of constructs. Appendix E contains the resulting box plots for each variable in the two cluster groups.

Figure 8.8 Variable Significance for Cluster 1

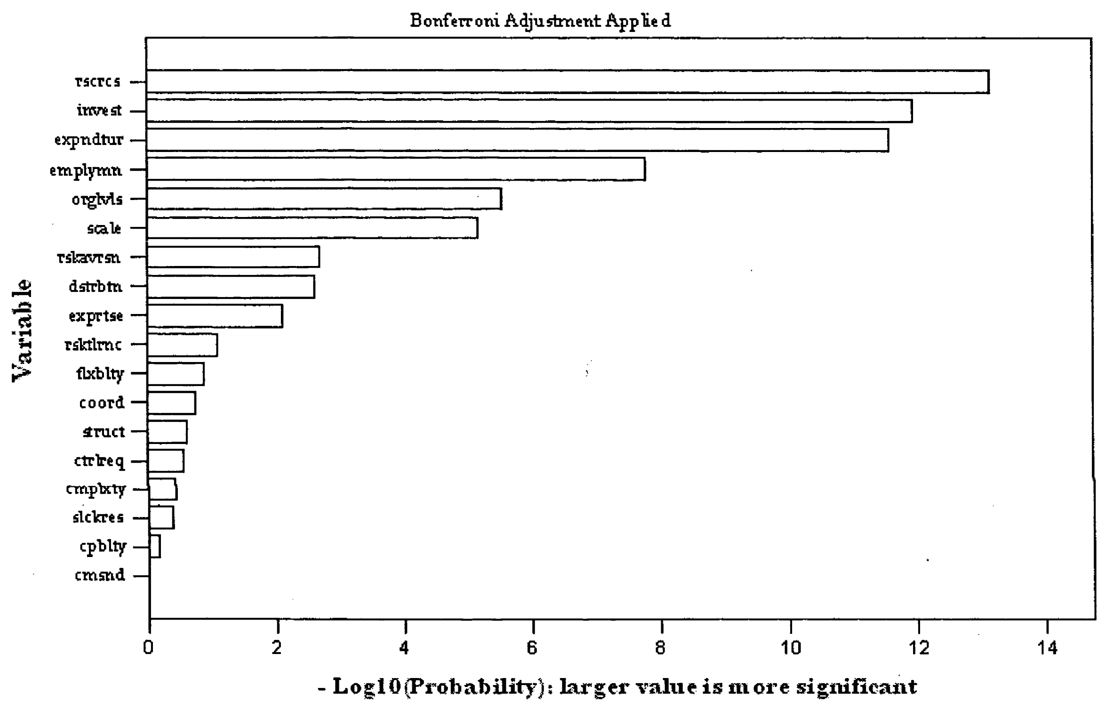


Figure 8.9 Variable Significance for Cluster 2

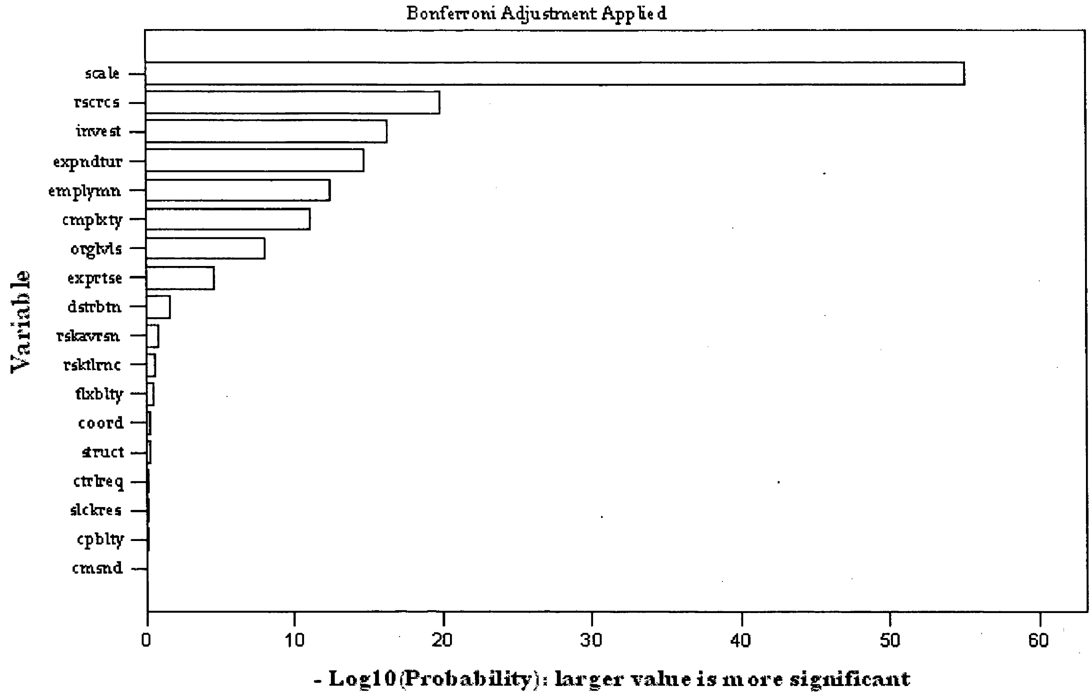


Figure 8.8 and Figure 8.9 show the significance of variables in each cluster. Variable significance varies between clusters. In cluster 1, the *Resources* variable is most significant, whereas in the second cluster, the *Scale* variable is most significant. However, overall, the largest variables are similar across clusters. These are *Resources*, *Investment*, *Expenditure*, *Scale*, *Employment*, *Organisation Levels*, *Risk Aversion* and *Distribution.*

Additional analysis was conducted in order to inform on the amount of scree in the variable clusters. The two-step cluster procedure was repeated using the stronger variables noted above. Only one firm changed groups between the two iterations: this firm had very few employees, many organisational levels, a high degree of risk aversion and large geographic distribution. This firm may have exhibited properties of a "medium size" in this regard. This secondary analysis suggests that these variables appear to group most of the firms in the sample, but it is possible that medium-sized firms will switch cluster groups as they possess qualities akin to both. It is also possible that, if researchers want to finely classify firms in their samples, they should use all the variables observed. However, if only a broad categorisation is required, a reduced set of variables may be suitable.

8.7 Group Membership According to Self-Nominated Size

Analysis was then undertaken to compare the construct-indicator of size to the self-nominated indicator of size. This would allow the researcher to make some judgement about the degree to which the theory about size and the views of practitioners are in accordance.

Several methods exist for determining group membership of a collection of items when the dependent variable is known. Among these are logistic regression and discriminant analysis. Discriminant analysis allows the researcher to predict group membership "from a set of predictors" (Tabachnick and Fidell 1996:507). Discriminant analysis is suitable in situations where the dependent variable may have more than two states. Discriminant analysis assumes that each independent variable is normal, and each categorical variable has the same variance and covariance (Grimm and Yarnold 1995).

Logistic regression allows the researcher to "predict a discrete outcome such as group membership from a set of variables that may be continuous discrete or dichotomous" (Tabachnick and Fidell 1996:575). Logistic regression is appropriate when the dependent variable can occupy one of two states. Also, the method does not require the distribution or variance assumptions discriminant analysis (Tabachnick and Fidell 1996:575). Logistic regression was deemed a suitable method to use in this case.

Firm size was used as the dependent variable. This was based on the respondent's subjective classification of their own organisation, and was coded as "0" for a self-nominated small firm and "1" as a self-nominated large firm. For the purposes of this analysis, given the smaller sample size, medium firms were grouped with large firms. The independent variables constituted the constructs observed in Table 8.9.

8.7.1 Goodness of Model Fit

The Hosmer and Lemeshow Test was conducted to assess the model's goodness of fit. This test gives an assessment of the degree to which the model significantly explains group membership. This assessment is based on the difference between the *observed* membership (according to the dichotomous variable) and the *predicted* membership (according to the independent variables). If the Hosmer and Lemeshow statistic is less than or equal to .05, then the observed and predicted memberships are significantly different. If the statistic is greater than .05, then the two groups are similar and the model is deemed to have acceptable fit. Table 8.13 shows the results of this test.

Table 8.13 Contingency Table and Result for Hosmer and Lemeshow Test

		size self-nom bi = .00		size self-nom bi = 1.00		Total
		Observed	Expected	Observed	Expected	
Step 1	1	16	15.974	0	.026	16
	2	16	15.882	0	.118	16
	3	15	15.720	1	.280	16
	4	16	15.399	0	.601	16
	5	15	14.722	1	1.278	16
	6	13	13.463	3	2.537	16
	7	11	11.108	5	4.892	16
	8	7	7.359	9	8.641	16
	9	6	4.267	10	11.733	16
	10	0	1.106	19	17.894	19
		Chi-Square	df	Sig.		
		4.995	8	.758		

Table 8.13 shows a Hosmer and Lemeshow test statistic of .758, indicating an acceptable goodness of model fit.

8.7.2 Goodness of Independent Variable Fit

The Wald statistic was used to test the significance of each independent variable in the model. The Wald statistic is the square of the *t*-statistic, which tests the difference of two means. Its distribution is equivalent to the χ^2 asymptotic distribution (Phillips 1986). Table 8.14 shows the results of this testing. For convenience, significant readings have been highlighted.

Table 8.14 Analysis of Variable Fit

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	CORD	.146	.576	.064	1	.800	1.157
	RESO	-.162	.348	.218	1	.641	.850
	COMN	-.632	.444	2.023	1	.155	.532
	ORGL	1.170	.414	7.997	1	.005	3.221
	XPTS	.011	.013	.733	1	.392	1.011
	CTRL	.717	.514	1.947	1	.163	2.048
	SLKR	.669	.369	3.281	1	.070	1.953
	RSKA	.742	.363	4.176	1	.041	2.100
	RSKT	.435	.346	1.588	1	.208	1.546
	SCAL	-1.569	1.459	1.156	1	.282	.208
	FLEX	-.347	.538	.417	1	.518	.707
	EXPN	.151	.120	1.589	1	.208	1.163
	CPBL	.140	.315	.197	1	.657	1.150
	NVST	.336	.338	.993	1	.319	1.400
	STRU	-.412	.465	.788	1	.375	.662
	CMPX	-.008	.007	1.344	1	.246	.992
	DIST	-.619	.292	4.480	1	.034	.538
	EMPL	.703	.252	7.752	1	.005	2.020
	Constant	-12.948	3.882	11.126	1	.001	.000

The results of testing in Table 8.14 show that four variables are significant, being Organisation Levels, Risk Aversion, Distribution and Employment.

8.7.3 Observed Groupings

The Class Plot is used to give an indication of overall member grouping. Figure 8.10 shows the observed groups of candidates and the predicted probabilities of their cluster membership.

Figure 8.10 Observed Groups and Predicted Probabilities

```
      40 +                                                                  +
         |0                                                                 |
         |0                                                                 |
F        |0                                                                 |
R     30 +0                                                                 +
E        |0                                                                 |
Q        |0                                                                 |
U        |0                                                                 |
E     20 +0                                                                 +
N        |0                                                                 |
C        |00                                                                |
Y        |00                                                                |
      10 +00                                                                +
         |0000                                                              |
         |00000 0    1                                          1         1 |
         |000000000000 0   1    01        1   0  011 11         1  11   1111|
Predicted ---------------+--------------+--------------+---------------------
Prob:    0              .25            .5             .75                 1
Group:   000000000000000000000000000000111111111111111111111111111111

         Predicted Probability is of Membership for 1.00
         The Cut Value is .50
         Symbols: 0 - .00
                  1 - 1.00
         Each Symbol Represents 2.5 Cases.
```

The class plot in Figure 8.10 shows that the model based on the respondents' self-nominated size indicator is able to separate most cases of observed large firms (indicated by "1") and observed small firms (indicated by "0"). However, there are firms in each group which gather on the opposite side. This may indicate cases where respondents thing their firm is 'small', however the firm is actually quite large when compared to other firms.

8.8 Conclusions

The goal of this data collection and analysis stage was to gain an understanding of how each organisation's structural characteristics sat in relation to each other. This provided an indication of the degree to which constructs clustered in a similar way in real firms as they did conceptually.

Data were gathered for this stage using a survey instrument, which yielded a response rate of 16.7% with 163 useable responses. Comparison of early and later responses did not indicate any response bias. Substantive and Alpha analysis indicated a reliable survey instrument. Respondent and population profile comparison indicated acceptable levels of respondent representativeness. Analysis suggested that research variables revealed acceptable Cronbach Alpha coefficients.

This stage of the research has made a number of findings. Cluster analysis showed that variables clustered in a similar fashion to the theoretical clustering shown in Chapter 6. However, only two main clusters were observed in practice. Cluster analysis using complete linkages suggested two main groups of variables. One appeared to depict a similar cluster to the "resources" cluster observed in Chapter 6. The second cluster appeared to reflect the "behavioural" and "resultant" clusters observed in previous analysis. Two-step cluster analysis then revealed that the two clusters may be tentatively able to distinguish between firms in terms of size.

CHAPTER 9

DISCUSSION AND CONCLUSIONS

This chapter offers concluding discussion and summary comments on the thesis and is structured as follows. The chapter first gives a summary of the study's objectives and underlying theory. The chapter then presents the study's findings in terms of the thesis' original research questions. The following section illustrates the limitations of the study. Implications of the work for researchers, practitioners and policy makers are then drawn. Finally, potential areas for further work are presented.

9.1 Summary of the Objectives and Theory Underlying the Research

Organisational size is a common construct in the information systems research literature. However, its use has been inconsistent across studies. The size construct appears to be more complex than first appearances would suggest and the problem merited deeper investigation. This study explored the organisational size construct in information systems research. The study had three main objectives.

a) *To explore and explain the meaning of "organisational size" as a construct.*
b) *To explore the methods for measuring organisational size.*
c) *To improve the use of organisational size in information systems research and theory development.*

The discussion presented below outlines how these objectives were addressed.

The study first established the relationship between phenomena, constructs and indicators. The discussion argued that the relationship between these three should be valid and reliable in the interests of developing knowledge. A construct should reflect a researcher's understanding of a phenomenon. The value of a good construct is the degree to which it reflects this understanding in a valid and reliable way: the usefulness of the size construct can be determined by the accuracy with which it reflects the phenomenon of organisational size. Similarly, the usefulness of size indicators can be determined by the degree to which they accurately proxy for the size construct. Some constructs are well understood and defined. The meaning and measurement of these constructs is generally straightforward. Other constructs are less clearly defined, or poorly understood. Reliable meaning and measurement of these constructs is more difficult.

The study then examined the substantial disagreement in terms of the construct's use in the extant research literature. This disagreement was seen in three ways. Disagreement and inconsistency was observed, first, at the construct level and, second, at the indicator level. The study then presented evidence of disagreement between individual studies in the research literature. This evidence showed that researchers have been delivering inconsistent findings with respect to size for some time over a range of topic areas. It suggested that the size inconsistency is not restricted to particular organisational research areas or subjects. The study then showed that several authors have observed the inconsistency in other studies. However, few studies have attempted to solve the problem in conceptual terms.

Given the requirements of a good construct, the study sought from the research literature a method for investigating constructs. Churchill's measure development paradigm was deemed an appropriate method for this purpose as it provided a structured approach to solving the problem in the context of validity.

In Study 1, the thesis began exploring the underlying dimensions of the construct through an analysis of the research literature. Over 2,000 research papers were read in six information systems journals in order to see what researchers understood size to mean and how they measured it. In order to determine the meaning of the size construct, each research paper was first *open coded*. This generated a substantial but not exhaustive list of concepts from the literature works. The second stage, *axial coding*, involved more clearly specifying the research areas developed in the previous stage. Specifically, this stage allowed for the linking between concepts within studies. In the third stage, *selective coding*, the individual selection items extracted in the previous stage were used to re-evaluate the literature works. This literature analysis showed that there appeared to be little agreement as to what organisational size meant. It then showed that researchers have many ways of measuring size and, in aggregate, have a large number of size indicators available. As a result of these analyses, the relationship between how size was measured and what researchers thought the construct meant appeared to be unclear. The thesis posited that this variation in understanding may at once explain and contribute to the inconsistent findings obtained in the literature.

Study 2 then sought to lend more coherent structure to these 21 constructs. The study used a concept map method (after Trochim 1989) to group the constructs. The name of each construct was written on a rectangular piece of card, with an example of the construct in a research context. Then, on the advice of Malhotra (1981) and Trochim (1989), the cards were individually distributed to 41 academics in the area of business and organisational research. Each academic was asked to group the cards into categories that they believed to be conceptually similar. Each participant's categories were entered into individual similarity matrixes which were aggregated into a group similarity matrix in order to show areas of similarity. The study found that the size constructs could be represented in three construct groupings. These groupings could be interpreted in terms of structural, behavioural and resultant aspects of firms.

In order to see how these constructs clustered in actual firms, Study 3 then conducted a survey of 1,000 Australian firms, selected at random from the business telephone directory. Cluster analysis using complete linkages, logistic regression and two-step cluster analysis were used to analyse the resulting survey data. Cluster analysis was used to see if the constructs clustered in real firms as they did in theory. Logistic regression was used to see which constructs might reflect how survey respondents saw the size of their own firms. Two-step cluster analysis was then used to determine whether the construct group could be used to distinguish between small and large firms. The SPSS and Microsoft Excel XP applications were used to conduct this analysis.

9.2 Overview of Findings

This thesis has, through three studies, made several observations regarding the size construct. Table 9.1 presents a summary of the studies undertaken in the thesis, the goals of each study and the associated outcomes.

Table 9.1 Summary of Studies and Results in the Thesis

Stage	Goals	Methods	Outcomes
Study 1	Specify conceptual domain of the organisational size construct	Literature analysis and review	▪ Organisation size has structural and non-structural relevance in the research literature ▪ The size construct has broad disciplinary relevance ▪ Literature review revealed 21 constructs underpinning the meaning of size ▪ The literature also showed 25 indicators of size in use
Study 2	Assess content validity and refine conceptual specification of the size construct	Concept mapping using a card sort exercise	▪ Constructs cluster into three main groups ▪ Cluster 1 included employment, scale, distribution, resources, expertise, slack resources, expenditure and investment ▪ Cluster 2 included organisation levels, structure, need for co-ordination, need for communication, need for control and complexity ▪ Cluster 3 included capability, economies of scale, market power, competitiveness, risk tolerance and risk aversion.
Study 3	Administer construct to sample and assess construct items and understanding	Questionnaire survey	▪ Some constructs are themselves complicated and subject to literature debate ▪ Cluster analysis with complete linkages revealed similar construct groupings to those found in Study 2 ▪ Two-step cluster analysis revealed the construct groupings can tentatively be used to differentiate between firms in terms of size ▪ Logistic regression revealed that four constructs underpin self-nominated size, being organisational levels, risk aversion, distribution and employment.

The study commenced with a set of four overarching research questions. The study's findings are presented in terms of these research questions. The thesis' findings were as follows.

1. *What does the organisational size construct mean? Is there more than one meaning? Is it a construct with a number of sub-dimensions or are there a number of different constructs?*

The meaning of size could not be easily determined solely through reading research papers in the area. However, the literature did suggest that firm size construct appears to have both structural and non-structural relevance, implying more than one meaning depending on the circumstances. Additionally, the literature evidence suggested that authors appear to lack an accepted view of the dimensions behind organisational size.

Study 1

Study 1 involved exploring the literature to examine the meaning and measurement of the size construct. There appeared to be more than one meaning of the size construct in the literature. The size construct appeared to have three main underlying dimensions. Whereas the literature appears to treat size as a unidimensional construct, most appropriately measured with a single indicator, the evidence presented in this thesis suggests that size is more complex than had previously been thought. Further, the analysis has shown that it is unlikely that a single size indicator could adequately proxy for size in an operational context.

The literature analysis revealed 21 underlying dimensions of the size construct. Deeper exploration of each of these constructs revealed that some of them, such as employment, were well understood and measured in the literature. However, others, such as *Economies of Scale*, were much more complex. In addition, some of these dimensions appeared, themselves, to be subject to significant literature debate in terms of both meaning and measurement. This suggested that size itself had varying meanings in the literature, as did some of its constituent dimensions.

The revised size construct comprised three main dimensions, tentatively called structural, behavioural and resultant. Only one of these dimensions is entirely resource-focused, such that a single indicator may not accurately capture all three dimensions at once.

Study 2

The card sort and multidimensional scaling analysis conducted in Study 2 revealed that these 21 underlying dimensions could be clustered into three distinct groups. Substantial dissimilarity was present in the card sort among these three clusters. One possible interpretation of this is that there are three separate meanings present across all the constructs found in the literature.

Study 3

Study 3 involved determining indicators for the constructs used in the previous two studies. These were operationalised in a survey of 1,000 firms. Cluster analysis of data from the sample of firms revealed two main clusters. One of these clusters, which focused on resources, was similar to a resources cluster present in the card sort exercise.

2. *Is there evidence of more than one construct/meaning in prior literature? How well have the different meanings been distinguished/explicated previously?*

The analysis presented in this thesis suggests a number of interpretations of the size construct in the research literature. The thesis found that firm size is important in a range of disciplines, including business analysis, organisation science, psychology and sociology. This suggested the possibility of a range of viewpoints on what size means.

The early business literature appeared to inherit theory about the nature of size from the analysis of social organisations such as tribes and families. The work of Caplow was instrumental in this regard. The literature on social organisations focused on the behaviour of groups of humans: the size of such organisations was generally appropriately measured using the number of employees. Accordingly, much of the older business literature measured size according to the number of employees. However, the meaning of size in this early literature appeared to have more than purely structural relevance. The evidence presented in this thesis suggests that this early research understood size to also have other non-structural aspects.

The analysis of the size as a construct in the information systems literature showed a range of applications and perspectives. The literature search identified 21 dimensions of size. While there did not appear to be significant agreement between authors about what size means, there also appeared to be very little overt *disagreement* between authors. That is, there was very little evidence of conflict in understanding between authors. One reason for this could be that few papers had gone into significant critical detail about the construct. This meant that the various meanings of size did not appear to be explicit or exclusive. As a result, authors could argue that size had a particular meaning without being in significant conflict with the comments of other authors.

The evidence suggests that the different meanings of size have not been well distinguished in the literature. A number of studies offered no discussion about their understanding of what the size construct meant. Some papers did not mention their choice of, or justification for, the indicator used to measure size. As a result, there was little evidence that the indicator used was able to adequately capture all of the dimensions of the size construct. Further, because there was a range of size indicators available to the researcher and there was no clear match between measurement and meaning, the extent of this disagreement was not immediately clear.

3. *How is the size construct measured? How should the size construct (or constructs) be measured?*

Size is measured in a variety of ways in the research literature. Evidence from the literature search revealed 25 indicators for organisational size in use in the research literature. These included *Annual Sales*, *Annual Revenue*, *Number of Employees*, *Self-nominated Size* and *Total Assets*. Of these indicators, the *Number of Employees* was the most common in the literature. Analysis of data from sample firms revealed that some of these structural indicators were highly correlated, consistent with earlier evidence from Shalit and Sankar (1977). However, Pearson correlation analysis revealed that, despite this, the indicators did not give equivalent results. This suggested that the indicators were not interchangeable.

Reasons for this multitude of indicators were not immediately clear. It may be because many studies took their definitions from the seminal literature of structuralist perspectives, such as the Aston Business School studies. These typically focused on structure and "configuration", without adequately capturing behavioural aspects of the construct. Similarly, early studies in the area of tribes and families (such as Caplow

1957) used the *Number of Employees* indicator to measure the size of social organisations and recent authors have carried this analysis over to commercial organisations. The ease with which quantitative data are available may explain the frequent use of some indicators. Kimberly (1976) observed that many researchers use the indicator which appears easiest to use.

This study was motivated, in part, by the discrepancies apparent in the contemporary research application of size indicators. The findings bear out this discrepancy: the analysis showed that the use of a single size indicator is not well suited to the analysis of the organisational size construct. By measuring organisational size using only a single indicator, such as the *Number of Employees*, researchers risk neglecting a substantial part of the size construct.

In determining how size *should* be measured, the thesis first explored what size meant. The thesis approached size measurement by determining the dimensions underlying the size construct, and then finding empirical indicators for these dimensions. A literature search for indicators for each of the 21 constructs was conducted. Measurement requirements meant that indicators for *Market Power*, *Competitiveness* and *Economies of Scale* could not be found. Indicators for the remaining 18 constructs were operationalised in a survey instrument in Study 3.

Measuring size using indicators for all 18 constructs resulted in a lengthy survey instrument. Additional analysis showed that, for firms in this data set, eight constructs were sufficient to distinguish between firms, tentatively in terms of their size. These were *resources*, *investment*, *expenditure*, *scale*, *employment*, *organisational levels*, *risk aversion* and *distribution*. It is possible that a reduced set of indicators based on these constructs may provide a balance between faithfully representing the construct and reducing survey length. Nunnally (1978:98) wrote, "by combining the information from a number of particular measures relating to a construct, one can increase the validity of the scientific generalization over that which would be obtained from employing only one measure".

4. *What does this enquiry into the nature of the size construct mean for theory in information systems? How can theory that uses the size construct as an independent variable or dependent variable be made more sound?*

Given the variety of theory types in information systems, this research question is answered, first, in terms of theory *about* size itself, and second, in terms of theory *involving* size as a construct.

For Theory About What Size Means

This thesis posits that, contrary to arguments of Thong (1999), the information systems discipline does not need separate theories for small and large business. Rather, more consistent understanding of size as a construct and improved indicators are required.

Based on the grouping shown in the two-step cluster analysis, the following contentions regarding 'small' and 'large' firms could be made. Based on the first cluster, 'smaller' firms may possess fewer structural resources. That is, smaller firms are likely to have fewer employees, less experience, lower degrees of investment, fewer resources and fewer slack resources. Iacovou and Benbasat (1995) wrote, "Because small organisations tend to lack such resources, their ability to receive all strategic benefits of the technology is usually limited". The findings strongly suggest, however, that the mere sum of resources on its own does not faithfully reflect the size construct.

Such an approach may neglect how those resources are employed and managed within the firm, in addition to the resultant effects of this application across the firm.

Based on the second cluster, smaller firms may have fewer organisation levels, less need for communication, co-ordination and control, and less complexity. If such firms have greater requirements for communications and co-ordination, then this may explain why some studies have found that 'larger firms' (according to the *Number of Employees*) adopt information systems and IT. However, even if the *Number of Employees* is high or the firm's distribution is large, the organisation may not adopt IT if their level of expenditure or slack resources is low.

Each construct in the third cluster is still subject to substantial literature debate. Tentatively, smaller firms may have less market power, fewer capabilities, may be more flexible but less competitive and are unlikely to possess economies of scale. Additionally, these firms may be more averse to risk and less tolerant of actual exposure to risk. For instance, a firm may have large amounts of resources and hence greater complexity. However, increased complexity may result in lower flexibility.

For Theory Involving Size

Research that uses the size construct can be made more sound in a variety of ways. First, research can be improved through an improved understanding of what size itself actually means. The evidence suggests that very few authors have attempted to narrow and define the size construct. Greater agreement in this regard may assist in addressing some of the inconsistencies which have arisen in the extant literature. Following this, the use of indicators which better reflect this conceptual understanding of the size construct will also improve this research. While purely structural indicators for size may be highly correlated, they can not necessarily be used interchangeably. Similarly, using individual indicators such as *Number of Employees* may ignore the effects of the other constructs within the cluster groupings.

Discussion presented in Chapters 3 and 5 noted that the size construct was particularly important in theories about technology adoption. These adoption theories would benefit from a better understanding of the size construct in a number of ways. First, different technology may appeal to or support different aspects of the firm. Using a single indicator, such as *Number of Employees,* to quantify this adoption may not give reliable results as not all of these effects may be captured. Second, a more consistent understanding of the size construct should support comparability between studies into different technology products. In this way, researchers can be more certain that the differences seen in adoption patterns are to do with the technology under analysis and not the constructs or indicators in use.

Research can also be improved through the use of more than one firm size indicator. The evidence presented in this thesis suggests that, most importantly, if proper attention is not paid to the size indicator used, studies risk delivering erroneous results. Further, these results may not be consistent with the literature theory on a broader scale. In the words of Hitt and Brynjolfsson (1996:122), "Our findings do highlight the fact that the answers one gets will depend on the questions one asks and how one addresses them, even when the same data are used". The continued use of purely structural indicators may mean that findings cannot be compared between studies. This reduced comparability could mean that the information systems research literature is internally inconsistent.

The results presented in the thesis also suggest that, consistent with Kimberley (1976), a single univariate size indicator may not be applicable to all organisations at once because these firms may possess contextual differences which render them idiosyncratic. Further, if size indicators are not interchangeable, then perhaps each measurement item is capturing a different aspect of the firm's profile. This raises the possibility of intervening effects between measurement items such that simply using more than one indicator (as in Child 1973) will also deliver unpredictable effects if the indicators are not used in the correct proportions. The implication of this argument is that simply using more than one indicator is not the convenient solution it appears to be.

9.3 Research Implications

Bearing in mind the limitations raised in the previous section, the findings of this study have implications for a number of groups. While arguably focused on research development, the thesis is relevant to practitioners, regulatory groups and researchers alike. The relevance to each group is discussed below.

9.3.1 Implications for Researchers

Arguably the largest group of benefactors of this research is the information systems research community. The theoretical model developed in this study should assist this group in developing and explaining extant theory with respect to organisational size. The implications for researchers are as follows.

First, the examination of organisations in the information systems literature is a popular topic. Research into technology adoption, in particular, is prevalent. This popularity has been fostered by substantial discussion in the disciplines that underpin or are related to information systems, such as accounting, management and organisation science. However, the competing viewpoints published therein have meant there are varying views of organisations, consistent with the words of Mason and Mitroff (1973): "there is a large, if not infinite, number of ways of discussing the influence of organisational structure on the design of MIS". Similarly, research into adoption, where firm size is frequently used as an independent variable, is subject to much debate (Swanson 1994).

With respect to the meaning of size, and despite arguments of Chin and Todd (1995) that a reliable definition is key, there does not appear to be any agreed definition of the size construct, possibly due to or because of the tacit understanding of the construct. Size is held to be one of the most important aspects of organisational analysis in the literature (Blau and Schoenherr 1971, Miller and Conaty 1980, Kimberley and Evanisko 1981, Aldrich and Marsden 1988, Lind et al. 1989, Kalleberg and Van Buren 1996). However, one implication of the findings in this thesis is that organisational size, as a construct, has more than just structural relevance. It may also comprise a behavioural component. To this end, Ford and Slocum (1977:569) wrote:

> *"It appears that many researchers believe all measures of size are measures of organisation size, but this may not be the case. Rather, it seems beneficial to distinguish between two types of size - size of the organisation and size of the domain and/or its task environment...one form of size (domain) will influence an organisation's size in that the domain determines the volume of work required...some current approaches treat size as a homogenous variable, ignoring the qualitative differences in its composition"*

Given this contention, adopting a purely structural approach to measurement (such as using *Number of Employees* as an indicator of size) may be ineffective and possibly erroneous.

Second, researchers in the information systems field should continue pursuing methods external to the information systems discipline. Information systems already benefits from a variety of research approaches (Galliers 1992) based largely on information systems' foundation disciplines. While some argue that researchers should begin to reference information systems studies at the expense of other disciplines (Baskerville and Myers 2002), it could be argued that information systems benefits from this "cross-pollination" (Prakken and McNamara 1998). The use of research approaches from outside the core information systems discipline has, to date, resulted in a fertile and diverse body of research approaches and topics (Keen 1980). It would be of benefit to continue this tradition. This study has adopted two research approaches, textual post-coding and multidimensional scaling, that are not strictly within the information systems domain. These methods have proved useful in the exploration of a problem that has plagued the research literature in general (and the information systems literature in particular) for some time.

With regard to the measurement of size, the main implication arising from this thesis is that there appears to be little agreement as to size indicators. These indicators do not appear to be equivalent or easily interchangeable. Additionally, there appears to be little correspondence between what size means and how it is measured. In order to address this situation, researchers should use an indicator of size which is better related to the size construct.

It is also important to note that studies may use an incorrect or inaccurate size indicator but by chance still end up with a correct answer (in terms of a finding that reflects the "true" state of size). Given the occasionally tenuous relationship between size measurement and meaning, it is also possible that researchers can make correct observations using an unsound indicator but sound theory.

With regard to gathering data, the evidence presented in this thesis suggested that finding size indicators for each dimension of size may lead to a large, impractical survey instrument. Such a survey may leave little room for other research variables and its length could also deter response. Within this, researchers should avoid selecting size indicators according to data availability alone. Yankelovich (1972) described this as McNamara's fallacy:

> *"The first step is to measure whatever can be easily measured. This is OK as far as it goes. The second step is to disregard that which can't be easily measured or give it an arbitrary quantitative value. This is artificial and misleading. The third step is to presume what can't be measured easily really isn't important. This is blindness. The fourth step is to say that what can't be measured really doesn't exist. This is suicide."*

Instead, researchers could consider using a smaller set of indicators for *resources*, *investment*, *expenditure*, *scale*, *employment*, *organisational levels*, *risk aversion* and *distribution*.

Additionally, because the analysis of large firms (such as those listed on the Australian Stock Exchange) is popular in the literature, substantial data concerning structural characteristics may be available. It could be argued, however, that these data items may not be as easy to obtain for unlisted companies. Many of these unlisted firms are deemed to be "small business". This is important if researchers wish to examine these smaller businesses, or to compare larger and smaller firms.

9.3.2 Implications for Practitioners and Managers

Practitioners and managers may benefit from the study in the following ways. First, managers should be aware that inconsistency can exist across indicators of organisation size. Hence, when attempting to quantify size, they should aim to use more than one approach to measurement. The evidence in this study suggests that the eight indicators of *resources*, *investment*, *expenditure*, *scale*, *employment*, *organisational levels*, *risk aversion* and *distribution* may be suitable for this purpose. Additionally, when reviewing studies that measure size with just one indicator, practitioners should bear in mind this inconsistency.

Practitioners may also have clients which are observing inconsistency with regard to size-based tax or employment assessments. These clients should be made aware that the measurement of size depends on the indicators selected for this purpose. Additionally, while these indicators may be widespread and highly correlated, they will not necessarily give the same results in actual testing.

The inconsistency observed in this thesis may extend to popular understanding of small to medium sized enterprises (SMEs). Otherwise common statements such as "resource poverty" may have a slightly different meaning and implication when viewed in the light of this new understanding of organisational size. Practitioners should bear in mind that other factors can affect the size of the firm and it is these antecedent factors which can mean that a "small firm" may or may not exhibit resource poverty.

9.3.3 Implications for Policy Makers

The findings from this study may have implications for policy development in the following ways.

Evidence presented in Chapter 1 showed that policy makers sometimes have difficulty gathering accurate firm-level data. This makes domestic and international comparison difficult. If one goal is efficient data collection, policy makers could consider using the eight indicators of *resources*, *investment*, *expenditure*, *scale*, *employment*, *organisational levels*, *risk aversion* and *distribution* for a more theoretically sound proxy for the size construct.

Some of the firms that are of interest to policy makers may have transnational interests, engaging in businesses in other countries and owning or being owned by foreign interests. The analysis of financial indicators in this regard can be difficult for several reasons. First, accounting standards are frequently incompatible across nation states. The process of determining Gross Revenue, for instance, depends heavily on what constitutes acceptable revenue sources and non-expensable items. Additionally, for "publicly traded firms...concentrated in high-tech industries, a large fraction of their assets are firm-specific or intangible" (Carpenter and Petersen 2002), making size measurement using *Total Assets* difficult. Second, the consolidation of financial documentation can make extracting values for partially-owned subsidiaries difficult. Different naming conventions across reporting jurisdictions will also impede this process.

Third, certain industries may pose difficulties when extracting data. For instance, mining and speculative exploration firms may push financial revenue and profit into the future, realising returns on investment at a later stage. Accordingly, in these circumstances, indicators for gross revenue or annual profit may be low until the firm makes a discovery. However, mining operations typically involve substantial human resources. This would result in an inflated *Number of Employees* indicator. Firms in these industries could hence be both "large" *and* "small" at the same time.

Finally, it is also possible that resource subsidies for small businesses may not be equally useful to every firm because of the different ways in which the size of the organisation can be measured.

9.4 Limitations

The study may be open to a number of limitations which should be considered when examining the findings of this research. Cook and Campbell's (1979) Threats to Validity framework is used to present these limitations in terms of threats to internal, external, construct and statistical validity. Limitations to the literature search in Study 1 were discussed in Section 5.6. Limitations of the card sort exercise in Study 2 were discussed in Section 6.4. Similarly, limitations of the survey data set in Study 3, including normality and outlier analysis, were discussed in Section 8.3. Limitations to the rest of the study are discussed below.

9.4.1 Internal Validity

Internal validity describes the degree to which "a relationship between two variables is causal" (Cook and Campbell 1979). Possible threats to internal validity are discussed below.

There may be a limitation over diffusion of treatments with respect to the survey, as the researcher had no control over the instrument once it had been sent to the sample firms. There is no guarantee that sample members approached or completed the survey instrument in the same way.

There may be a selection limitation present in the survey testing. For the sample, candidate firms were selected from the Yellow Pages, an advertising directory. There is no guarantee that the businesses sampled are representative of the population of Australian firms. Additionally, this directory only includes businesses that have paid to advertise in the directory.

It is possible that some of the firms surveyed may be exhibiting a type of survivorship bias. For instance, Thompson (1967) argued that firm size may indicate organisational fitness. In other words, older firms may be perceived as more successful because they are larger, and larger firms will hence inherently be older as larger firms will require time to grow in capacity and "scale" (Bogue 1972).

9.4.2 Construct Validity

Construct validity describes the "extent to which an operationalisation measures the concept it is supposed to measure" (Bagozzi et al. 1991:421). Aspects of limitation to construct validity are discussed below.

Inadequate preoperational explication of constructs may affect the survey. Each size dimension observed in the literature was measured using indicators from the research literature. Supporting discussion was also given. However, for some dimensions, alternative measurement approaches are used in the literature, and those used in this research may not be definitive. Also, some of the dimensions are complex and may be better proxied for using other indicators. Instrument pilot testing through cognitive interviews has hopefully alleviated respondent misunderstanding. It is also possible that there are some components of the organisational size construct that have been accidentally overlooked. While this is unlikely given the breadth and extent of the literature search conducted in this study, the possibility of missed items cannot be discounted.

Mono-operation bias has hopefully been alleviated through the use of several research approaches throughout the study. The overall research was conducted according to Churchill's (1979) measure development paradigm. Research bias analysis was conducted using Cook and Campbell's Threats to Validity framework and Nunnally's (1978) response bias list. Item generation was guided by Loevinger's prescriptive directions for item generation. Method selection was conducted using Jenkins' guidelines for method selection. Empirical conceptual development was conducted using Trochim's Concept Map approach. Size dimension searching was conducted using Strauss and Corbin's (1998) and Neuman's (1994) response post-coding program. The survey instrument was developed with reference to the prior literature, and used the advice of Dillman (1978) and Straub (1989). Discussion of results was conducted using the advice of Perry (1998).

The selection of these frameworks was important. No single, comprehensive framework or process could be found in the literature to address the curious problem matter in this study. Additionally, the researcher was particularly concerned about lending structure and rigour to the study wherever possible. The use of these frameworks was hence deemed important to the study's scientific approach and the approach was not dissimilar to those seen in other studies involving Churchill's measure development paradigm (as observed in Chapter 4). Importantly, however, the effect of such diverse approaches may be substantial. Further analysis of the findings presented in this study may shed additional light on this matter. Perhaps, with time and work, a more homogenous approach could be developed for cultivating constructs based on literature concepts and participant understanding.

The effect of survey non-response bias may be substantial. The survey obtained a response rate of 16.3%. While this was observed to be generally similar to other studies of Australian commercial markets, the low response rate may mean some response bias is present. Evidence from the non-response analysis suggested no significant difference between early and later respondents, suggesting minimal effect of such bias.

The effect of evaluation apprehension and experimenter expectancies may affect the results. The survey cover letter, written by the researcher, encouraged sample members to respond to the study. Respondents may have tried to signal favourable business conditions in order to appear healthier. In order to counter these potential effects, the survey instrument contained some open-ended questions and non-threatening language was also used. Some survey questions required opinion-based responses, however no other ways of measuring those constructs could be sourced from the literature. The survey and cover letter were also developed so as to have minimal impact on the recipient: clearance from the university Ethics committee was obtained in this regard.

There may also be a limiting effect of confounding constructs and levels of constructs. The literature search in Study 1 revealed 21 constructs, of which 18 were operationalised in a survey instrument in Study 3. While cluster analysis revealed that eight constructs were sufficient to separate small and large firms in the sample, the required weighting of each construct is not known and the study assumed that each construct would be equally weighted in the construct mix. Further testing may shed more light on this potential effect.

9.4.3 External Validity

External validity describes the degree to which "an observed causal relationship should be generalised to and across different measures, persons, settings and times" (Calder et al. 1982:240). Possible limitations to external validity are discussed below.

First, there may be a limitation of selection. Respondents to the survey instrument were self-selecting and the researcher cannot be sure that these respondents were wholly representative of the population of firms. In this regard, the findings may pertain only to those sample members that responded to the survey. Similarly, a literature search conducted using a different set of journals may lead to a different set of size dimensions. While the number of papers searched was large, the possibility of this effect cannot be discounted.

Second, there may be a limitation of setting. The findings may be limited to the study's single geographical region and subsequent replications of the study in other countries may deliver different results.

Third, there may be a limitation of history. The survey method provides data from a single period in time. Surveys conducted at later times may deliver different results due to environmental changes.

9.4.4 Statistical Conclusion Validity

Statistical conclusion validity concerns the degree of application, robustness and inferential appropriateness of the statistical methods (Cortina 2002). This thesis used a variety of statistical techniques in its data analysis, including multidimensional scaling, hierarchical and two-step cluster analysis, logistic regression, Pearson correlation analysis and log transform normalisation. Potential limitations in this regard are discussed below.

The threat of low statistical power may affect the results of the survey. There were 163 useable responses to the survey. Literature evidence suggested that this was sufficient for cluster analysis. However, a larger data set may have improved the predictive power of the statistical tests.

The assumptions of statistical tests may affect the tests in terms of normality. A number of studies (such as Hickson et al. 1969 and Kimberley 1976) have shown that organisational size and age can exhibit significant skewness and kurtosis. That is, measures of organisational age, for instance, tend to be skewed towards the lower bound, and not towards the point of centrality. Intuitively, there are more smaller, younger firms than there are larger, older firms (due to natural attrition, takeovers and mergers) (Hart 1962). The potential skewness and kurtosis suggests possible population non-normality. The affected items were normalised to alleviate this.

The reliability of measures limitation may affect the dataset. Cronbach Alpha analysis indicated acceptable levels of item reliability. Where low Alphas were obtained, the number of items was reduced. However, it was not possible to conduct test/retest reliability analysis on the survey. While the instrument used question items from the prior literature, the potential effect of this limitation cannot be discounted.

Some of the independent variables used in this study were found to be significantly correlated. Hence, it is possible that the significance of the statistical testing may be affected in part by random irrelevancies affecting the statistical tests, despite the application of sampling controls. Additionally, Goodness of Fit testing was conducted where possible, such as the Hosmer and Lemeshow Test, the Wald statistic for logistic regression and cophenetic correlation testing for the cluster analysis.

Random irrelevancies in the test setting and random heterogeneity of respondents may affect the statistical testing. Sample members were restricted *ex ante* to Australian commercial firms in order to mitigate some of these effects. However, it is still possible that otherwise unobserved factors may have produced the results observed in statistical testing. Hopefully, a replicated study in the future may bear this concern out.

9.5 Future Work

The research presents several fertile avenues of further research. First, the study beckons a wider selection of journals for the purposes of gathering size dimensions. In particular, the inclusion of publications not wholly devoted to information systems (such as *Management Science* or *Decision Sciences*) or even outside of information systems altogether (such as *Organizational Science* or *Operations Research*) would make a valuable contribution to the robustness of the study by confirming or adding to the list of dimensions already obtained. In future developments of this study, this period could be extended back to the inception of these journals.

Second, the study would welcome the examination of a larger time period: the formative years of the late 1970s and early 1980s (Robey 1981), when computer technology was moving into the realms of widespread affordability, would provide valuable insights into the behaviour of organisational size. In tandem, these two research extensions would make for a formidable and informative study.

A third avenue for research concerns the deeper examination of organisational size indicators. Specifically, further exploration of the ways in which the use of different size indicators affects research outcomes would be of benefit. For instance, the analysis of which indicators suit which industries or research domains may assist in exploring firms in different sectors. Similarly, indicators could not be found for some constructs. Silberston (1972), for example, argued that "market power" might be better suited to business analysis than "organisational size": the degree to which this is correct could make for valuable research.

This thesis covers the first two stages of Churchill's measure development paradigm. To this end, Bollen (1989:268) wrote,

> *"In virtually all cases we do not expect to have a completely accurate description of reality. The goal is more modest. If the model...helps us to understand the relations between variables and does a reasonable job of matching (fitting) the data, we may judge it (the model) as partially validated. The assumption that we have identified the exact process generating the data would not be accepted."*

Further research that encompasses the third stage of the measure development paradigm may deliver additional insight into the size construct.

Discussion presented in Chapter 1 argued that the findings of this study were aimed at the information systems discipline, however it may constitute a basis for work in other disciplines. Additional analysis using a wider range of journals may also afford a comparison between information systems-related organisational size dimensions and those found in other disciplines. Further analysis of the data collected from the literature analysis may also provide additional insight into how size is used, how important the construct is to individual research projects and how these have changed over time. Again, this analysis may serve to confirm this study's findings.

Different types of statistical analysis may also benefit the research community. For instance, there is evidence that time-series measurement of firm size may require different indicators to cross-sectional analysis (consistent with Winsten and Hall 1961). Similarly, a larger survey with a greater response rate might provide further insight into the cluster analyses presented in this thesis.

The discussion of intra-study discrepancy has highlighted the confusion that can arise when pursuing research into abstract phenomena. Other constructs in information systems are also in need of critical review. For instance, authors such as Zammuto (1982) and Weill and Olson (1989) argued that the "firm performance" construct may also be poorly founded or inadequately understood across studies. The group of methods used in this thesis may allow researchers to examine these other constructs in the same way. The careful examination of these circumstances would be of indubitable benefit to the information systems research, practitioner and policy-making groups.

Finally, there may be some interaction between the three size clusters observed in Chapter 6. For instance, fewer resources may mean less need for communication. This in turn may result in heightened flexibility as it is easier to mobilise the firm for new circumstances. Similarly, greater employment and experience may result in more organisational levels and, coincidentally, greater organisation-wide capability. This contention, coupled with the possibility that the other items may have intervening effects, suggests that organisational size is highly complex. This future work might also explore different interpretations of the cluster model, possibly using more than three clusters as a basis for argument. Future research to explore these possible interaction effects would be of benefit.

9.6 Conclusions

This study has shed light on the nature and reasons for the inconsistency surrounding the size construct in the information systems literature. Organisational size is at once so popular yet at the same time so contentious because there is no clear agreement about what size means as a construct, nor how it should be measured. Further, the current approaches to measuring size may not capture all the aspects of size.

The overall size construct appears to comprise three principal dimensions and is not a single-faceted concept as a univariate measurement approach would suggest. This multidimensionality may partially explain why researchers have obtained inconsistent, inaccurate or erroneous results in the past.

The second point to observe is that each of these dimensions is markedly different. Importantly, whereas many indicators have focused on firm resources, one dimension of the construct appears to suggest a more behavioural aspect to size. Further, the third dimension may partially depend on the matching of these two dimensions in terms of resultant size dimensions.

This study contributes to knowledge in the following ways. First, it has developed a list of the dimensions which underpin the size construct and the indicators for measuring size in the information systems literature. There is no evidence of a similar catalogue in the published research literature.

Second, the thesis used a variety of empirical methods to explore the relationship between dimensions of firm size. The thesis then developed an approach to measuring firm size which is closely related to the construct's theoretical underpinnings. The thesis has applied this new understanding of the size construct in an operational setting. The thesis has shown that the outcomes of empirical testing can be affected by the size indicator used. There have been very few studies that have explored the size construct in this depth.

With information systems researchers seeking recognition and legitimacy for the discipline (Baskerville and Myers 2002, Lyytinen and King 2004), it is important to ensure that this reputation is for considered scholarly work brought about through careful design and sober reflection. This study has explored an important construct in the organisational research literature and attempted to explain why results from the construct's use have been inconsistent.

REFERENCES

Aaby, N. E., Slater, S. F., 1989, "Management Influence on Export Performance: A Review of the Empirical Literature 1978 – 1988", International Marketing Review, Vol. 6, No. 4, 7 – 22

ABS (Australian Bureau of Statistics), 1999, "Small Business in Australia Update 1997-1998", Australian Bureau of Statistics, Canberra, Australia

ABS (Australian Bureau of Statistics), 2002, "Changes to Economic Statistics as a Result of Taxation Reform", Australian Economic Indicators, Australian Bureau of Statistics, Canberra, Australia

Aczel, A. D., 1993, Complete Business Statistics, 2nd Ed., Richard Irwin Publishers, Illinois

Adams, G. R., Schvaneveldt, J. D., 1991, Understanding Research Methods, 2nd Ed., Longman Publishing, New York

Adhikari, A., Lebow, M. I., Zhang, H., 2004, "Firm Characteristics and Selection of International Accounting Software", Journal of International Accounting, Auditing and Taxation, Vol. 13, No. 1, 53 – 69

Ahire, S. L., Golhar, D. Y., Waller, M. A., 1996, "Development and Validation of TQM Implementation Constructs", Decision Sciences, Vol. 27, No. 1, 23 – 56

Ahituv, N., Neumann, S., 1990, Principles of Information Systems for Management, 3rd Ed., Wm. C. Brown Publishers, Dubuque, Indiana

Ahituv, N., Neumann, S., Zviran, M., 1989, "Factors Affecting the Policy for Distributing Computing Resources", MIS Quarterly, Vol. 13, No. 4, 389 – 402

Ahituv, N., Zif, J., Machlin, I., 1998, "Environmental Scanning and Information Systems in Relation to Success in Introducing New Products", Information and Management, Vol. 33, No. 4, 201 – 211

Ahn, S., Denis, D. J., 2004, "Internal Capital Markets and Investment Policy: Evidence from Corporate Spinoffs", Journal of Financial Economics, Vol. 71, No. 3, 489 – 516

Aiken, M., Bacharach, S. B., French, J. L., 1980, "Organisational Structure, Work Process and Proposal Making in Administrative Bureaucracies", Academy of Management Journal, Vol. 23, No. 4, 631 – 652

Aiken, M., Hage, J., 1971, "The Organic Organization and Innovation", Sociology, Vol. 5, No. 1, 63 – 82

Aldrich, H. E., Auster, E. R., 1986, "Even Dwarfs Started Small: Liabilities of Age and Size and Their Strategic Implications", In B. M. Staw, L. L. Cummings

(Eds.) Research in Organizational Behavior, Vol. 8, 165 – 198, JAI Press, New York

Aldrich, H. E., Marsden, P. V., 1988, "Environments of Organizations" in Handbook of Sociology, N. Smelser (Ed), Sage Publications, Beverly Hills, California

Ali, A., Swiercz, P. M., 1991, "Firm Size and Export Behavior: Lessons from the Midwest", Journal of Small Business Management, Vol. 29, No. 2, 71 – 79

Al-Khaldi, M. A., Wallace, R. S. O., 1999, "The Influence of Attitudes on Personal Computer Utilisation Among Knowledge Workers: the Case of Saudi Arabia", Information and Management, Vol. 36, No. 4, 185 – 204

Allen, J. W., 1998, "Capital Markets and Corporate Structure: the Equity Carve-outs of Thermo Electron", Journal of Financial Economics, Vol. 48, No. 1, 99 – 124

Anandarajan, M., Arinze, B., 1998, "Matching Client/Server Processing Architectures With Information Processing Requirements: A Contingency Study", Information and Management, Vol. 34, No. 5, 265 – 274

Anastasi, A., 1982, Psychological Testing, 5th Ed., Macmillan Publishers, New York

Anderberg, M. R., 1973, Cluster Analysis for Applications, Academic Press, New York

Anderson, J. C., 1987, "An Approach for Confirmatory Measurement and Structural Equation Modeling of Organisational Properties", Management Science, Vol. 33, No. 4, 525 – 541

Anderson, J. C., Schroeder, R. G., Tupy, S. E., White, E. M., 1981, Materials Requirements Planning: A Study of Implementation and Practice, American Production and Inventory Control Society, Falls Church, Virginia

Anderson, T., Warkov, S., 1961, "Organizational Size and Functional Complexity: A Study of Administration in Hospitals", American Sociological Review, Vol. 26, 23 – 28

Ang, S., Straub, D. W., 1998, "Production and Transaction Economies and IS Outsourcing: A Study of the US Banking Industry", MIS Quarterly, Vol. 22, No. 4, 535 – 552

Angoff, W. H., 1988, "Validity: An Evolving Concept", in H. Wainer, H. I. Braun (Editors), Test Validity, Lawrence Erlbaum Publishers, New Jersey

Arrow, K. , 1962, "Economic Welfare and the Allocation of Resources for Invention", in Nelson, R. (Ed.), The Rate of Inventive Activity, Princeton University Press, Princeton, New Jersey

Arrow, K. J., 1994, "Methodological Individualism and Social Knowledge", The American Economic Review, Vol. 84, No. 2, 1 – 9

Asthana, S. C., Mishra, B. K., 2001, "The Differential Information Hypothesis, Firm Size, and Earnings Information Transfer: An Empirical Investigation", Journal of Business Research, Vol. 53, No. 1, 37 – 47

Astley, W. G., Van de Ven, A., 1983, "Central Perspectives and Debates in Organisation Theory", Administrative Science Quarterly, Vol. 28, 245 – 273

Atiase, R. K., 1985, "Predisclosure Information, Firm Capitalization and Security Price Behavior Around Earnings Announcements", Journal of Accounting Research, Vol. 23, No. 1, 21 – 36

ATO (Australian Taxation Office), 2002, "Failure to Lodge on Time Fact Sheet for Tax Practitioners", ATO Practice Statement Law Administration 2002/8, Australian Taxation Office, Canberra, Australia

Ausubel, D. P., 1963, The Psychology of Meaningful Verbal Learning, Grune & Stratton Publishers, New York

Avison, D. E., Shah, H. U., 1997, The Information Systems Development Life Cycle: A First Course in Information Systems, McGraw-Hill, London

Azzam, A. M., 1997, "Measuring Market Power and Cost-Efficiency Effects of Industrial Concentration", Journal of Industrial Economics, Vol. 45, No. 4, 377 – 386

Backeljau, T., De Bruyn, L., De Wolf, H., Jordaens, K., Van Dongen, S., Winnepenninckx, B., 1996, "Multiple UPGMA and Neighbour Joining Trees and the Performance of Some Computer Packages", Molecular Biology and Evolution, Vol. 13, 309 – 313

Bagozzi, R. P., Fornell, C., 1982, "Theoretical Concepts, Measurements, and Meaning", in C. Fornell, (Ed), A Second Generation of Multivariate Analysis, Vol. 2, Praeger Publishers, 5 – 23

Bagozzi, R. P., Yi, Y., Phillips, L. W., 1991, "Assessing Construct Validity in Organizational Research", Administrative Science Quarterly, Vol. 36, No. 3, 421 – 458

Bailey, J. E., Pearson S. W., 1983, "Development of a Tool for Measuring and Analysing Computer User Satisfaction", Management Science, Vol. 29, No. 5, 530 – 545

Bailey, K. D., 1973, "Monothetic and Polythetic Typologies and their Relation to Conceptualization, Measurement and Scaling", American Sociological Review, Vol. 38, No. 1, 18 – 33

Bailey, K. D., 1992, "Typologies", in Borgatta, E., Borgatta, M., (Eds), Encyclopedia of Sociology, 2188 – 2194, Macmillan Publishers, New York

Bajwa, D. S., Lewis, L. F., 2003, "Does Size Matter? An Investigation of Collaborative Information Technology Adoption by U.S. Firms", Journal of Information Technology Theory and Application, Vol. 5, No. 1, 29 – 46

Bakos, J. Y., 1987, "Dependent Variables for the Study of Firm and Industry-Level Impacts of Information Technology", Proceedings of the Eight International Conference on Information Systems, Pittsburgh, Pennsylvania, December, 10 – 23

Ball, R., Foster, G., 1982, "Corporate Financial Reporting: A Methodological Review of Empirical Research", Journal of Accounting Research, Vol. 20, 161 – 248

Bamberger, J., 1997, "Essence of the Capability Maturity Model", IEEE Computing, Vol. 30, No. 6, 112 – 114

Banker, R, D., Kauffman, R, J., 1988, "Strategic Contribution of Information Technology: An Empirical Study of ATM Networks", Proceedings of the Ninth International Conference on Information Systems, Minneapolis, 141 – 150

Bannerjee, S., Golhar, D. Y., 1984, "Electronic Data Interchange: Characteristics of Users and Nonusers", Information and Management, Vol. 26, No. 1, 65 – 74

Banville, C., Landry, M., 1989, "Can the Field of MIS be Disciplined?", Communications of the ACM, Vol. 32, No. 1, 48 – 60

Banz, R. D., 1981, "The Relationship Between Return and Market Value of Common Stocks", Journal of Financial Economics, Vol. 9, No. 1, 3 – 18

Barber, A. E., Wesson, M. J., Roberson, Q. M., Taylor, M. S., 1999, "A Tale of Two Job Markets: Organisational Size and its Effects on Hiring Practices and Job Search Behaviour", Personnel Psychology, Vol. 52, No. 4, 841 – 867

Barki, H., Rivard, S., Talbot, J., 1988, "An Information Systems Keyword Classification Scheme", MIS Quarterly, Vol. 12, No. 2, 299 – 322

Barlow, D. H., Hayes, S. C., Nelson, R. O., 1984, The Scientist-Practitioner: Research and Accountability in Clinical and Educational Settings, Pergamon Press, New York

Barnett, W. P., Amburgey, T. L., 1990, "Do Larger Organizations Generate Stronger Competition?" in J. V. Singh (Ed.), Organizational Evolution: New Directions, 246 – 248, Sage, Newbury Park, California

Barney, J. B., Zajac, E., 1994, "Competitive Organizational Behavior: Toward an Organizationally-Based Theory of Competitive Advantage", Strategic Management Journal, Vol. 15, 5 – 9

Barney, J., Wright, M., Ketchen, D. J., 2001, "The Resource-based View of the Firm: Ten Years After 1991", Journal of Management, Vol. 27, No. 6, 625 – 641

Baroudi, J. J., Orlikowski, W. J., 1989, "The Problem of Statistical Power in MIS Research", MIS Quarterly, Vol. 13, No. 1, 87 – 106

Bartholomew, D. J., 1996, Statistical Approach to Social Measurement, Academic Press, London

Barua, A., Kriebel, C. H., Mukhopadhyay, T., 1995, "Information Technologies and Business Value: An Analytic and Empirical Investigation", Information Systems Research, Vol. 6, No. 1, 3 – 23

Baskerville, R. L., Myers, M. D., 2002, "Information Systems as a Reference Discipline", MIS Quarterly, Vol. 26, No. 1, 1 – 14

Baskerville, R., Pries-Heje, J., 1999, "Grounded Action Research: a Method for Understanding IT in Practice", Accounting, Management and Information Technologies, Vol. 9, No. 1, 1 – 23

Basu, A., Blanning, R. W., 1999, "Metagraphs in Workflow Support Systems", Decision Support Systems, Vol. 25, No. 3, 199 – 208

Baucus, M. S., Baucus, D. A., 1997, "Paying the Piper: An Empirical Examination of Longer-term Financial Consequences of Illegal Corporate Behaviour", Academy of Management Journal, Vol. 40, No. 1, 129 – 151

Beach, R., Muhlemann, A. P., Price, D. H. R., Patterson A., Sharp, J. A., 2000, "A Review of Manufacturing Flexibility", European Journal of Operational Research, Vol. 122, No. 1, 41 – 57

Beams, F. A., 1969, "Indications of Pragmatism and Empiricism in Accounting Thought", The Accounting Review, Vol. 44, No. 2, 382 – 388

Beauclair, R. A., Straub, D. W., 1990, "Utilising GDSS Technology: Final Report on a Recent Study", Information and Management, Vol. 18, No. 5, 213 – 220

Beckmann, M. J., 1960, "Some Aspects of Returns to Scale in Business Administration", The Quarterly Journal of Economics, Vol. 74, No. 3, 464 – 471

Beer, M., 1964, "Organizational Size and Job Satisfaction", The Academy of Management Journal, Vol. 7, No. 1, 34 – 44

Benbasat, I., Weber, R., 1996, "Rethinking 'Diversity' in Information Systems Research", Information Systems Research, Vol. 7, No. 4, 389 – 399

Benbasat, I., Zmud, R. W., 2003, "The Identity Crisis Within the IS Discipline: Defining and Communicating the Discipline's Core Properties", MIS Quarterly, Vol. 27, No. 2, 183 – 194

Bendix, R., 1956, Work and Authority in Industry, Harper and Row, New York

Berenson, M. L., Levine, D. M., 1999, Basic Business Statistics: Concepts and Applications, 7th Ed., Prentice-Hall, Upper Saddle River, New Jersey

Berg, B. L., 1989, Qualitative Research Methods for the Social Sciences, Allyn and Bacon, Boston

Berk, J. B., 1997, "Does Size Really Matter?", Financial Analysts Journal, Vol. 53, No. 5, 12 – 18

Berrill, A., Goode, S., Hart, D., 2004, "Managerial Expectations of Internet Commerce Adoption after the 'Tech Wreck' of 2000 – An Australian Perspective", Journal of Global Information Technology Management, Vol. 7, No. 3, 45 – 61

Beshers, J. M., 1957, "Models and Theory Construction", American Sociological Review, Vol. 22, No. 1, 32 – 38

Beyer, J. M., Trice, H. M., 1979, "A Re-examination of the Relations Between Size and Various Components of Organisational Complexity", Administrative Science Quarterly, Vol. 24, 48 – 64

Bhatnagar, R., Sohal, A. S., 2005, "Supply Chain Competitiveness: Measuring the Impact of Location Factors, Uncertainty and Manufacturing Practices", Technovation, Vol. 25, No. 5, 453 – 446

Biegel, D., Johnsen, J., Shafran, R., 1997, "Overcoming Barriers Faced by African American Families with a Family Member with Mental Illness", Family Relations, Vol. 46, No. 2, 163 – 178

Bilkey, W., 1978, "An Attempted Integration of the Literature on the Export Behavior of Firms", Journal of International Business Studies, Vol. 9, No. 1, 33 – 46

Bisantz, A. M., Roth, E., Brickman, B., Gosbee, L. L., Hettinger, L., McKinney, J., 2003, "Integrating Cognitive Analyses in a Large-Scale System Design Process", International Journal of Human-Computer Studies, Vol. 58, No. 2, 177 – 206

Blau, J. R., McKinley, W., 1979, "Ideas, Complexity and Innovation", Administrative Science Quarterly, Vol. 24, No. 2, 200 – 219

Blau, P. M., 1970, "A Formal Theory of Differentiation In Organizations", American Sociological Review, Vol. 35, No. 2, 201 – 218

Blau, P. M., Falbe, C. M., McKinley, W., Tracy, P. K., 1976, "Technology and Organization in Manufacturing", Administrative Science Quarterly, Vol. 21, No. 1, 20 – 40

Blau, P. M., Schoenherr, R. A., 1971, The Structure of Organisations, Basic Books, New York

Blau, P. M., Scott, W. R., 1962, Formal Organisations, Chandler Publishing Co., San Francisco

Bloom, P. N., Perry, V. G., 2001, "Retailer Power and Supplier Welfare: The Case of Wal-Mart", Journal of Retailing, Vol. 77, No. 3, 379 – 396

Bogue, E. G., 1972, "Alternatives to the Growth-Progress Syndrome", Educational Forum, Vol. 37, 35 – 43

Bollen, K. A., 1989, Structural Equations with Latent Variables, Wiley and Sons, New York

Bonaccorsi, A., 1992, "On the Relationship Between Firm Size and Export Intensity", Journal of International Business Studies, Vol. 23, No. 4, 605 – 635

Boubakri, N., Cosset, J., Guedhami, O., 2004, "Privatization, Corporate Governance and Economic Environment: Firm-level Evidence from Asia-Pacific Basin", Finance Journal, Vol. 12, No. 1, 65 – 90

Bourgeois, L. J., 1981, "On the Measurement of Organizational Slack", Academy of Management Review, Vol. 6, No. 1, 29 – 39

Bowen, F. E., 2002, "Does Size Matter?", Business and Society, Vol. 41, No. 1, 118 – 124

Boyd, R., 1980, "Scientific Realism and Naturalistic Epistemology", Proceedings of the Biennial Meeting of the Philosophy of Science Association, Volume Two: Symposia and Invited Papers, Vol. 1980, 613 – 662

Boyer, G. L., Carlson, G., 1989, "Characteristics of Periodical Literature for the Potential Reader or Author in Information Management", MIS Quarterly, Vol. 13, No. 2, 221 – 229

Brancheau, J. C., Wetherbe, J. C., 1987, "Key Issues in Information Systems Management", MIS Quarterly, Vol. 11, No. 1, 91 – 116

Brancheau, J., Janz, B., Wetherbe, J., 1996, "Key Issues in Information Systems Management: 1994-95 SIM Delphi Results", MIS Quarterly, Vol. 20, No. 2, 225 – 242

Bretschneider, S., Wittmer, D., 1993, "Organisational Adoption of Microcomputer Technology: The Role of Sector", Information Systems Research, Vol. 4, No. 1, 88 – 108

Bristow, H. W., Baber, C., Cross, J., Knight, J. F., Woolley, S. I., 2004, "Defining and Evaluating Context for Wearable Computing", International Journal of Human-Computer Studies, Vol. 60, No. 5, 798 – 819

Brock, D. B., Sulsky, L. M., 1994, "Attitudes Toward Computers: Construct Validation and Relations to Computer Use", Journal of Organizational Behavior, Vol. 15, No. 1, 17 – 35

Brooks, P. J., Hanauer, J. B., Padowska, B., Rosman, H., 2003, "The Role of Selective Attention in Preschoolers' Rule Use in a Novel Dimensional Card Sort", Cognitive Development, Vol. 18, No. 2, 195 – 215

Brouthers, K. D., Brouthers, L. E., Werner, S., 2000, "Influences on Strategic Decision-Making in the Dutch Financial Services Industry", Journal of Management, Vol. 26, No. 5, 863 – 884

Brown, C. V., Magill, S. L., 1994, "Alignment of the IS Functions with the Enterprise: Toward a Model of Antecedents", MIS Quarterly, Vol. 18, No. 4, 371 – 403

Browne, J., Dubois, D., Rathmill, K., Sethi, S. P., Stecke, K. E., 1984, "Classification of Flexible Manufacturing Systems", The FMS Magazine, Vol. 2 No. 2, 114 – 117

Bruce, V., 1983, "Recognizing Faces", Philosophical Transactions of the Royal Society of London, Vol. 302, No. 1110, 423 – 434

Brunekreeft, G., 2001, "A Multiple-Unit, Multiple-Period Auction in the British Electricity Spot Market", Energy Economics, Vol. 23, No. 1, 99 – 118

Bruvold, N. T., Comer, J., 1988, "A Model for Estimating the Response Rate to a Mailed Survey", Journal of Business Research, Vol. 16, No. 2, 101 – 116

Brynjolfsson, E., Hitt, L., 1996, "Paradox Lost? Firm-Level Evidence on the Returns to Information Systems Spending", Management Science, Vol. 42, No. 4, 541 – 558

Brynjolfsson, E., Malone, T. W., Gurbaxani, V., Kambil, A., 1994, "Does Information Technology Lead to Smaller Firms?", Management Science, Vol. 40, No. 12, 1628 – 1644

Buckley, W. F., 1967, Sociology and Modern Systems Theory, Prentice-Hall, Englewood Cliffs, New Jersey

Bujaki, M. L., Richardson, A. J., 1997, "A Citation Trail Review of the Uses of Firm Size in Accounting Research", Journal of Accounting Literature, Vol. 16, 1 – 27

Burns, L. R., Wholey, D. R., 1993, "Adoption and Abandonment of Matrix Management Programs: Effects of Organisational Characteristics and Interorganisational Networks", Academy of Management Journal, Vol. 36, No. 1, 106 – 138

Burns, M. R., 1983, "Economies of Scale in Tobacco Manufacture, 1897-1910", The Journal of Economic History, Vol. 43, No. 2, 461 – 474

Burns, T., Stalker, G. M., 1961, The Management of Innovation, Tavistock Publications Ltd., London

Burton, R. M., Minton, J. W., Obel, B., 1991, "Organizational Size and Efficiency: An Information Processing View", Scandinavian Journal of Management, Vol. 7, No. 2, 79 – 93

Butler, J., 1999, "Risk Management Skills Needed in a Packaged Software Environment", Information Systems Management, Vol. 16, No. 3, 15 – 21

Byrd, T. A., Turner, D. E., 2000, "Measuring the Flexibility of Information Technology Infrastructure: Exploratory Analysis of a Construct", Journal of Management Information Systems, Vol. 17, No. 1, 167 – 208

Byrd, T. A., Turner, D. E., 2001, "An Exploratory Examination of the Relationship Between Flexible IT Infrastructure and Competitive Advantage", Information and Management, Vol. 39, 41 – 52

Calder, B. J., Phillips, L. W., Tybout, A. M., 1982, "The Concept of External Validity", The Journal of Consumer Research, Vol. 9, No. 3, 240 – 244

Calof, J. L., 1993, "The Impact of Size on Internationalization", Journal of Small Business Management, Vol. 31, No. 4, 60 – 69

Caplow, T., 1957, "Organisational Size", Administrative Science Quarterly, Vol. 1, No. 4, 484 – 505

Cardinal, L. B., Alessandri, T. M., Turner, S. F., 2001, "Knowledge Codifiability, Resources, and Science-based Innovation", Journal of Knowledge Management, Vol. 5, No. 2, 195 – 205

Carmines, E. G., Zeller, R. A., 1991, Reliability and Validity Assessment, Sage Publications, Newbury Park

Carpenter, M. A., Fredrickson, J. W., 2001, "Top Management Teams, Global Strategic Posture, and the Moderating Role of Uncertainty", Academy of Management Journal, Vol. 44, No. 3, 533 – 545

Carpenter, R., Petersen, B. C., 2002, "Is the Growth of Small Firms Constrained by Internal Finance?", Review of Economics and Statistics, Vol. 84, No. 2, 298 – 309

Casper, S., Matraves, C., 2003, "Institutional Frameworks and Innovation in the German and UK Pharmaceutical Industry", Research Policy, Vol. 32, No. 10, 1865 – 1879

Cat, J., 1995, "The Popper-Neurath Debate and Neurath's Attack on Scientific Method", Studies in History and Philosophy of Science, Vol. 26, No. 2, 219 – 250

Cataldo, E. F., Johnson, R. M., Kellstedt, L. A., Milbrath, L. W., 1970, "Card Sorting as a Technique for Survey Interviewing", The Public Opinion Quarterly, Vol. 34, No. 2, 202 – 215

Cattell, R. B., 1966, "The Scree Test for the Number of Factors", Multivariate Behavioral Research, Vol. 1, 245 – 276

Cavusgil, S. T., Nevin, J. R., 1981, "Internal Determinants of Export Marketing Behavior: An Empirical Investigation", Journal of Marketing Research, Vol. 18, 114 – 119

Chaffee, E. E., 1985, "Three Models of Strategy", Academy of Management Review, Vol. 10, No. 1, 89 – 98

Chambers, R. G., 1983, "Scale and Productivity Measurement Under Risk", The American Economic Review, Vol. 73, No. 4, 802 – 805

Chan, Y. E., Huff, S. L., Copeland, D. G., 1997, "Assessing Realized Information Systems Strategy", The Journal of Strategic Information Systems, Vol. 6, No. 4, 273 – 298

Chan, Y., 2000, "IT Value: The Great Divide Between Qualitative and Quantitative and Individual and Organizational Measures", Journal of Management Information Systems, Vol. 16, No. 4, 225 – 261

Chapin, F. S., 1951, "The Growth of Bureaucracy: An Hypothesis", American Sociological Review, Vol. 16, No. 6, 835 – 836

Chau, P. Y. K., Hu, P. J. H., 2002, "Investigating Healthcare Professionals' Decisions to Accept Telemedicine Technology: An Empirical Test of Competing Theories", Information and Management, Vol. 39, No. 4, 297 – 311

Chau, P. Y. K., Tam, K. Y., 2000, "Organisational Adoption of Open Systems: A 'Technology-Push, Need-Pull' Perspective", Information and Management, Vol. 37, No. 5, 229 – 239

Chen, K. H., Metcalf, P. R. W., 1980, "The Relationship Between Pollution Control Record and Financial Indicators Revisited", Accounting Review, Vol. 55, No. 1, 168 – 177

Chen, M., Hambrick, D. C., 1995, "Speed, Stealth, and Selective Attack: How Small Firms Differ", Academy of Management Journal, Vol. 38, No. 2, 453 – 483

Chen, R., Wong, K. A., 2004, "The Determinants of Financial Health of Asian Insurance Companies", Journal of Risk and Insurance, Vol. 71, No. 3, 469 – 500

Chen, W. S., Hirschheim, R., 2004, "A Paradigmatic and Methodological Examination of Information Systems Research from 1991 to 2001", Information Systems Journal, Vol. 14, 197 – 235

Chengular-Smith, I., Duchessi, P., 1999, "The Initiation and Adoption of Client-Server Technology in Organisations", Information and Management, Vol. 35, No. 2, 77 – 88

Child, J., 1973, "Predicting and Understanding Organization Structure", Administrative Science Quarterly, Vol. 18, No. 2, 168 – 185

Childers, G. W., Mayhew, B. H., Gray, L. N., 1971, "System Size and Structural Differentiation in Military Organizations: Testing a Baseline Model of the Division of Labor", American Journal of Sociology, Vol. 76, No. 5, 813 – 830

Chin, W. W., Todd, P. A., 1995, "On the Use, Usefulness, and Ease of Use of Structural Equation Modeling in MIS Research: A Note of Caution", MIS Quarterly, Vol. 19, No. 2, 237 – 246

Ching, C., Holsapple, C. W., Whinston, A. B., 1996, "Toward IT Support for Coordination in Network Organisations", Information and Management, Vol. 30, No. 4, 179 – 199

Chiu, T., Fang, D., Chen, J., Wang, Y., Jeris, C., 2001, "A Robust and Scalable Clustering Algorithm for Mixed Type Attributes in Large Database Environment", Proceedings of the Seventh ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, 263 – 268

Choe, J., 1996, "The Relationships Among Performance of Accounting Information Systems, Influence Factors, and Evolution Level of Information Systems", Journal of Management Information Systems, Vol. 12, No. 4, 215 – 230

Choe, J., 2004, "The Consideration of Cultural Differences in the Design of Information Systems", Information and Management, Vol. 41, No. 5, 669 – 684

Choi, T. Y., Hong, T., 2002, "Unveiling the Structure of Supply Networks: Case Studies in Honda, Acura, and DaimlerChrysler", Journal of Operations Management, Vol. 20, No. 5, 469 – 493

Chou, H., Jou, S., 1999, "MIS Key Issues in Taiwan's Enterprises", International Journal of Information Management, Vol. 19, No. 5, 369 – 387

Choudhury, V., 1997, "Strategic Choices in the Development of Interorganisational Information Systems", Information Systems Research, Vol. 8, No. 1, 1 – 24

Choudhury, V., 1998, "Uses and Consequences of Electronic Markets: An Empirical Investigation in the Aircraft Parts Industry", MIS Quarterly, Vol. 22, No. 4, 471 – 508

Christensen, C., da Rocha, A., Gertner, R., 1987, "An Empirical Investigation of the Factors Influencing Export Success of Brazilian Firms", Journal of International Business Studies, Vol. 18, 61 – 78

Chularut, P., DeBacker, T., 2004, "The Influence of Concept Mapping on Cchievement, Self-regulation, and Self-Efficacy in Students of English as a Second Language", Contemporary Educational Psychology, Vol. 29, No. 3, 248 – 263

Chung, K. Y., Park, T., Ro, B. T., 1996, "Differential Market Reactions to Accounting Changes Away From Versus Towards Common Accounting Practices", Journal of Accounting and Public Policy, Vol. 15, No. 1, 29 – 53

Church, A., 1993, "Incentives in Mail Surveys: A Meta-Analysis", Public Opinion Quarterly, Vol. 57, 62 – 79

Churchill, G. A., 1979, "A Paradigm for Developing Better Measures of Marketing Construct", Journal of Marketing Research, Vol. 16, 64 – 72

Clarke, C. J., 1983, "Size and Administrative Intensity in Macro-Level Systems: A Reconciliation", Social Forces, Vol. 61, No. 3, 886 – 892

Claver, E., Gonzalez, R., Llopis, J., 2000, "An Analysis of Research in Information Systems (1981-1997)", Information and Management, Vol. 37, No. 4, 181 – 195

Coakes, E., Merchant, K., 1996, "Expert Systems: A Survey of their Use in UK Business", Information and Management, Vol. 30, No. 5, 223 – 230

Coates, R., Updegraff, D. E., 1973, "The Relationship Between Organizational Size and the Administrative Component of Banks", Journal of Business, Vol. 46, No. 4, 576 – 588

Cohen, W. M., Klepper, S., 1992, "The Anatomy of R&D Intensity Distributions", American Economic Review, Vol. 82, No. 4, 773 – 799

Colbert, G., Murray, D., 1999, "State Accountancy Regulations, Audit Firm Size, and Auditor Quality: An Empirical Investigation", Journal of Regulatory Economics, Vol. 16, No. 3, 267 – 286

Colombo, M. G., Delmastro, M., 1999, "Some Stylized Facts on Organization and its Evolution", Journal of Economic Behavior and Organization, Vol. 40, No. 3, 255 – 274

Comrey, A. L., 1973, A First Course in Factor Analysis, Academic Press, New York

Conrath, D. W., Mignen, O. P., 1990, "What is Being Done to Measure User Satisfaction with EDP/MIS", Information and Management, Vol. 19, 7 – 19

Cook, T. D., Campbell, D. T., 1979, Quasi-Experimentation: Design and Analysis Issues for Field Settings, Rand McNally Publishers, Chicago

Cooper, L. G., 1973, "A Multivariate Investigation of Preferences", Multivariate Behavioural Research, Vol. 8, 253 – 272

Cornwall, J., Cornwall, W., 2002, "A Demand and Supply Analysis of Productivity Growth", Structural Change and Economic Dynamics, Vol. 13, No. 2, 203 – 229

Cortina, J. M., 2002, "Big Things Have Small Beginnings: An Assortment of 'Minor' Methodological Misunderstandings", Journal of Management, Vol. 28, No. 3, 339 – 362

Corwin, R. G., 1972, "Strategies for Organizational Innovation: an Empirical Comparison", American Sociological Review, Vol. 37, 441 – 454

Cote, J. A., Buckley, M. R., 1987, "Estimating Trait, Method, and Error Variance: Generalizing Across 70 Construct Validation Studies", Journal of Marketing Research, Vol. 24, No. 3, 315 – 318

Cotter, J. F., Peck, S. W., 2001, "The Structure of Debt and Active Equity Investors: The Case of the Buyout Specialist", Journal of Financial Economics, Vol. 59, No. 1, 101 – 147

Cramer, J. S., Hartog, J., Jonker, N., Van Praag, C. M., 2002, "Low Risk Aversion Encourages The Choice for Entrepreneurship: An Empirical Test of a Truism", Journal of Economic Behavior and Organization, Vol. 48, No. 1, 29 – 36

Cronbach, L. J., Quirk, T. J., 1976, "Test Validity", International Encyclopaedia of Education, McGraw-Hill, New York

Cronbach, L. J., 1960, Essentials of Psychological Testing, 2nd Ed., Harper and Brothers Printers, New York

Cronbach, L. J., 1971, "Test Validation" in R. L. Thorndike (Ed.), Educational Measurement, 2nd Ed., American Council on Education, Washington, D. C.

Cronbach, L. J., Meehl, P. H., 1955, "Construct Validity in Psychological Tests", Psychological Bulletin, Vol. 52, 281 – 302

Culnan, M. J., 1987, "Mapping the Intellectual Structure of Management Information Systems, 1980 – 1985: A Co-citation Analysis", MIS Quarterly, Vol. 11, 341 – 353

Culnan, M. J., Swanson, B. E., 1986, "Research in Management Information Systems, 1980–1984: Points of Work and Reference", MIS Quarterly, Vol. 10, No. 3, 289 – 301

Cyert, R., March, J., 1963, The Behavioral Theory of the Firm, Prentice-Hall, Englewood Cliffs, New Jersey, USA

Daley, B. J., Shaw, C. R., Balistrieri, T., Glasenapp, I., Placentine, L., 1999, "Concept Maps: A Strategy to Teach and Evaluate Critical Thinking", Journal of Nursing Education, Vol. 38, 42 – 47

Dalton, D. R., Kesner, I. F., 1983, "Inside/Outside Succession and Organizational Size: The Pragmatics of Executive Replacement", Academy of Management Journal, Vol. 26, No. 4, 736 – 742

Dalton, D. R., Todor, W. D., Spendolini, M. J., Fielding, G. J., Porter, L. W., 1980, "Organization Structure and Performance: A Critical Review", The Academy of Management Review, Vol. 5, No. 1, 49 – 64

Damanpour, F., 1987, "The Adoption of Technological, Administrative and Ancillary Innovations: Impact of Organisational Factors", Journal of Management, Vol. 13, No. 4, 675 – 688

Damanpour, F., 1991, "Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators", Academy of Management Journal, Vol. 34, No. 3, 555 – 590

Damanpour, F., 1996, "Organisational Complexity and Innovation: Developing and Testing Multiple Contingency Models", Management Science, Vol. 42, No. 5, 693 – 716

Damsgaard, J., Lyytinen, K., 1997, "Hong Kong's EDI Bandwagon Derailed or on the Right Track" In: McMaster, T., Mumford, E., Swanson, E., Warboys, B., Wastell, D. (Eds.), Facilitating Technology Transfer Through Partnership: Learning from Practice and Research, Chapman and Hall, London

Daniel, F., Lohrke, F. T., Fornaciari, C. J., Turner, R. A., 2004, "Slack Resources and Firm Performance: a Meta-Analysis", Journal of Business Research, Vol. 57, No. 6, 565 – 574

Davis, C. K., Wetherbe, J. C., 1979, "An Analysis of the Impact of Distributed Data Processing on Organizations in the 1980's", MIS Quarterly, Vol. 3, No. 4, 47 – 56

Davis, S. J., Haltiwanger, J., 1992, "Gross Job Creation, Gross Job Destruction, and Employment Reallocation", The Quarterly Journal of Economics, Vol. 107, No. 3, 819 – 863

Davison, M. L., 1983, Multidimensional Scaling, John Wiley and Sons, New York

Debreceny, R., Putterill, M., Tung, L., Gilbert, A. L., 2002, "New Tools for the Determination of e-Commerce Inhibitors", Decision Support Systems, Vol. 34, No. 2, 177 – 195

Dekker, I., Barling, J., Kelloway E. K., 1996, "Work Force Size and Multifaceted Job Satisfaction: A Cross-National Study", Journal of Social Psychology, Vol. 136, No. 2, 201 – 208

Delone, W. H., 1981, "Firm Size and the Characteristics of Computer Use", MIS Quarterly, Vol. 5, No. 4, 1965 – 1977

Delone, W. H., 1988, "Determinants of Success for Computer Usage in Small Business", MIS Quarterly, Vol. 12, No. 1, 51 – 61

Delone, W. H., McLean, E. R., 1992, "Information Systems Success: The Quest for the Dependant Variable", Information Systems Research, Vol. 3, No. 1, 60 – 95

Delone, W. H., McLean, E. R., 2003, "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update", Journal of Management Information Systems, Vol. 19, No. 4, 9 – 30

Dillman, D. A., 1978, Mail and Telephone Surveys: The Total Design Method, John Wiley and Sons, New York

Diwan, R. K., 1966, "Alternative Specifications of Economies of Scale", Economica, Vol. 33, No. 132, 442 – 453

Dong, D., Saha, A., 1998, "He Came, He Saw, (and) He Waited: An Empirical Analysis of Inertia in Technology Adoption", Applied Economics, Vol. 30, No. 7, 893 – 906

Downs, G. W., Mohr, L. B., 1976, "Conceptual Issues in the Study of Innovation", Administrative Science Quarterly, Vol. 21, No. 4, 700 – 714

Drew, M. E., Naughton, T., Veeraraghavan, M., 2003, "Firm Size, Book-to-Market Equity and Security Returns: Evidence from the Shanghai Stock Exchange", Australian Journal of Management, Vol. 28, No. 2, 119 – 139

Dreyer, B., Grønhaug, K., 2004, "Uncertainty, Flexibility, and Sustained Competitive Advantage", Journal of Business Research, Vol. 57, No. 5, 484 – 494

Dubin, R., 1978, Theory Building, Revised Edition, Free Press, New York

Duncan, N. B., 1995, "Capturing Flexibility of Information Technology Infrastructure: A Study of Resource Characteristics and Their Measure", Journal of Management Information Systems, Vol. 12, No. 2, 37 – 57

Dunn, W. N., 2002, "A Pragmatic Strategy for Discovering and Testing Threats to the Validity of Sociotechnical Experiments", Simulation Modelling Practice and Theory, Vol. 10, No. 3, 169 – 194

Dunn-Rankin, P., 1983, Scaling Methods, Lawrence Erlbaum Associates Publishers, London

Durkheim, E., 1947, The Division of Labor in Society, Glencoe, Illinois

Earl, M. J., 1989, Management Strategies for Information Technology, Prentice Hall, Englewood Cliffs, New Jersey

Eder, L. B., Arinze, B., Darter, M. E., Wise, D. E., 2000, "An Analysis of Intranet Infusion Levels", Information Resources Management Journal, Vol. 13, No. 3, 14 – 22

Edfelt, R., 1986, "U.S. Business in International Competitive Perspective", Issues in International Business, Vol. 1, No. 1, 17 – 24

Ein-Dor, P., Segev, E., 1978, "Organisational Context and the Success of Management Information Systems", Management Science, Vol. 24, No. 10, 1064 – 1077

Ein-Dor, P., Segev, E., 1982, "Organizational Context and MIS Structure: Some Empirical Evidence", MIS Quarterly, Vol. 6, 55 – 68

Eisele, C. F., 1974, "Organization Size, Technology, and Frequency of Strikes", Industrial and Labor Relations Review, Vol. 27, No. 4, 560 – 571

Elfving, G., Sitgreaves, R., Solomon, H., 1959, "Item Selection Procedures for Item Variables with a Known Factor Structure", Psychometrika, Vol. 24, 189 – 205

Elliot, G. J., Jones, E., Barker, P., 2002, "A Grounded Theory Approach to Modelling Learnability of Hypermedia Authoring Tools", Interacting with Computers, Vol. 14, No. 5, 547 – 574

ESFC (Employment and Skills Formation Council), 1994a, "Making it Work – Women and Small Business", Department of Education, Science and Training, Canberra, Australia

ESFC (Employment and Skills Formation Council), 1994b, "The Shape of Things to Come: Small Business Employment and Skills", Department of Education, Science and Training, Canberra, Australia

Ettlie, J. E., Bridges, W. P., O'Keefe, R. D., 1984, "Organisational Strategy and Structural Differences for Radical Versus Incremental Innovation", Management Science, Vol. 30, No. 6, 682 – 695

Evangelista, R., Iammarino, S., Mastrostefano, V., Silvani, A., 2001, "Measuring the Regional Dimension of Innovation: Lessons from the Italian Innovation Survey", Technovation, Vol. 21, No. 11, 733 – 745

Evans, J. S., 1991, "Strategic Flexibility for High Technology Manoeuvres: a Conceptual Framework", Journal of Management Studies, Vol. 28, No. 1, 69 – 89

Everitt, B. S., 1980, Cluster Analysis, 2nd Ed., Gower Publications, London

Everitt, B. S., Dunn, G., 1991, Applied Multivariate Data Analysis, Edward Arnold, London

Evers, F. T., Bohlen, J. M., Warren, R. D., 1976, "The Relationships of Selected Size and Structure Indicators in Economic Organizations", Administrative Science Quarterly, Vol. 21, No. 2, 326 – 342

Ewing, G., Freer, Y., Logie, R., Hunter, J., McIntosh, N., Rudkin, S., Ferguson, L., 2003, "Role and Experience Determine Decision Support Interface

Requirements in a Neonatal Intensive Care Environment", Journal of Biomedical Informatics, Vol. 36, No. 4-5, 240 – 249

Ewusi-Mensah, K., 1997, "Critical Issues in Abandoned Information Systems Development Projects", Communications of the ACM, Vol. 40, No. 9, 74 – 80

Fama, E. F., 1965, "The Behavior of Stock-Market Prices", Journal of Business, Vol. 38, No. 1, 34 – 105

Fawcett, J., Downs, F. S., 1986, The Relationship of Theory and Research, F. A. Davis Publishers, Philadelphia

Fayad, M. E., Laitinen, M., 1997, "Process Assessment Considered Wasteful", Communications of the ACM, Vol. 40, No. 11, 125 – 128

Fenton, N. E., Neil, M., 1999, "Software Metrics: Successes, Failures and New Directions", The Journal of Systems and Software, Vol. 47, 149 – 157

Fenwick, I., Schellinck, K., Kendall, W., 1983, "Assessing the Reliability of Psychographic Analyses", Marketing Science, Vol. 2, No. 1, 57 – 73

Fiegenbaum, A., Karnani, A., 1991, "Output Flexibility – A Competitive Advantage for Small Firms", Strategic Management Journal, Vol. 12, 101 – 114

Filion, F. L., 1975, "Estimating Bias Due to Non-response in Mail Surveys", Public Opinion Quarterly, Vol. 39, No. 4, 482 – 492

Fitzgerald, L., Johnston R., Brignall S., Silvestro R., Voss, C., 1991, Performance measurement in service business, CIMA, UK

Ford, J. D., Slocum, J. W., 1977, "Size, Technology, Environment and the Structure of Organizations", The Academy of Management Review, Vol. 2, No. 4, 561-575

Fraley, C., Raftery, A. E., 1998, "How Many Clusters? Which Clustering Method? Answers Via Model-Based Cluster Analysis", Computer Journal, Vol. 4, 578 – 588

Freeman, J. H., Hannan, M. T., 1975, "Growth and Decline Processes in Organisations", American Sociological Review, Vol. 40, 215 – 228

Fuller, M. K., Swanson, E. B., 1992, "Information Centers as Organizational Innovation: Exploring the Correlates of Implementation Success", Journal of Management Information Systems, Vol. 9, No. 1, 47 – 67

Furnham, A., 1986, "Response Bias, Social Desirability and Dissimulation", Personality and Individual Differences, Vol. 7, 385 – 400

Galbraith, J., 1971, "Organisation Design: An Information-Processing View" in J. W. Lorsch, P. R. Lawrence (Eds), Organisational Planning: Cases and Concepts, 49 – 74, Irwin Publishers, Illinois

Gale, B., 1972, "Market Share and Rate of Return", The Review of Economics and Statistics, Vol. 54, 412 – 423

Galletta, D. F., Lederer, A. L., 1989, "Some Cautions on the Measurement of User Information Satisfaction", Decision Sciences, Vol. 20, No. 3, 419 – 438

Galliers, R. (Ed.), 1992, Information Systems Research: Issues, Methods and Practical Guidelines, Blackwell Publishing, Oxford

Gammack, J., 1987, "Different Techniques and Different Aspects on Declarative Knowledge". In: Kidd, A. L., (Ed.), Knowledge Acquisition for Expert Systems: A Practical handbook, 137–163, Plenum, New York

Gaver, J., Gaver, K., 1993, "Additional Evidence on the Association Between the Investment Opportunity Set and Corporate Financing, Dividend, and Compensation Policies", Journal of Accounting and Economics, Vol. 16, 125–160

Geletkanycz, M. A., Hambrick, D. C., 1997, "The External Ties of Top Executives: Implications for Strategic Choice and Performance", Administrative Science Quarterly, Vol. 42, No. 4, 654 – 681

Gergen, K. J., 1973, "Social Psychology as History", Journal of Personality and Social Psychology, Vol. 26, 309 – 320

Gerhart, B., Milkovich, G. T., 1990, "Organizational Differences in Managerial Compensation and Financial Performance", Academy of Management Journal, Vol. 33, No. 4, 663 – 691

Gerwin, D., 1993, "Manufacturing Flexibility: a Strategic Perspective", Management Science, Vol. 39, 395 – 410

Gibbons F. D., Roth F. P., 2002, "Judging the Quality of Gene Expression-Based Clustering Methods Using Gene Annotation", Genome Research, Vol. 12, 1574 – 1581

Giddens, A., 1987, Social Theory and Modern Sociology, Stanford University Press, Stanford, California

Gifford, S., 1992, "Innovation, Firm Size and Growth in a Centralized Organization", The Rand Journal of Economics, Vol. 23, No. 2, 284 – 299

Gioia, D. A., Pitre, E., 1990, "Multiparadigm Perspectives on Theory Building", The Academy of Management Review, Vol. 15, No. 4, 584 – 602

Girshick, M. A., Lerner, D., 1950-1951, "Model Construction in the Social Sciences- An Expository Discussion of Measurement and Prediction", Public Opinion Quarterly, Vol. 14, No. 4, 710 – 728

Glaser, B., 1978, Theoretical Sensitivity, Sociology Press, Mill Valley, California

Glaser, B., 1992, Emergence v. Forcing: Basics of Grounded Theory Analysis, Sociology Press, Mill Valley, California

Globerman, S., 1975, "Technological diffusion in the Canadian Tool and Die industry", Review of Economics and Statistics, Vol. 4, No. 57, 428 – 434

Godfrey, P. C., Hill, C. W., 1995, "The Problem of Unobservables in Strategic Management Research", Strategic Management Journal, Vol. 16, No. 7, 519–533

Godfrey-Smith, P., 2003, Theory and Reality in Introduction to the Philosophy of Science, University of Chicago Press, Chicago

Gold, A. H., Malhotra, A., Segars, A., 2001, "Knowledge Management: An Organisational Capabilities Perspective", Journal of Management Information Systems, Vol. 18, No. 1, 185 – 214

Goldberg , L. R., 1968, "Simple Models or Simple Processes: Some Research on Clinical Judgments", American Psychologist, Vol. 23, 482 – 496

Golden, W., Powell, P., 2000, "Towards a Definition of Flexibility: in Search of the Holy Grail?", Omega, Vol. 28, No. 4, 373 – 384

Goode, S., 2002, "Management Attitudes to the World Wide Web in Australian Small Business", Information Systems Management, Vol. 19, No. 1, 45 – 48

Goode, S., Stevens, K., 2000, "An Analysis of the Business Characteristics of Adopters and Non-adopters of World Wide Web Technology", Information Technology and Management, Vol. 1, No. 1, 129 – 154

Gopal, R. D., Sanders, G. L., 1997, "Preventive and Deterrent Controls for Software Piracy", Journal of Management Information Systems, Vol. 13, No. 4, 29 – 48

Gorman, S. P., Malecki, E. J., 2000, "The Networks of the Internet: an Analysis of Provider Networks in the USA", Telecommunications Policy, Vol. 24, No. 2, 113 – 134

Goss, E., Vozikis, G. S., 1994, "High Tech Manufacturing: Firm Size, Industry and Population Density", Small Business Economics, Vol. 6, 291 – 297

Gourville, J. T., Moon, Y., 2004, "Managing Price Expectations Through Product Overlap", Journal of Retailing, Vol. 80, No. 1, 23 – 35

Green, S. B., 1991, "How Many Subjects Does it Take to do a Regression Analysis?", Multivariate Behavioral Research, Vol. 26, 499 – 510

Greenley, G., Okemgil, M., 1998, "A Comparison of Slack Resources in High and Low Performing British Companies", Journal of Management Studies, Vol. 35, 377 – 398

Gremillion, L., 1984, "Organizational Size and Information Systems Use: An Empirical Study", Journal of Management Information Systems, Vol. 1, No. 2, 4 – 17

Grimm, L. G., Yarnold, P. R., 1995, Reading and Understanding Multivariate Statistics, APA Publishers, Washington DC

Gropper, D. M., 1991, "An Empirical Investigation of Changes in Scale Economies for the Commercial Banking Firm, 1979-1986", Journal of Money, Credit and Banking, Vol. 23, No. 4, 718 – 727

Grover, V., Cheon, M. J., Teng, J. T. C., 1994, "A Descriptive Study on the Outsourcing of Information Systems Functions", Information and Management, Vol. 27, 33 – 34

Grover, V., Goslar, M. D., 1993, "The Initiation, Adoption, and Implementation Telecommunications Technologies in US Organisations", Journal of Management Information Systems, Vol. 10, No. 1, 140 – 161

Grover, V., Lee, C., Durand, D., 1993, "Analysing Methodological Rigor of MIS Survey Research from 1980-1989", Information and Management, Vol. 24, No. 6, 305 – 317

Grover, V., Teng, J. T. C., 1992, "An Examination of DBMS Adoption and Success in American Organisations", Information and Management, Vol. 23, 239 – 248

Grusky, O., 1961, "Corporate Size, Bureaucratization, and Managerial Succession", American Journal of Sociology, Vol. 67, 261 – 269

Gupta, N., 1980, "Some Alternative Definitions of Size", The Academy of Management Journal, Vol. 23, No. 4, 759 – 766

Gupta, Y. P., Goyal, S., 1989, "Flexibility of Manufacturing Systems: Concepts and Measurement", European Journal of Operational Research, Vol. 43, 119 – 135

Gutter, M. S., Fox, J. J., Montalto, C. P., 1999, "Racial Differences in Investor Decision Making", Financial Services Review, Vol. 8, No. 3, 149 – 162

Hackney, R., Burn, J., Salazar, A., 2004, "Strategies for Value Creation in Electronic Markets: Towards a Framework for Managing Evolutionary Change", The Journal of Strategic Information Systems, Vol. 13, No. 2, 91 – 103

Haer, J. L., 1955, "A Test of the Unidimensionality of the Index of Status Characteristics", Social Forces, Vol. 34, No. 1, 56 – 58

Hage, J., 1980, Theories of Organisation, Wiley Publishers, New York

Hall, M., Weiss, L., 1967, "Firm Size and Profitability", Review of Economics and Statistics, Vol. 49, No. 3, 319 – 331

Hall, R. H., 1963, "Bureaucracy and Small Organisations", Sociology and Social Research, Vol. 48, 38 – 46

Hall, R. H., Haas, J. E., Johnson, N. J., 1967, "Organisational Size, Complexity and Formalization", American Sociological Review, Vol. 32, No. 6, 903 – 912

Hallock, K. F., 1998, "Layoffs, top executive pay, and firm performance", The American Economic Review, Vol. 88, No. 4, 711 – 724

Hambrick, D. C., 1981, "Environment, Strategy, and Power Within Top Management Teams", Administrative Science Quarterly, Vol. 26, No. 2, 253 – 275

Hambrick, D. C., 1982, "Environmental Scanning and Organizational Strategy", Strategic Management Journal, Vol. 3, No. 2, 159 – 174

Hamilton, I., 1921, The Soul and Body of an Army, Edward Arnold and Co., London

Hariharan, G., Chapman, K. S., Domian, D. L., 2000, "Risk Tolerance and Asset Allocation for Investors Nearing Retirement", Financial Services Review, Vol. 9, No. 2, 159 – 170

Harris, S. E., Katz, J. L., 1991, "Firm Size and the Information Technology Investment Intensity of Life Insurers", MIS Quarterly, Vol. 15, No. 3, 333 – 352

Harrison, W. L., Farn, C., 1990, "A Comparison of Information Management Issues in the United States of America and Republic of China", Information and Management, Vol. 18, 177 – 188

Hart, P. E., 1962, "The Size and Growth of Firms", Economica, Vol. 29, No. 113, 29 – 39

Hart, S. L., Banbury, C., 1994, "How Strategy-Making Processes Can Make a Difference", Strategic Management Journal, Vol. 15, 251 – 269

Hartigan, J. A., 1975, Clustering Algorithms, Wiley & Sons Publishers, New York

Hartman, L. B., van Hee, K. M., 1995, "Application of Markov Decision Processes to Search Problems", Decision Support Systems, Vol. 14, No. 3, 283 – 298

Haveman, H. A., 1993, "Organizational Size and Change: Diversification in the Savings and Loan Industry After Deregulation", Administrative Science Quarterly, Vol. 38, No. 1, 20 – 50

Hayley, K. J., Lyman, H. T., 1990, "The Realities of CASE", Information Systems Management, Vol. 7, No. 3, 18 – 24

He, Z., Khalifa, M., Kusy, M., Zhao, T., 1994, "A Survey Study of the Current IS Usage in the Chinese Manufacturing Industry", Information and Management, Vol. 34, 285 – 294

Heath, H., Cowley, S., 2004, "Developing a Grounded Theory Approach: a Comparison of Glaser and Strauss", International Journal of Nursing Studies, Vol. 41, No. 2, 141 – 150

Heaton, R., Chelune, G., Talley, J., Kay, G., Curtis, G., 1993, Wisconsin Card Sorting Test Manual: Revised and Expanded, Psychological Assessment Resources, Florida

Hendershot, G. E., James, T. F., 1972, "Size and Growth as Determinants of Administrative Production Ratios in Organisations", American Sociological Review, Vol. 37, 149 – 153

Henderson, R., Cockburn, I., 1994, "Measuring Competence? Exploiting Firm Effects in Pharmaceutical Research", Strategic Management Journal, Vol. 15, 63 – 84

Herbst, P. G., 1957, "Measurement of Behaviour Structures by Means of Input-Output Data", Human Relations, Vol. 10, No. 4, 335 – 346

Hickson, D. J., Pugh, D. S., Pheysey, D., 1967, "Operations Technology and Organisation Structure: An Empirical Reappraisal", Administrative Science Quarterly, Vol. 14, 378 – 397

Hirsch, P. M., 1975, "Organizational Effectiveness and the Institutional Environment", Administrative Science Quarterly, Vol. 20, 327 – 344

Hitt, L. M., 1999, "Information Technology and Firm Boundaries: Evidence From Panel Data", Information Systems Research, Vol. 10, No. 2, 134 – 150

Hitt, L. M., Brynjolfsson, E., 1996, "Productivity, Business Profitability, and Consumer Surplus: Three Different Measures of Information Technology Value", MIS Quarterly, Vol. 20, No. 2, 121 – 142

Hitt, M. A., Hoskisson, R. E., Kim, H., 1997, "International Diversification: Effects on Innovation and Firm Performance in Product-Diversified Firms", Academy of Management Journal, Vol. 40, No. 4, 767 – 798

Ho, S. S. M., Lam, K. C. K., Sami, H., 2004, "The Investment Opportunity Set, Director Ownership, and Corporate Policies: Evidence From an Emerging Market", Journal of Corporate Finance, Vol. 10, No. 3, 383 – 408

Hoeft, R. M., Jentsch, F. G., Harper, M. E., Evans, A. W., Bowers, C. A., Salas, E., 2003, "TPL-KATS – Concept Map: a Computerized Knowledge Assessment Tool", Computers in Human Behavior, Vol. 19, No. 6, 653 – 657

Hoffman, V. B., Joe, J. R., Moser, D. V., 2003, "The Effect of Constrained Processing on Auditors' Judgments", Accounting, Organizations and Society, Vol. 28, No. 7 – 8, 699 – 714

Holcomb, J. P., 2000, "Using a Term-Long Project Sequence in Introductory Statistics", The American Statistician, Vol. 54, No. 1, 9 – 54

Holden, A., 1986, "Small Business Can Market in Europe: Results from a Survey of U.S. Exporters", Journal of Small Business Management, Vol. 24, 22 – 29

Holden, R. R., Book, A. S., Edwards, M. J., Wasylkiw, L., Starzyk, K. B., 2003, "Experimental Faking in Self-reported Psychopathology: Unidimensional or Multidimensional?", Personality and Individual Differences, Vol. 35, No. 5, 1107 – 1117

Holsapple, C. W., Johnson, L. E., Manakyan, H., Tanner, J., 1994, "Business Computing Research Journals: A Normalised Citation Analysis", Journal of Management Information Systems, Vol. 11, No. 1, 131 – 141

Howorth, C., Westhead, P., 2003, "The Focus of Working Capital Management in UK Small Firms", Management Accounting Research, Vol. 14, No. 2, 94 – 111

Hrebiniak, L. G., Alutto, J. A., 1973, "A Comparative Organizational Study of Performance and Size Correlates in Impatient Psychiatric Departments", Administrative Science Quarterly, Vol. 18, No. 3, 365 – 382

Huberman, B., Loch, C., 1996, "Collaboration, Motivation, and the Size of Organizations", Journal of Organizational Computing and Electronic Commerce, Vol. 6, No. 2, 109 – 130

Hunter, J. E., Schmidt, F. L., 1990, Methods of Meta-Analysis: Correcting Error and Bias in Research Findings, Sage Publications, Newsbury Park

Hunton, J. E., Price, K. H., 1997, "Effects of the User Participation Process and Task Meaningfulness on Key Information System Outcomes", Management Science, Vol. 43, No. 6, 797 – 812

Hwang, H., Ku, C., Yen, D. C., Cheng, C., 2004, "Critical Factors Influencing the Adoption of Data Warehouse Technology: a Study of the Banking Industry in Taiwan", Decision Support Systems, Vol. 37, No. 1, 1 – 21

Hymer, S., Pashigian, P., 1962, "Firm Size and Rate of Growth", The Journal of Political Economy, Vol. 70, No. 6, 556 – 569

Iacobucci, D., Neelamegham, R., Hopkins, N., 1999, "Measurement Quality Issues in Dyadic Models of Relationships", Social Networks, Vol. 21, No. 3, 211 – 237

Iacovou, C. L., Benbasat, I., 1995, "Electronic Data Interchange and Small Organisations: Adoption and Impact of Technology", MIS Quarterly, Vol. 19, No. 4, 465 – 486

Iacovou, C. L., Benbasat, I., Dexter, A. A., 1995, "Electronic Data Interchange and Small Organisations: Adoption and Impact of Technology", MIS Quarterly, Vol. 19, No. 4, 465 – 485

Igbaria, M., Greenhaus, J. H., 1991, "Career Orientations of MIS Employees: An Empirical Analysis", MIS Quarterly, Vol. 15, No. 2, 151 – 170

Igbaria, M., Zinatelli, N., Cragg, P., Cavaye., A. L. M., 1997, "Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model", MIS Quarterly, Vol. 21, No. 3, 279 – 293

Iman, R. I., Conover, W. J., 1983, Modern Business Statistics, John Wiley and Sons Publishers, New York

Indik, B. P., 1964, "The Relationship Between Organization Size and Supervision Ratio", Administrative Science Quarterly, Vol. 9, No. 3, 301 – 312

Ittner, C. D., Lambert, R. A., Larcker, D. F., 2003, "The Structure and Performance Consequences of Equity Grants to Employees of New Economy Firms", Journal of Accounting and Economics, Vol. 34, No. 1, 89 – 127

Ivancevich, D. M., Hermanson, D. R., Smith, L. M., 1998, "The Association of Perceived Data Recovery Plan Strength With Organisational Characteristics", Journal of Information Systems, Vol. 12, No. 1, 31 – 41

Ivancevich, J. M., Lorenzi, P. Skinner, S. J., 1997, Management Quality and Competitiveness, 2nd Ed., McGraw-Hill, New York

Jarvenpaa, S. L., Dickson G. W., DeSanctis, G., 1985, "Methodological Issues in Experimental IS Research", MIS Quarterly, Vol. 9, No. 2, 141 – 156

Jayaratne, J., Wolken, J., 1999, "How Important are Small Banks to Small Business Lending?: New Evidence From a Survey of Small Firms", Journal of Banking & Finance, Vol. 23, No. 2-4, 427 – 458

Jenkins, M. A., 1985, "Research Methodologies and MIS Research", E. Mumford et al. (Eds) Research Methodologies in Information Systems, 103 – 117, Elsevier Science Publishers, North Holland

Jensen, M., 1986, "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers", American Economic Review, Vol. 76, 323 – 329

Jerome, H., 1932, "The Measurement of Productivity Changes and the Displacement of Labor", The American Economic Review, Vol. 22, No. 1, 32 – 40

Johnsen, J. A., Biegel, D. E., Shafran, R., 2000, "Concept Mapping in Mental Health: Uses and Adaptations", Evaluation and Program Planning, Vol. 23, 67 – 75

Johnson, E. J., Russo, J. E., 1984, "Product Familiarity and Learning New Information", Journal of Consumer Research", Vol. 11, 542 – 550

Johnson, R. A., Wichern, D. W., 1982, Applied Multivariate Statistical Analysis, Prentice Hall Publishers, Englewood Cliffs, New Jersey

Jones, M., 2003, "The Expert System: Constructing Expertise in an IT/Management Consultancy", Information and Organization, Vol. 13, No. 4, 257 – 284

Joo, Y., Kim, Y., 2004, "Determinants of Corporate Adoption of e-Marketplace: an Innovation Theory Perspective", Journal of Purchasing and Supply Management, Vol. 10, 89 – 101

Kalantaridis, C., 2004, "Internationalization, Strategic Behavior, and the Small Firm: A Comparative Investigation", Journal of Small Business Management, Vol. 42, No. 3, 245 – 263

Kalleberg, A. L., Reynolds, J., Marsden, P. V., 2003, "Externalizing Employment: Flexible Staffing Arrangements in US Organizations", Social Science Research, Vol. 32, No. 4, 525 – 552

Kalleberg, A. L., Van Buren, M. E., 1996, "Is Bigger Better? Explaining the Relationship Between Organization Size and Job Rewards", American Sociological Review, Vol. 61, No. 1, 47 – 67

Kapur, S., 1995, "Technological Diffusion With Social Learning", Journal of Industrial Economics, Vol. 43, No. 2, 173 – 196

Karimi, J., Gupta, Y. P., 1996, "Impact of Competitive Strategy and Information Technology Maturity on Firms' Strategic Response to Globalisation", Journal of Management Information Systems, Vol. 12, No. 4, 55 – 89

Katsikeas, C., Morgan, R. E., 1994, "Differences in Perceptions of Exporting Problems Based on Firm Size and Export Market Experience", European Journal of Marketing, Vol. 28, No. 5, 17 – 39

Katz, A. I., 1993, "Measuring Technology's Business Value", Information Systems Management, Vol. 10, No. 1, 33 – 40

Katz, D., Kahn, R. L., 1966, The Social Psychology of Organizations, John Wiley, New York

Kauffman, R. J., Weill, P., 1989, "An Evaluative Framework for Research on the Performance Effects of Information Technology Investments", Proceedings of the 10th International Conference on Information Systems (ICIS), Boston, Massachusetts, December 4 – 6 , 377 – 388

Kaynak, E., Kothari, J., 1984, "Export Behavior of Small and Medium-Sized Manufacturers", Management International Review, Vol. 2, 61 – 69

Keen P. G. W., 1980, "MIS Research: Reference Disciplines and Cumulative Tradition", Proceedings of the First International Conference on Information Systems, Philadelphia, Pennsylvania, December, 9 – 18

Kendall, D. G., 1971, "Maps From Marriages: An Application of Nonmetric Multidimensional Scaling to Parish Register Data", in F. R. Hodgson, D. G. Kendall, Tatu, P. (Eds), Mathematics in Archaeological and Historical Sciences, Edinburgh University, Edinburgh

Kennickell, A., 1997, Codebook for 1995 Survey of Consumer Finances, Washington, D. C.

Khalifa, M., Kwok, C. W. R., 1999, "Remote Learning Technologies: Effectiveness of Hypertext and GSS", Decision Support Systems, Vol. 26, 195 – 207

Kianifard, F., 1994, "Evaluation of Clinimetric Scales: Basic Principles and Methods", The Statistician, Vol. 43, No. 4, 475 – 487

Kieser, A., 1994, "Why Organisation Theory Needs Historical Analyses - and How This Should be Performed", Organisational Science, Vol. 5, No. 4, 608 – 620

Kim, C. Y., McLeod, R., 1999, "Expert, Linear Models, and Nonlinear Models of Expert Decision Making in Bankruptcy Prediction: A Lens Model Analysis", Journal of Management Information Systems, Vol. 16, No. 1, 189 – 207

Kim, S., 2002, "Firm Characteristics Influencing the Extent of Electronic Billing Adoption: an Empirical Study in the US Telecommunication Industry", Telematics and Informatics, Vol. 19, No. 3, 201 – 223

Kimberly, J., 1975, "Classification and Organisational Analysis: The Case of Rehabilitation Organisations", Western Sociological Review, Vol. 6, 47 – 60

Kimberly, J., 1976, "Organisational Size and the Structuralist Perspective: A Review, Critique and Proposal", Administrative Science Quarterly, Vol. 21, No. 4, 571 – 597

Kimberly, J., Evanisko, M., 1981, "Organizational Innovation: the Influence of Individual, Organizational, and Contextual Factors on Hospital Adoption of Technological and Administrative Innovations", Academy of Management Journal, Vol. 124, No. 4, 689 – 713

King, W. R., 1996, "Achieving Global Strategic Advantage", Information Systems Management, Vol. 13, No. 4, 57 – 60

Kivijarvi, H., Saarinen, T., 1995, "Investment in Information Systems and the Financial Performance of the Firm", Information and Management, Vol. 28, 143 – 163

Klassen, R. D., Jacobs, J., 2001, "Experimental Comparison of Web, Electronic and Mail Survey Technologies in Operations Management", Journal of Operations Management, Vol. 19, No. 6, 713 – 728

Klatzky, S. R., 1970, "Relationship of Organisational Size to Complexity and Coordination", Administrative Science Quarterly, Vol. 15, No. 4, 428 – 438

Klein, L. A., Cerullo, M. J., Cerullo, M. V., 1992, "Integration of the Microcomputer Into the Changing Accounting Curriculum: An Analysis of Recent Findings", Computers and Education, Vol. 19, No. 3, 209 – 217

Kline, P., 1994, An Easy Guide to Factor Analysis, Routledge Publishers, London

Koberg, C. S., Uhlenbruck, N., Sarason, Y., 1996, "Facilitators of Organisational Innovation: The Role of Life-Cycle Stage", Journal of Business Venturing, Vol. 11, 133 – 149

Kohli, R., Devaraj, S., 2004, "Contribution of Institutional DSS to Organizational Performance: Evidence From a Longitudinal Study", Decision Support Systems, Vol. 37, No. 1, 103 – 118

Koste, L. L., Malhotra, M. K., Sharma, S., 2004, "Measuring Dimensions of Manufacturing Flexibility", Journal of Operations Management, Vol. 22, No. 2, 171 – 196

Kowtha, N. R., Choon, T. W. I., 2001, "Determinants of Website Development: a Study of Electronic Commerce in Singapore", Information and Management, Vol. 39, No. 3, 227 – 242

Kriesberg, L., 1962, "Careers, Organization Size, and Succession", The American Journal of Sociology, Vol. 68, No. 3, 355 – 359

Krippendorff, K., 1980, Content analysis: an introduction to its methodology, Sage Publications, London

Krishnaswami, S., Pottier, S., 2001, "Agency Theory and Participating Policy Usage Evidence From Stock Life Insurers", The Journal of Risk and Insurance, Vol. 68, No. 4, 659 – 683

Kruskal, J. B., 1964a, "Nonmetric Multidimensional Scaling: A Numerical Method", Psychometrika, Vol. 29, No. 2, 115 – 129

Kruskal, J. B., 1964b, "Multidimensional Scaling by Optimising Goodness of Fit to a Nonmetric Hypothesis", Psychometrika, Vol. 29, 1 – 27

Kruskal, J. B., Wish, M., 1978, Multidimensional Scaling, Quantitative Applications in the Social Sciences, No. 07-011, Sage Publications, California, USA

Kudyba, S., Diwan, R., 2002, "Research Report: Increasing Returns to Information Technology", Information Systems Research, Vol. 13, No. 1, 104 – 111

Lai, V. S., 1994, "A Survey of Rural Small Business Computer Use: Success Factors and Decision Support", Information and Management, Vol. 26, 297 – 304

Laitinen, E. K., 2002, "A Dynamic Performance Measurement System: Evidence From Small Finnish Technology Companies", Scandinavian Journal of Management, Vol. 18, No 1, 65 – 99

Lall, S., Kumar, R., 1981, "Firm Level Export Performance in an Inward Looking Economy: The Indian Engineering Industry", World Development, Vol. 9, 453 – 463

Lancaster, K., 1968, Mathematical Economies, Macmillan Publishers, New York

Lance, G. N., Williams, W. T., 1967b, "A General Theory of Classificatory Sorting Strategies I: Hierarchical Systems", Computer Journal, Vol. 9, No. 4, 373 – 380

Lance, G. N., Williams, W. T., 1967a, "A General Theory of Classificatory Sorting Strategies II: Clustering Systems", Computer Journal, Vol. 10, No. 3, 51 – 60

Lang, J. R., Calatone, R. J., Gudmundson, D., 1997, "Small Firm Information Seeking as a Response to Environmental Threats and Opportunities", Journal of Small Business Management, Vol. 35, 11 – 23

Larzarsfeld, P. F., 1937, "Some Remarks on the Typological Procedures in Social Research", Zeitschrift fur Sozialforschung, Vol. 6, 119 – 139

Law, D., Gorla, N., "Exploring Factors Underlying Effective Office Information Systems", Information and Management, Vol. 31, 1996, 25-35

Lawless, M. W., Finch, L. K., 1989, "Choice and Determinism: A Test of Hrebiniak and Joyce's Framework on Strategy-Environment Fit", Strategic Management Journal, Vol. 10, No. 4, 351 – 365

Lawrence, P., Lorsch, J., 1967, Organization and Environment, Harvard University Press, Cambridge, Massachusetts

Leauby, B. A., Brazina, P., 1998, "Concept Mapping: Potential Uses in Accounting Education", Journal of Accounting Education, Vol. 16 No. 1, 123 – 138

LeBaron, D., Farrelly, G. Guha, S., 1989, "Facilitating a Dialogue on Risk: A Questionnaire Approach", Financial Analysts Journal, Vol. 45, 19 – 24

Lederer, A. L., Sethi, V., 1992, "Root Causes of Strategic Information Systems Planning Implementation Problems", Journal of Management Information Systems, Vol. 9, No. 1, 25 – 45

Lee, B., Barua, A., Whinston, A. B., 1997, "Discovery and Representation of Causal Relationships in MIS Research: A Methodological Framework", MIS Quarterly, Vol. 21, No. 1, 109 – 136

Lee, J., 2001b, "The Impact of Knowledge Sharing, Organizational Capability and Partnership Quality on IS Outsourcing Success", Information and Management, Vol. 38, No. 5, 323 – 335

Lee, M. C. S., Adams, D. A., 1990, "A Manager's Guide to the Strategic Potential of Information Systems", Information and Management, Vol. 19, 169 – 182

Lee, M. D., 2001a, "Determining the Dimensionality of Multidimensional Scaling Models for Cognitive Modelling", Journal of Mathematical Psychology, Vol. 45, 149 – 166

Lee, S., Han, I., 2000, "The Impact of Organizational Contexts on EDI Controls", International Journal of Accounting Information Systems, Vol. 1, No. 3, 153 – 177

Lee, V. E., Smith, J. B., 1995, "Effects of High School Restructuring and Size on Early Gains in Achievement and Engagement", Sociology of Education, Vol. 68, No. 4, 241 – 270

Lehman, J. A., 1986, "Organizational Size and Information System Sophistication", Journal of Management Information Systems, Vol. 2, No. 3, 78 – 86

Leifer, R., 1988, "Matching Computer-Based Information Systems With Organizational Structures", MIS Quarterly, Vol. 12, No. 1, 63 – 73

Lending, D, Chervany, N. L., 2002, "Case Tool Use and Job Design: A Restrictiveness/ Flexibility Explanation", The Journal of Computer Information Systems, Vol. 43, No. 1, 81 – 91

Lewis, B. R., Snyder, C. A., Rainer, R. K., 1995, "An Empirical Assessment of the Information Resource Management Construct", Journal of Management Information Systems, Vol. 12, No. 1, 199 – 223

Lewis, C. M., Rogalski, R. J., Seward, J. K., 2003, "Industry Conditions, Growth Opportunities and Market Reactions to Convertible Debt Financing Decisions", Journal of Banking and Finance, Vol. 27, No. 1, 153 – 181

Li, E. Y., Rogers, J. C., 1991, "An Information System Profile of US Companies", Information and Management, Vol. 21, 19 – 36

Li, M., Ye, L. R., 1999, "Information Technology and Firm Performance: Linking with Environmental, Strategic and Managerial Contexts", Information and Management, Vol. 35, 43 – 51

Lin, C., 2002, "Organizational Size, Multiple Audiences, and Web Site Design", Technical Communication, Vol. 49, No. 1, 36 – 44

Lin, C., Pervan, G., 2003, "The Practice of IS/IT Benefits Management in Large Australian Organizations", Information and Management, Vol. 41, No. 1, 13 – 24

Lind, M. R., Zmud, R. W., Fischer, W. A., 1989, "Microcomputer Adoption - The Impact of Organisational Size and Structure", Information and Management, Vol. 16, 157 – 162

Loevinger, J., 1957, "Objective Tests as Instruments of Psychological Theory", Psychological Reports, Vol. 3, No. 9, 635 – 694

London, H. I., 1975, Social Science Theory Structure and Application, New York Press, New York

Love, T., 2001, "Theoretical Perspectives and Perry's 5 Chapter PhD Thesis Model", Teaching and Learning Forum 2001, Curtin University, Perth

Low, G. C., Henderson-Sellers, B., Han, D., 1995, "Comparison of Object-Oriented and Traditional Systems Development Issues in Distributed Environments", Information and Management, Vol. 28, No. 5, 327 – 340

Lucas, H. C., 1975, Why Information Systems Fail, Columbia University Press, New York

Lyytinen, K., King, J. L., 2004, "Nothing At The Center?: Academic Legitimacy in the Information Systems Field", Journal of the Association for Information Systems, Vol. 5, No. 6, 220 – 246

Maansaari, J., Iivari, J., 1999, "The Evolution of CASE Usage in Finland Between 1993 and 1996", Information and Management, Vol. 36, 37 – 53

Mabert, V. A., Soni, A., Venkataramanan, M. A., 2003, "The Impact of Organization Size on Enterprise Resource Planning (ERP) Implementations in the US Manufacturing Sector", Omega, Vol. 31, No. 3, 235 – 246

MacDermid, S. M., Litchfield, L. C., Pitt-Catsouphes, M., 1999, "Organizational Size and Work-Family Issues", Annals of the American Academy of Political and Social Science, Vol. 562, 111 – 126

MacQueen, K. M., Milstein, B., 1999, "A Systems Approach to Qualitative Data Management and Analysis", Field Methods, Vol. 11, No. 1, 27 – 39

Malhotra, N. K., 1981, "A Scale to Measure Self-Concepts, Person Concepts, and Product Concepts", Journal of Marketing Research, Vol. 18, 456 – 464

Mansfield, E., 1963, "Size of Firm, Market Structure, and Innovation", The Journal of Political Economy, Vol. 71, No. 6, 556 – 576

March, S. T., Smith, G. F., 1995, "Design and Natural Science Research on Information Technology", Decision Support Systems, Vol. 15, 251 – 266

Marchant, G., 1990, "Discussion of Determinants of Auditor Expertise", Journal of Accounting Research, Vol. 26, 21 – 28

Markman, G. D., Baron, R. A., 2003, "Person–Entrepreneurship Fit: Why Some People are More Successful as Entrepreneurs Than Others", Human Resource Management Review, Vol. 13, No. 2, 281 – 301

Marriott, R., 1949, "Size of Working Group and Output", Occupational Psychology, Vol. 23, 47 – 57

Marsden, P. V., Cook, C. R., Knoke, D., 1996, "American Organizations and Their Environments: a Descriptive Review", In Organizations in America: Analyzing Their Structures and Human Resource Practices, A. L. Kalleberg, D. Knoke, P. V. Marsden, J. L. Spaeth, (Eds), 45 – 66, Sage, Thousand Oaks, California

Martinez-Ros, E., 1999, "Explaining the Decisions to Carry Out Product and Process Innovations: The Spanish Case", The Journal of High Technology Management Research, Vol. 10, No. 2, 223 – 242

Mason, C. F., Phillips, O. R., 2000, "An experimental evaluation of strategic preemption", International Journal of Industrial Organization, Vol. 18, No. 1, 107 – 135

Mason, R. O., 1989, "MIS Experiments: A Pragmatic Perspective", in The Information Systems Research Challenge: Experimental Research Methods, Benbasat, I. (Ed), Harvard Business School Research Colloquium, Vol. 2, 3 – 20, Harvard Business School, Harvard

Mason, R. O., Mitroff, I. I., 1973, "A Program for Research in Management Information Systems", Management Science, Vol. 19, No. 5, 475 – 485

Massetti, B., 1998, "An Ounce of Preventative Research Design is Worth a Ton of Statistical Analysis Cure", MIS Quarterly, Vol. 22, No. 1, 89 – 93

Masunaga, H., Horn, J., 2000, "Characterizing Mature Human Intelligence: Expertise Development", Learning and Individual Differences, Vol. 12, No. 1, 5 – 33

McDonald, R. P., 1981, "The Dimensionality of Tests and Items", British Journal of Mathematical and Statistical Psychology, Vol. 34, 100 – 117

McEnroe, J. E., Martens, S. C., 1998, "An Examination of the Auditing Standards Promulgation Process Involving SAS No. 69", Journal of Accounting and Public Policy, Vol. 17, No. 1, 1 – 26

McFarlan, F. W., McKenney, J. L., 1982, "The Information Archipelago - Maps and Bridges", Harvard Business Review, Vol. 60, No. 5, 109 – 119

McFarlan, F., W., McKenney, J. L., Pyburn, P., 1983, "The Information Archipelago - Plotting a Course", Harvard Business Review, Vol. 61, No. 1, 145 – 155

McLean, E. R., Kappelman, L. A., Thompson, J. P., 1993, "Converging End-user and Corporate Computing", Communications of the ACM, Vol. 36, No. 12, 79 – 92

McLennan, S., 1997, Yearbook Australia, Australian Bureau of Statistics, Government Publishing Service, Canberra, Australia

McPherson, M., 1983, "The Size of Voluntary Organizations", Social Forces, Vol. 61, No. 4, 1044 – 1064

Megginson, W. L., Nash, R., van Randenborgh, M., 1994, "The Financial and Operating Performance of Newly Privatized Firms: An International Empirical Analysis", Journal of Finance, Vol. 49, 403 – 452

Melman, S., 1951, "The Rise of Administrative Overhead in the Manufacturing Industries of the United States, 1899 – 1947", Oxford Economic Papers, Vol. 3, No. 1, 62 – 112

Mendelson, H., Pillai, R. R., 1998, "Clockspeed and Informational Response: Evidence from the Information Technology Industry", Information Systems Research, Vol. 9, No. 4, 415 – 434

Merten, A. G., Severance, D. G., 1981, "Data Processing Control: A State-of-the-Art Survey of Attitudes and Concerns of DP Executives", MIS Quarterly, Vol. 5, No. 2, 11 – 32

Methe, D. T., 1992, "The Influence of Technology and Demand Factors on Firm Size and Industrial Structure in the DRAM Market 1973 - 1988", Research Policy, Vol. 21, 13 – 25

Meyer, J., 1997, "The Acceptance of Visual Information in Management", Information and Management, Vol. 32, 275 – 287

Meyer, M. W., 1972, "Size and the Structure of Organizations: A Causal Analysis", American Sociological Review, Vol. 37, No. 4, 434 – 440

Meyers, L. S., Grossen, N. E., 1974, Behavioural Research: Theory, Procedure and Design, Freeman and Co. Publishers, San Francisco, USA

Miles, M. B., Huberman, A. M., 1984, Qualitative Data Analysis, Sage Publications, Beverly Hills, California, USA

Miller, D. C., 1991, Handbook of Research Design and Social Measurement, 5th Ed., Sage Publications, California USA

Miller, D., Droge, C., 1986, "Psychological and Traditional Determinants of Structure", Administrative Science Quarterly, Vol. 31, 539 – 560

Miller, G. A., Conaty, J., 1980, "Differentiation in Organizations: Replication and Cumulation", Social Forces, Vol. 59, No. 1, 265 – 274

Miller, W., 1983, The Survey Method in the Social and Political Sciences, Frances Pinter, London

Mingers, J., 2001, "Combining IS Research Methods: Towards a Pluralist Methodology", Information Systems Research, Vol. 12, No. 3, 240 – 259

Mintzberg, H., 1979, The Structuring of Organizations, Prentice-Hall, Englewood Cliffs, New Jersey

Mitchell, A. A., Dacin , P., 1996, "The Assessment of Alternative Measures of Consumer Expertise", Journal of Consumer Research, Vol. 23, 219 – 239

Mitchell, D. L., Klein, G., Balloun, J. L., 1996, "Mode and Gender Effects on Survey Data Quality", Information and Management, Vol. 30, 27 - 34

Mitra, S., Chayam, A. K., 1996, "Analysing Cost-Effectiveness of Organisations: The Impact of Information Technology Spending", Journal of Management Information Systems, Vol. 13, No. 2, 29 – 58

Moch, M. K., Morse, E. V., 1977, "Size, Centralization and Organizational Adoption of Innovations", American Sociological Review, Vol. 42, No. 5, 716 – 725

Moenaert, R. K., Souder, W. E., 1996, "Context and Antecedents of Information Utility at the R&D Marketing Interface", Management Science, Vol. 42, No. 11, 1592 – 1610

Mohr, L., 1969, "Determinants of Innovation in Organisations", American Political Science Review, Vol. 63, 111 – 126

Mojena, R., 1977, "Hierarchical Grouping Methods and Stopping Rules: An Evaluation", Computer Journal, Vol. 20, 426 – 432

Montazemi, A. R., 1988, "Factors Affecting Information Satisfaction in the Context of the Small Business Environment", MIS Quarterly, Vol. 12, No. 2, 239 – 256

Moore, F. T., 1959, "Economies of Scale: Some Statistical Evidence", The Quarterly Journal of Economics, Vol. 73, No. 2, 232 – 245

Moore, G. C., Benbasat, I., 1991, "Development of an Instrument to Measure the Perception of Adopting an Information Technology Innovation", Information Systems Research, Vol. 2, No. 3, 192 – 223

Morgan, R. E., Strong, C. A., 2003, "Business Performance and Dimensions of Strategic Orientation", Journal of Business Research, Vol. 56, No. 3, 163 – 176

Mukhopadhyay, T., Kekre, S., 1995, "Business Value of Information Technology: A Study of Electronic Data Interchange", MIS Quarterly, Vol. 19, No. 2, 137 – 157

Mullet, K., Sano, D., 1994, Designing Visual Interfaces: Communication Oriented Techniques, SunSoft Press/Prentice-Hall, Englewood Cliffs, New Jersey

Mullineaux, D. J., 1978, "Economies of Scale and Organizational Efficiency in Banking: A Profit- Function Approach", The Journal of Finance, Vol. 33, No. 1, 259 – 280

Mumford, M. D., 1999, "Construct Validity and Background Data: Issues, Abuses, and Future Directions", Human Resource Management Review, Vol. 9, No. 2, 117 – 145

Murphy, N. B., 1976, "The Relationship Between Organizational Size and the Administrative Component of Banks: A Comment", The Journal of Business, Vol. 49, No. 1, 62 – 65

Nabali, H. M., 1991, "Hospital Information Systems", Information and Management, Vol. 20, 323 – 332

Nahm, A. Y., Vonderembse, M. A., Koufteros, X. A., 2003, "The Impact of Organizational Structure on Time-Based Manufacturing and Plant Performance", Journal of Operations Management, Vol. 21, No. 3, 281 – 306

Negandhi, A. R., Reimann, B. C., 1973, "Correlates of Decentralisation: Closed and Open Systems Perspectives", Academy of Management Journal, Vol. 16, 570 – 581

Nemati, H. R., Barko, C. D., 2002, "Enhancing Enterprise Decisions Through Organizational Data Mining", Journal of Computer Information Systems, Vol. 42, No. 4, 21 – 28

Neuman, W. L., 1994, Social Research Methods: Qualitative and Quantitative Approaches, 2nd Ed., Prentice Hall Publishers, Massachusetts, USA

Neuman, W. L., 2000, Social Research Methods: Qualitative and Quantitative Approaches, 4th Ed., Allyn & Bacon, Needham Heights, Massachusetts, USA

Newbold, P., 1991, Statistics for Business and Economics, 3rd Ed., Prentice-Hall International, Massachusetts, USA

Newell, S., Goldsmith, R. E., 2001, "The Development of a Scale to Measure Perceived Corporate Credibility", Journal of Business Research, Vol. 52, No. 3, 235 – 247

Newell, S., Swan, J., Robertson, M., 1998, "A Cross-National Comparison of the Adoption of Business Process Reengineering: Fashion-Setting Networks?", The Journal of Strategic Information Systems, Vol. 7, No. 4, 299 – 317

Nezlek, G., Jain, H. K., Nazareth, D. L., 1999, "An Integrated Approach to Enterprise Computing Architectures", Communications of the ACM, Vol. 42, No. 11, 89 – 90

Nord, W. R., Tucker, S., 1987, Implementing Routine and Radical Innovations, New Lexington Press, San Francisco

Norman, G. R., Streiner, D. L., 2000, "Logistic Regression", in Norman, G. R., Streiner, D. L. (Eds), Biostatistics: The Bare Essentials. Hamilton, Canada, B.C. Decker Publishers, 139 – 144

Nunnally, J. C., 1978, Psychometric Theory, 2nd Ed., McGraw-Hill, New York

O'Rourke, A. D., 1985, "Differences in Exporting Practices, Attitudes and Problems by Size of Firm", American Journal of Small Business, Vol. 9, 25 – 29

Oktemgil, M., Greenley, G., Broderick, A. J., 2000, "An Empirical Study of Isolating Mechanisms in UK Companies", European Journal of Operational Research, Vol. 122, No. 3, 638 – 655

Olle, T. W., Hagelstein, J., MacDonald, I. G., Rolland, C., Sol, H. G., Van Assche, F. J. M., Verrijn-Stuart, A. A., 1988, Information Systems Methodologies: A Framework for Understanding, Addison-Wesley Publishing Co., England

Olson, M. H., Chervany, N. L., 1980, "The Relationship Between Organizational Characteristics and the Structure of the Information Services Function", MIS Quarterly, Vol. 4, No. 2, 57 – 68

Orlikowski, W. J., Baroudi, J. J., 1991, "Studying Information Technology in Organisations: Research Approaches and Assumptions", Information Systems Research, Vol. 2, 1 – 28

Orlitzky, M., 2001, "Does Firm Size Confound the Relationship Between Corporate Social Performance and Firm Financial Performance?", Journal of Business Ethics, Vol. 33, No. 2, 167 – 180

Oxman, R., 2004, "Think-Maps: Teaching Design Thinking in Design Education", Design Studies, Vol. 25, No. 1, 63 – 91

Pagell, M., Krause, D. R., 2004, "Re-exploring the Relationship Between Flexibility and the External Environment", Journal of Operations Management, Vol. 21, No. 6, 629 – 649

Palvia, P., Means, D. B., Jackson, W. M., 1994, "Determinants of Computing in Very Small Business", Information and Management, Vol. 27, 161 – 174

Palvia, P., Palvia, S. C., 1999, "An Examination of the IT Satisfaction of Small-Business Users", Information and Management, Vol. 35, No. 3, 127 – 137

Panteli, N., 2002, "Richness, Power Cues and Email Text", Information and Management, Vol. 40, No. 2, 75 – 86

Patzer, G. L., 1996, Using Secondary Data in Market Research: United States and Worldwide, Quorum Books, Westport, Connecticut

Paulson, S. K., 1980, "Organizational Size, Technology, and Structure: Replication of a Study of Social Service Agencies Among Small Retail Firms", Academy of Management Journal, Vol. 23, No. 2, 341 – 347

Pavri, F., Ang, J., 1995, "A Study of the Strategic Planning Practices in Singapore", Information and Management, Vol. 28, 33 – 47

Pearce, J. A., Chapman, B. L., David, F. R., 1982, "Environmental Scanning for Small and Growing Firms", Journal of Small Business Management, Vol. 20, No. 3, 27 – 35

Perona, M., Miragliotta, G., 2004, "Complexity Management and Supply Chain Performance Assessment. A Field Study and a Conceptual Framework", International Journal of Production Economics, Vol. 90, 103 – 115

Perrow, C., 1961, "The Analysis of Goals in Complex Organizations", American Sociological Review, Vol. 26, No. 6, 854 – 866

Perry, C., 1998, "A Structured Approach for Presenting Theses", Australasian Marketing Journal, Vol. 6, No. 1, 63 – 85

Peterson, P. B., 2003, "The Use of Expatriates and Inpatriates in Central and Eastern Europe Since the Wall Came Down", Journal of World Business, Vol. 38, No. 1, 55 – 69

Pfeffer, J., 1982, Organisations and Organisation Theory, Pitman Publishing, Massachusetts

Phillips, P. C. B., 1986, "The Exact Distribution of the Wald Statistic", Econometrica, Vol. 54, No. 4, 881 – 895

Pick, J. B., 1991, "Staffing, Planning and Control of Information Systems in Charitable Nonprofit Organisations", Information and Management, Vol. 20, 295 – 311

Pierce, J. L., Delbecq, A. L., 1977, "Organization Structure, Individual Attitudes and Innovation", Academy of Management Review, Vol. 2, 27 – 37

Pinsonneault, A., Rivard, S., 1998, "Information Technology and the Nature of Managerial Work: From the Productivity Paradox to the Icarus Paradox?", MIS Quarterly, Vol. 22, No. 3, 287 – 311

Pleatsikas, C., Teece, D., 2001, "The Analysis of Market Definition and Market Power in the Context of Rapid Innovation", International Journal of Industrial Organization, Vol. 19, No 5, 665 – 693

Poon, S., Swatman, P. M. C., 1999, "An Exploratory Study of Small Business Internet Commerce Issues", Information and Management, Vol. 35, 9 – 18

Porter, L., Lawler, E., 1965, "Properties of Organization Structure in Relation to Job Attitudes and Job Behaviour", Psychological Bulletin, Vol. 64, 23 – 51

Post, G. V., Kagan, A., Keim, R. T., 1999, "A Structural Equation Evaluation of CASE Tools Attributes", Journal of Management Information Systems, Vol. 15, No. 4, 215 – 234

Potelle, H., Rouet, J., 2003, "Effects of Content Representation and Readers' Prior Knowledge on the Comprehension of Hypertext", International Journal of Human-Computer Studies, Vol. 58, No. 3, 327 – 345

Prakken, H., McNamara, P., 1998, Norms, Logics and Information Systems, Frontiers in Artificial Intelligence and Applications Series, Vol. 49, IOS Press, Amsterdam.

Premkumar, G., King, W. R., 1994, "Organisational Characteristics and Information Systems Planning: An Empirical Study", Information Systems Research, Vol. 5, No. 2, 75 – 109

Prescott, M., Conger, S., 1995, "Information Technology Innovations: A Classification by IT Lotus of Impact and Research Approach", The Data Base for Advances in Information Systems, Vol. 26, No. 2, 20 – 41

Price, J. L., Mueller, C. W., 1986, Handbook of Organizational Measurement, Pitman Publishers, Massachusetts

Priem, R., Butler, J., 2001, "Is the Resource-Based 'View' a Useful Perspective for Strategic Management Research?", Academy of Management Review, Vol. 26, No 1, 22 – 40

Pugh, D. S., Hickson, D. J., Hinings, C. R., 1969, "An Empirical Taxonomy of Structures of Work Organizations", Administrative Science Quarterly, Vol. 14 No. 1, 115 – 126

Pugh, D. S., Hickson, D. J., Hinings, C. R., Macdonald, K. M., Turner, C., Lupton, T., 1963, "A Conceptual Scheme for Organizational Analysis", Administrative Science Quarterly, Vol. 8, No. 3, 289 – 315

Pugh, D. S., Hickson, D. J., Hinings, C. R., Turner, C., 1968, "Dimensions of Organization Structure", Administrative Science Quarterly, Vol. 13, No. 1, 65 – 105

Quirk, J. P., 1961, "The Capital Structure of Firms and the Risk of Failure", International Economic Review, Vol. 2, No. 2, 210 – 228

Raelin, J. A., 1997, "A Model of Work Based Learning", Organization Science, Vol. 8, No. 6, 563 – 578

Ragu-nathan, B., Ragu-nathan, T. S., Tu, Q., Shi, Z., 2001, "Information Management (IM) Strategy: the Construct and its Measurement", Journal of Strategic Information Systems, Vol. 10, No. 4, 265 – 289

Raho, L. E., Belohlav, J. A., Fiedler, K. D., 1987, "Assimilating New Technology into the Organization: An Assessment of McFarlan and McKenney's Model", MIS Quarterly, Vol. 11, No. 1, 43 – 56

Rai, A., Bajwa, D. S., 1997, "An Empirical Investigation Into Factors Relating to the Adoption of Executive Information Systems: An Analysis of EIS for Collaboration and Decision Support", Decision Sciences, Vol. 28, No. 4, 939 – 975

Ray, J. J., 1972, "A New Reliability Maximization Procedure for Likert Scales", Australian Psychologist, Vol. 7, No. 1, 40 – 46

Raymond, L., 1985, "Organisational Characteristics and MIS Success in the Context of Small Business", MIS Quarterly, Vol. 9, No. 1, 37 – 52

Raymond, L., 1991, "Organisational Context and Information Systems Success: A Contingency Approach", Journal of Management Information Systems, Vol. 6, No. 4, 5 – 19

Renwick, F. B., 1969, "Asset Management and Investor Portfolio Behavior: Theory and Practice", Journal of Finance, Vol. 24, No. 2, 181 – 206

Riemenschneider, C. K., Mykytyn, P. P., 2000, "What Small Business Executives Have Learned About Managing Information Technology", Information and Management, Vol. 37, No. 5, 257 – 269

Rivard, S., Huff, S. L., 1984, "User Developed Applications: Evaluation of Success from the DP Department Perspective", MIS Quarterly, Vol. 8, No. 1, 39 – 50

Robey, D., 1981, "Computer Information Systems and Organisational Structure", Communications of the ACM, Vol. 24, No. 1, 679 – 687

Robey, D., 1996, "Research Commentary: Diversity in Information Systems Research: Threat, Promise, and Responsibility", Information Systems Research, Vol. 7, No. 4, 400 – 408

Robey, D., Bakr, M. M., Miller, T. S., 1977, "Organizational Size and Management Autonomy: Some Structural Discontinuities", Academy of Management Journal, Vol. 20, No. 3, 378 – 397

Rogers, E. M., 1962, Diffusion of Innovations, 1st Ed., Free Press, New York

Rogers, E. M., 1971, Diffusion of Innovations, 2nd Ed., Free Press, New York

Rogers, E. M., 1983, Diffusion of Innovations, 3rd Ed., Free Press, New York

Rogers, E. M., 1995, Diffusion of Innovations, 4th Ed., Free Press, New York

Rohlf, F. J., 1970, "Adaptive Hierarchical Clustering Schemes", Systematic Zoology, Vol. 19, 58 – 82

Rohlf, F. J., Fisher, D. L., 1968, "Test for Hierarchical Structure in Random Data Sets", Systematic Zoology, Vol. 17, 407 – 412

Rosenberg, S., Kim, M. P., 1975, "The Method of Sorting as a Data Gathering Procedure in Multivariate Research", Multivariate Behavioral Research, Vol. 10, 489 – 502

Rouleau, L., Clegg, S. R., 1992, "Postmodernism and Postmodernity in Organization Analysis", Journal of Organizational Change Management, Vol. 5, No. 1, 8 – 26

Roussinov, D., Zhao, J. L., 2003, "Automatic Discovery of Similarity Relationships Through Web Mining", Decision Support Systems, Vol. 35, No. 1, 149 – 166

Ruhl, J. B., Salzman, J., 2003, "Mozart and the Red Queen: The Problem of Regulatory Accretion in the Administrative State", Georgetown Law Journal, Vol. 91, No. 4, 757 – 760

Rummel, R. J., 1970, Applied Factor Analysis, Northwestern University Press, Evanston, Illinois

Russell, R. M., Maidment, S. C., Brooke, I., Topping, M. D., 1998, "An Introduction to a UK Scheme to Help Small Firms Control Health Risks From Chemicals", The Annals of Occupational Hygiene, Vol. 42, No. 6, 367 – 376

Ryan, L. V., Scott, W. G., 1995, "Ethics and Organizational Reflection: The Rockefeller Foundation and Postwar 'Moral Deficits', 1942-1954", The Academy of Management Review, Vol. 20, No. 2, 438 – 461

Ryan, S. D., Harrison, D. A., 2000, "Considering Social Subsystem Costs and Benefits in Information Technology Investment Decisions: A View from the Field on Anticipated Payoffs", Journal of Management Information Systems, Vol. 16, No. 4, 11 – 40

Ryan, S. D., Prybutok, V. R., 2001, "Factors Affecting the Adoption of Knowledge Management Technologies: A Discriminative Approach", Journal of Computer Information Systems, Vol. 41, No. 4, 31 – 37

Sambamurthy, V., Zmud, R. W., 1999, "Arrangements for Information Technology Governance: A Theory of Multiple Contingencies", MIS Quarterly, Vol. 23, No. 2, 261 – 290

Samiee, S., Walters, P. G. P., 1990, "Influence of Firm Size on Export Planning and Performance", Journal of Business Research, Vol. 20, 235 – 248

Sampler, J. L., Short, J. E., 1994, "An Examination of Information Technology's Impact on the Value of Information and Expertise: Implications for Organisational Change", Journal of Management Information Systems, Vol. 11, No. 2, 59 – 74

Sarle, W. S., 1995, "Measurement Theory: Frequently Asked Questions", Disseminations of the International Statistical Applications Institute, 4th Ed., 61 – 66, ACG Press, Wichita, Kansas

Schiffman, S., Reynolds, M. L., Young, F. W., 1981, Introduction to Multidimensional Scaling, Academic Press, New York

Schminke, M., Ambrose, M. L., Cropanzano, R. S., 2000, "The Effect of Organizational Structure on Perceptions of Procedural Fairness", Journal of Applied Psychology, Vol. 85, No. 2, 294 – 304

Schneider, K. C., Johnson, K. C., 1995, "Stimulating Response to Market Surveys of Business Professionals", Industrial Marketing Management, Vol. 24, 265 – 276

Schooley, D., Worden, D., 1996, "Risk Aversion Measures: Comparing Attitudes and Asset Allocation", Financial Services Review, Vol. 5, 87 – 99

Schulz, M., Jobe, L. A., 2001, "Codification and Tacitness as Knowledge Management Strategies: an Empirical Exploration", The Journal of High Technology Management Research, Vol.12, No. 1, 139 – 165

Schumm, W. R., 1982, "Integrating Theory, Measurement and Data Analysis in Family Studies Survey Research", Journal of Marriage and the Family, Vol. 44, No. 4, 983 – 998

Schumpeter, J. A., 1934, The Theory of Economic Development: an Inquiry Into Profits, Capital, Credit, Interest, and the Business Cycle, Harvard University Press, Cambridge, Massachusetts

Schumpeter, J., 1942, Capitalism, Socialism, and Democracy, Harper and Row, New York

Schunn, C. D., Anderson, J. R., 1999, "The Generality/Specificity of Expertise in Scientific Reasoning", Cognitive Science, Vol. 23, No. 3, 337 – 370

Schwab, D. P., 1980, "Construct Validity in Organizational Behaviour" in B. M. Staw, L. L. Cummings (Eds.), Research in Organizational Behaviour, Vol. 2, 3 – 43, JAI Press, Greenwich, Connecticut

Schwartz, M. F., Wood, D. C. M., 1993, "Discovering Shared Interests Using Graph Analysis", Communications of the ACM, Vol. 36, No. 8, 78 – 89

Scott, A. C., Clayton, J. E., Gibson, E., 1991, A Practical Guide to Knowledge Acquisition, 1st Ed., Addison-Wesley Publishers, New York

Scott, R. W., 1975, "Organizational Structure", Annual Review of Sociology, Vol. 1, 1 – 20

Seddon, P. B., 1997, "A Respecification and Extension of the DeLone and McLean Model of IS Success", Information Systems Research, Vol. 8, No. 3, 240 – 253

Seddon, P. B., Staples, S., Patnayakuni, R., Bowtell, M., 1999, "Dimensions of Information Systems Success", Communications of the Association for Information Systems, Vol. 2, No. 20, 1 – 61

Segelod, E., 2002, "Resource Allocation in a Few Industries: Determinants and Trends", International Journal of Production Economics, Vol. 77, No. 1, 63 – 70

Selltiz, C., Wrightsman, L. S., Cook, S.W., 1976, Research Methods in Social Relations, Holt, Rinehart and Winston, New York

Sethi, V., King, W. R., 1991, "Construct Measurement in Information Systems Research: An Illustration in Strategic Systems", Decision Sciences, Vol. 22, No. 3, 455 – 472

Sethi, V., King, W. R., 1994, "Development of Measures to Assess the Extent to Which an Information Technology Provides Competitive Advantage", Management Science, Vol. 40, No. 12, 1601 – 1627

Shalit, S. S., Sankar, U., 1977, "The Measurement of Firm Size", Review of Economics and Statistics, Vol. 59, No. 3, 290 – 298

Shanteau, J., Weiss, D. J., Thomas, R. P., Pounds, J. C., 2002, "Performance-Based Assessment of Expertise: How to Decide if Someone is an Expert or Not", European Journal of Operational Research, Vol. 136, No. 2, 253 – 263

Shao, Y. P., 1999, "Expert Systems Diffusion in British Banking: Diffusion Models and Media Factor", Information and Management, Vol. 35, 1 – 8

Shen, L. Y., Lu, W., Shen O., Li, H., 2003, "A Computer-Aided Decision Support System for Assessing a Contractor's Competitiveness", Automation in Construction, Vol. 12, No. 5, 577 – 587

Silberston, A., 1972, "Economies of Scale in Theory and Practice", The Economic Journal, Vol. 82, No. 325, 369 – 391

Simon, J. L., 1997, "Firm Size and Market Behavior: A Theory of Their Relationship", Journal of Economic Behavior and Organization, Vol. 33, No. 1, 107 – 120

Singhvi, S. S., Desai, H., 1971, "An Empirical Analysis of the Quality of Corporate Financial Disclosure", The Accounting Review, Vol. 46, 129 – 138

Slack, N., 1987, "The Flexibility of Manufacturing Systems", International Journal of Operations and Production Management, Vol. 7, No. 4, 35 – 45

Slappendel, C., 1996, "Perspectives on Innovation in Organisations", Organization Studies, Vol. 17, No. 1, 107 – 129

Smith, H. J., Milberg, S. J., Burke, S. J., 1996, "Information Privacy: Measuring Individuals' Concerns about Organizational Practices", MIS Quarterly, Vol. 20, No. 2, 167 – 196

Smyth, D. J., Boyes, W. J., Peseau, D. E., 1975, "The Measurement of Firm Size: Theory and Evidence for the United States and the United Kingdom", Review of Economics and Statistics, Vol. 57, No. 1, 111 – 114

Snizek, W. E., 1995, "Virtual Offices: Some Neglected Considerations", Communications of the ACM, Vol. 38, No. 9, 15 – 17

Snow, C. S., Hambrick, D. C., 1980, "Measuring Organizational Strategies: Some Theoretical and Methodological Problems", The Academy of Management Review, Vol. 5, No. 4, 527 – 538

Sohal, A. S., Ng, L., 1998, "The Role and Impact of Information Technology in Australian Business", Journal of Information Technology, Vol. 13, No. 3, 201 – 217

Srinivasan, A., 1985, "Alternative Measures of System Effectiveness: Associations and Implications", MIS Quarterly, Vol. 9, No. 3, 243 – 253

Starbuck, W. H., 1965, "Organisational Growth and Development", Handbook of Organisations, March, J. G. (Ed), Rand McNally Publishers, Chicago, USA

Steiger, J. H., 1990, "Structural Equation Model Evaluation and Modification: An Interval Estimation Approach", Multivariate Behavioural Research, Vol. 25, 173 – 180

Stevens, S. S., 1946, "On the Theory of Scales of Measurement", Science, Vol. 103, No. 2684, 677 – 680

Stock, G. N., Greis, N. P., Fischer, W. A., 2002, "Firm Size and Dynamic Technological Innovation", Technovation, Vol. 22, No. 9, 537 – 549

Straub, D. W., 1989, "Validating Instruments in MIS Research", MIS Quarterly, Vol. 13, No. 2, 147 – 169

Straub, D. W., 1990, "Effective IS Security: An Empirical Study", Information Systems Research, Vol. 1, No. 3, 255 – 276

Straub, D., Nance, W. D., 1990, "Discovering and Disciplining Computer Abuse in Organisations: A Field Study", MIS Quarterly, Vol. 14, No. 1, 44 – 61

Strauss, A., Corbin, J., 1998, Basics of Qualitative Research, Sage Publications, London

Sturdivant, F. D., Ginter, J. L., Sawyer, A. G., 1985, "Managers' Conservatism and Corporate Performance", Strategic Management Journal, Vol. 6, No. 1, 17 – 38

Sutton, R. I., D'Aunno, T., 1989, "Decreasing Organizational Size: Untangling the Effects of Money and People", Academy of Management Review, Vol. 14, 194 – 212

Swanson, E. B., 1994, "Information Systems Innovation Among Organizations", Management Science, Vol. 40, No. 9, 1069 – 1092

Swanson, E. B., Dans, E., 2000, "System Life Expectancy and the Maintenance Effort: Exploring Their Equilibration", MIS Quarterly, Vol. 24, No. 2, 277 – 297

Swanson, L., 2003, "An Information-Processing Model of Maintenance Management", International Journal of Production Economics, Vol. 83, No. 1, 45 – 64

Tabachnick, B. G., Fidell, L. S., 1989, Using Multivariate Statistics, 2nd Ed., Harper Collins Publishers, New York

Tabachnick, B. G., Fidell, L. S., 1996, Using Multivariate Statistics, 3rd Ed., Harper Collins Publishers, New York

Talacchi, S., 1960, "Organization Size, Individual Attitudes and Behavior: An Empirical Study", Administrative Science Quarterly, Vol. 5, No. 3, 398 – 420

Talmor, E., Wallace, J. S., 1998, "Computer Industry Executives: An Analysis of the New Barons' Compensation", Information Systems Research, Vol. 9, No. 4, 398 – 415

Tan, H., Acevedo, G. L., 2004, "Evaluating SME Training Programs: Some Lessons from Mexico's CIMO Program", World Bank Working Paper

Tan, J., 2003, "Curvilinear Relationship Between Organizational Slack and Firm Performance: Evidence from Chinese State Enterprises", European Management Journal, Vol. 21, No. 6, 740 – 749

Tashakkori, A., Teddlie, C., 1998, "Mixed Methodology: Combining Qualitative and Quantitative Approaches", in L. Bickman, D. J. Rog (Eds), Applied Social Sciences Research Methods Series, Vol. 46, Sage Publications, Thousand Oaks, California.

Temtime, Z. T., 2003, "The Moderating Impacts of Business Planning and Firm Size on Total Quality Management Practices", The TQM Magazine, Vol. 15, No. 1, 52 – 61

Teo, H. H., Tan, B. C. Y., Wei, K. K., Woo, L. Y., 1995, "Reaping EDI Benefits Through a Pro-Active Approach", Information and Management, Vol. 28, 185 – 195

Teo, T. S. H., Ang, J. S. K., Pavri, F. N., 1997, "The State of Strategic IS Planning Practices in Singapore", Information and Management, Vol. 33, 13 – 23

Teo, T. S. H., King W. R., 1999, "An Empirical Study of the Impacts of Integrating Business Planning and Information Systems Planning", European Journal of Information Systems, Vol 8, 200 – 210

Teo, T. S. H., Ranganathan, C., 2004, "Adopters and Non-Adopters of Business-to-Business Electronic Commerce in Singapore", Information and Management, Vol. 42, No. 1, 89 – 102

Terrien, F. C., Mills, D. C., 1955, "The Effects of Changing Size Upon the Internal Structure of an Organization", American Sociological Review, Vol. 20, 11 – 13

Thomas, E., 1959, "Role Conceptions and Organisational Size", American Sociological Review, Vol. 24, 30 – 37

Thompson, J. D., 1967, Organisations in Action, McGraw Hill Publishers, New York

Thong, J. Y. L., 1999, "An Integrated Model of Information Systems Adoption in Small Business", Journal of Management Information Systems, Vol. 15, No. 4, 187 – 214

Thong, J., Yap, C. S., 1994, "Engagement of External Expertise in Information Systems Implementation", Journal of Management Information Systems, Vol. 11, No. 2, 209 – 231

Thorndike, R. L., Hagen, E., 1969, Measurement and Evaluation in Psychology and Education, 3rd Edition, John Wiley and Sons, New York

Tienari, J., Tainio, R., 1999, "The Myth of Flexibility in Organisational Change", Scandinavian Journal of Management, Vol. 15, 351 – 384

Timmons, J. A., 1990, New Venture Creation: Entrepreneurship in the 1990s, Irwin Publishers, Homewood, Illinois

Torkzadeh, G., Doll, W. J., 1999, "The Development of a Tool for Measuring the Perceived Impact of Information Technology on Work", Omega, Vol. 27, 327 – 339

Torkzadeh, G., Xia, W., 1992, "Managing Telecommunications by Steering Committee", MIS Quarterly, Vol. 16, No. 2, 187 – 200

Tornatzky, L. G., Klein, K. J., 1982, "Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings", IEEE Transactions of Engineering Management, Vol. 29, No. 1, 28 – 45

Townsend, J. C., 1953, Introduction to Experimental Methods, McGraw Publishers, Boston, Massachusetts

Trochim, W. M. K., 1989, "An Introduction to Concept Mapping for Planning and Evaluation", Evaluation and Program Planning, Vol. 12, 1–16

Trochim, W. M. K., 1993, The Concept System, Concept Systems, Ithaca, New York

Trochim, W. M. K., Linton, R., 1986, "Conceptualisation for Evaluation and Planning", Evaluation and Planning, Vol. 9, 289 – 308

Truman, G. E., 2000, "Integration in Electronic Exchange Environments", Journal of Management Information Systems, Vol. 17, No. 1, 209 – 244

Trumpower, D. L., Goldsmith, T. E., 2004, "Structural Enhancement of Learning", Contemporary Educational Psychology, Vol. 29, No. 4, 426 – 446

Tsouderos, J. E., 1955, "Organisational Change in Terms of a Series of Selected Variables", American Sociological Review, Vol. 20, 206 – 210

Turner, P., Turner, S., 2001, "A Web of Contradictions", Interacting with Computers, Vol. 14, No. 1, 1 – 14

Twiggs, J. E., McQuillan, J., Ferree, M. M., 1999, "Meaning and Measurement: Reconceptualizing Measures of the Division of Household Labor", Journal of Marriage and the Family, Vol. 61, No. 3, 712 – 724

Tyler, G. W., 1986, "Organization Size and Staff Tenure", The Journal of the Operational Research Society, Vol. 37, No. 4, 373 – 380

Udo, G. J., Davis, J. S., 1992, "Factors Affecting Decision Support System Benefits", Information and Management, Vol. 23, No. 6, 359 – 371

Upton, D., 1994, "The Management of Manufacturing Flexibility", California Management Review, Vol. 36, No. 2, 72 – 89

Van Boxtel, M. P. J., van Beijsterveldt, C. E. M., Houx, P. J., Anteunis, L. J. C., Metsemakers, J. F. M., Jolles, J., 2000, "Mild Hearing Impairment can Reduce Verbal Memory Performance in a Healthy Adult Population", Journal of Clinical and Experimental Neuropsychology, Vol. 22, 147 – 154

van der Bauwhede, H., Willekens, M., Gaeremynck, A., 2003, "Audit Firm Size, Public Ownership, and Firms' Discretionary Accruals Management", The International Journal of Accounting, Vol. 38, No. 1, 1 – 22

van der Heijden, B., 2000, "The Development and Psychometric Evaluation of a Multidimensional Measurement Instrument of Professional Expertise", High Ability Studies, Vol. 11, No. 1, 9 – 41

Venkatraman, N., 1989, "Strategic Orientation of Business Enterprises: the Construct, Dimensionality, and Measurement", Management Science, Vol. 35 No. 8, 942 – 962

Venkatraman, N., Grant, J. H., 1986, "Construct Measurement in Organizational Strategy Research: a Critique and Proposal", Academy of Management Review, Vol. 11, 71 – 87

Volberda, H. W., 1996, "Toward the Flexible Form: How to Remain Vital in Hypercompetitive Environments", Organisation Science, Vol. 7, No. 4, 359 – 374

Wade, M. R., Gravill, J. I., 2003, "Diversification and Performance of Japanese IT Subsidiaries: a Resource-Based View", Information and Management, Vol. 40, No. 4, 305 – 316

Waggle, D., Englis, B., 2000, "Asset Allocation Decisions in Retirement Accounts: an All-or-Nothing Proposition?", Financial Services Review, Vol. 9, No. 1, 79 – 92

Wagner, J. A., Klein, N. M., Keith, J. E., 2003, "Buyer–Seller Relationships and Selling Effectiveness: the Moderating Influence of Buyer Expertise and Product Competitive Position", Journal of Business Research, Vol. 56, No. 4, 295 – 302

Wainer, H., Berg, W., 1972, "The Dimensions of De Maupassant: A Multidimensional Analysis of Students Perception of Literature", American Education Research Journal, Vol. 9, 485 – 491

Wald, J. K., 1999, "How Firm Characteristics Affect Capital Structure: An International Comparison", The Journal of Financial Research, Vol. 22, No. 2, 161-187

Waldman, D. A., Ramirez, G. G., House, R. J., Puranam, P., 2001, "Does Leadership Matter? CEO Leadership Attributes and Profitability Under Conditions of Perceived Environmental Uncertainty", Academy of Management Journal, Vol. 44, No. 1, 134 – 143

Waldron, V. R., 1986, "Interviewing for Knowledge", IEEE Transactions on Professional Communications, Vol. 29, No. 2, 31 – 34

Wallace, R. S. O., Naser, K., Mora. A., 1994, "The Relationship Between the Comprehensiveness of Corporate Annual Reports and Firm Characteristics in Spain", Accounting and Business Research, Vol. 25, No. 97, 41 – 53

Walsham, G., 1993, Interpreting Information Systems in Organisations, Wiley Publishing, Chichester, UK

Walters, J. E., 1931, Applied Personnel Administration, Wiley, New York

Wang, P., 1994, "Information Systems Management Issues in the Republic of China for the 1990s", Information and Management, Vol. 26, 341 – 352

Wang, Y., Tang, T., Tang, J. E., 2001, "An Instrument for Measuring Customer Satisfaction Toward Web Sites That Market Digital Products and Services", Journal of Electronic Commerce Research, Vol. 2, No. 3, 89 – 102

Wareham, J., Gerrits, H., 1999, "De-contextualising Competence: Can Business Best Practice be Bundled and Sold?", European Management Journal, Vol. 17, No. 1, 39 – 49

Warner, W. L., Low, J., 1947, The Social System of the Modern Factory, Yale University Press, New Haven, Connecticut

Watts, R. L., Zimmerman, J. L., 1979, "The Demand for and Supply of Accounting Theories: The Market for Excuses", The Accounting Review, Vol. 54, No. 2, 273 – 301

Webb, E. J., 1968, "Unconventionality, Triangulation and Inference", in Barnette, W. L. (Ed.), Readings in Psychological Tests and Measurements, Revised Ed., 16 – 21, Irwin-Dorsey Publishers, Ontario, Canada

Weber, M., 1946, "Bureaucracy", in Shafritz, J. M., Ott, S. J. (Eds.), Classics of Organization Theory, 4th Ed., Wadsworth Publishing Company, California

Webster, J., Martocchio, J. J., 1992, "Microcomputer Playfulness: Development of a Measure with Workplace Implications", MIS Quarterly, Vol. 16, No. 2, 201 – 226

Webster, J., Starbuck, W. H., 1988, "Theory Building in Industrial and Organizational Psychology" in C. L. Cooper and I. Robertson (Eds.), International Review of Industrial and Organizational Psychology, 93 – 138, Wiley Publishers, Chichester

Webster, J., Watson, R. T., 2002, "Analyzing the Past to Prepare for the Future: Writing a Literature Review", MIS Quarterly, Vol. 26, No. 2, xiii – xxiii

Weick, K., 1969, The Social Psychology of Organising, Addison Wesley Publishers, Reading, Massachusetts

Weill, P., 1992, "The Relationship Between Investment in Information Technology and Firm Performance: A Study of the Valve Manufacturing Sector," Information Systems Research, Vol. 3, No. 4, 307 – 333

Weill, P., Olson, M. H., 1989, "An Assessment of the Contingency Theory of Management Information Systems", Journal of Management Information Systems, Vol. 6, No. 1, 59 – 79

Weill, P., Olson, M. H., 1989, "Managing Investment in Information Technology: Mini Case Examples and Implications", MIS Quarterly, Vol. 13, No. 1, 3 – 17

Weinberg, J. A., 1994, "Firm Size, Finance, and Investment", Economic Quarterly, Vol. 80, No. 1, 19 – 40

Weisbenner, S., 1999, "Do Pension Plans with Participant Investment Choice Teach Households to Hold More Equity?", Finance and Economics Discussion Series 1999-61, Federal Reserve Board, Federal Reserve Bank of the United States

West, S. G., Biesanz, J. C., Pitts, S. C., 2000, "Causal Inference and Generalization in Field Settings: Experimental and Quasi-Experimental Designs", In H. T. Reis, C. M. Judd (Eds.), Handbook of Research Methods in Social and Personality Psychology, 40 – 84, Cambridge University Press, New York

Westhead, P., Wright, M., Ucbasaran, D., 2002, "International Market Selection Strategies Selected by 'Micro' and 'Small' Firms", Omega, Vol. 30, No. 1, 51 – 68

Wheeler, L. A., Collins, S. K. R., 2003, "The Influence of Concept Mapping on Critical Thinking in Baccalaureate Nursing Students", Journal of Professional Nursing, Vol. 19, No. 6, 339 – 346

Whitmire, S., 1992, "Measuring the Complexity of Object-Oriented Software". International Conference on Applications of Software Measurement, 3rd, California, 15–19 November, 2.207 – 2.242

Wickliffe, V. P., 2004, "Refinement and Re-assessment of the Consumer Decision-Making Style Instrument", Journal of Retailing and Consumer Services, Vol. 11, No. 1, 9 – 17

Wildemuth, B. M., 1990, "A Method for Inducing Process Models from Qualitative Data", Library & Information Science Research, Vol. 12, 329 – 40

Willett, P., 1988, "Recent Trends in Hierarchic Document Clustering: A Critical Review", Information Processing & Management, Vol. 24, No. 5, 577 – 597

Williams, B., 2003, "Domestic and International Determinants of Bank Profits: Foreign Banks in Australia", Journal of Banking and Finance, Vol. 27, No. 6, 1185 – 1210

Winklhofer, H., Diamantopoulos, A., 2002, "A Comparison of Export Sales Forecasting Practices Among UK Firms", Industrial Marketing Management, Vol. 31, No. 6, 479 – 490

Winsten, C., Hall, M., 1961, "The Measurement of Economies of Scale", Journal of Industrial Economics, Vol. 9, No. 3, 255 – 264

Wixom, B. H., Watson, H. J., 2001, "An Empirical Investigation of the Factors Affecting Data Warehousing Success", MIS Quarterly, Vol. 25, No. 1, 17 – 41

Wolfram, C. D., 1998, "Strategic Bidding in a Multi-Unit Auction: an Empirical Analysis of Bids to Supply Electricity in England and Wales", Rand Journal of Economics, Vol. 29, No. 4, 703 – 725

Woo, C. Y., 1987, "Path Analysis of the Relationship Between Market Share, Business-Level Conduct and Risk", Strategic Management Journal, Vol. 8, 149 – 168

Woodward, J., 1965, Industrial Organisation: Theory and Practice, Oxford University Press, London

Yang, H., 1996, "Key Information Management Issues in Taiwan and the US", Information and Management, Vol. 30, 251 – 267

Yankelovich, D., 1972, Corporate Priorities: A Continuing Study of the New Demands on Business, Stamford, Connecticut

Yao, J. E., Xu, X., Liu, C., Lu, J., 2002, "Organizational Size: A Significant Predictor of IT Innovation Adoption", The Journal of Computer Information Systems, Vol. 43, No. 2, 76 – 82

Yao, R., Hanna, S., 2003, "Has Financial Risk Tolerance Changed Since 1983?", Consumer Interests Annual, Vol. 49

Yap, C. S., 1990, "Distinguishing Characteristics of Organisations Using Computers", Information and Management, Vol. 18, 97 – 107

Yetton, P. W., 1994, "Converting Information Technology to Performance Improvement", Australian Journal Of Public Administration, Vol. 53, No. 3, 379 – 393

Young, G., Smith, K. G., Grimm, C. M., Simon, D., 2000, "Multimarket Contact and Resource Dissimilarity: a Competitive Dynamics Perspective", Journal of Management, Vol. 26, No. 6, 1217 – 1236

Youngner, J. S., 1998, "The Scientific Misconduct Process: A Scientist's View From the Inside", Journal of the American Medical Association, Vol. 279, No. 1, 62 – 64

Zammuto, R. F., 1982, Assessing Organisational Effectiveness: Systems Change, Adaption and Strategy, SUNY Press, Albany, New York

Zeffane, R., 1992, "Patterns of Structural Control in High and Low Computer User Organisations", Information and Management, Vol. 23, 159 – 170

Zelazo, P. D., Frye, D., Rapus, T., 1996, "An Age-Related Dissociation Between Knowing Rules and Using Them", Cognitive Development, Vol. 11, No. 1, 37 – 63

Zelditch, M., Hopkins, T. K., 1961, "Laboratory Experiments with Organisations" in Etzioni, A. (Ed.), Complex Organisations, Holt, Hart and Winston, New York

Zhang, T., Ramakrishnan, R., Livny, M., 1996, "BIRCH: An Efficient Data Clustering Method for Large Databases", Proceedings of 1996 ACM-SIGMOD International Conference on Management of Data, Montreal, Quebec, 103 – 114

Zmud, R. W., Applegate, L. E., 1992, "Measuring Technology Incorporation/Infusion", Journal of Product Innovation Management, Vol. 9, No. 2, 148 – 155

APPENDIX A: GRAPH OF CONSTRUCTS IN THE RESEARCH LITERATURE

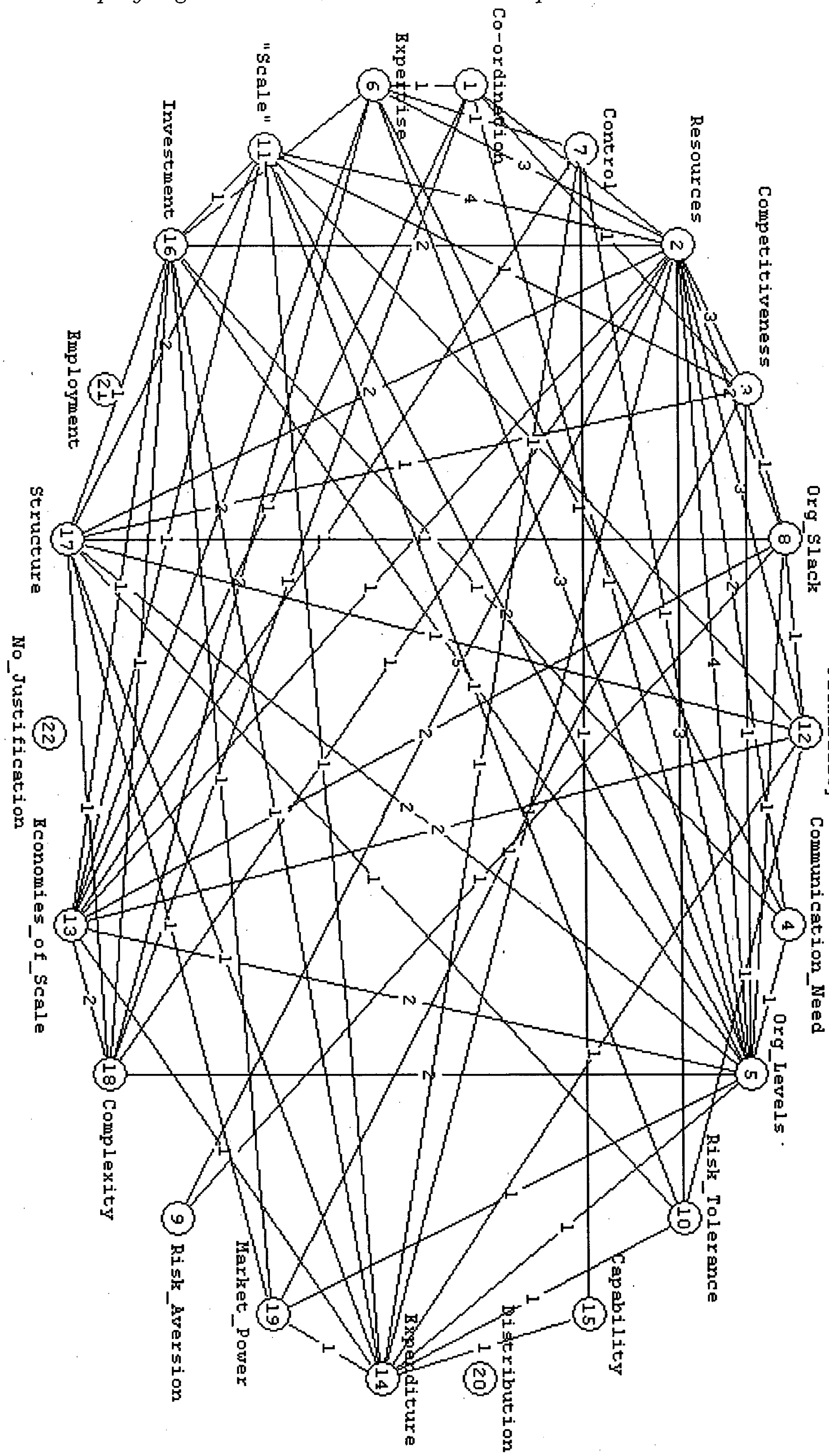
The approach of post-coding text can assist in specifying salient areas of interest, however, it generally won't afford any deeper indication of the relative importance of each of these areas. A graph approach may solve this problem, by allowing nodes to represent areas of research, and vertices (or edges) to represent the relative weights between these areas. Graph theory has received some attention in the Information Systems literature in areas such as workflow analysis (Basu and Blanning 1999) and search query handling (Hartman and van Hee 1995). The network modelling and optimisation literature, in particular, uses graph theory (such as Gorman and Malecki 2000).

A graph approach was deemed suitable to represent the relationships between research items. Each of the research item categories was assigned a number in order to ascribe orthogonality. Next, each node was given a weighting based on the number of times a study made use of that research theory. When a study made use of more than one theory, an edge was drawn between the two nodes representing the relevant items.

The graph representation was an important process as it represented the culmination of the analysis and literature work conducted thus far. Further, the process depended heavily on the individual perspective of the researcher. As Strauss and Corbin write, "other researchers may use other labels depending on their foci, training and interpretation". Additionally, it is difficult to develop a perfectly homogeneous picture of the construct from such brief, discontinuous and disaggregated text as was presented in this group of research papers: as noted, each paper delivers a small amount of discussion regarding the authors' understanding of organisational size. As MacQueen and Milstein (1999) advise, in cases where the research discussion was vague or inconclusive, the opinion of two other researchers was sought. Finally, a second staff member checked the groupings upon conclusion of the coding process.

The final graph of the constructs is shown in Figure A1. The figure shows the literature relation between constructs by a line between construct nodes. The number shown on the line between two construct nodes represents the number of times the two constructs are mentioned in the same research paper description.

Figure A1: Graph of Organisational Size Construct Relationships



It is important to note that graph theory, despite being popular in some areas of the research literature, is unproven in the context of conceptual relationship analysis. While this new application is exciting, it should be borne in mind that some degree of error always exists when applying a new method in this way. Similarly, it is possible that this node/vertex notation may obscure some subtle aspects of the research data. The effect of these limitations is unknown.

APPENDIX B: PARTICIPANT INFORMATION SHEET

Before Exercise

The purpose of this study is to explore the concept of organisational size. This stage of the study aims to find out how researchers view organisational size as a construct. This study is being run by a researcher at the ANU's School of Business and Information Management.. Participants are assured of anonymity, and data obtained will not be used for any purposes other than in this study. Participation in the study is purely voluntary.

On these index cards, I have listed a set of factors which comprise organisational size. These factors have been taken from studies in the research literature. Each card appears as follows [show card to participant and indicate points]. First, each card has the name of the item, and then an example of the item in context. You don't have to agree or disagree with the example, it's just to place the item in context. Second, each card has a number in the top right hand corner. Don't worry about the number, it's purely for administrative purposes.

What we'd like you to do is sort the cards into conceptually similar groupings. You may have as many groups as you deem to be appropriate. You may take as much time as you want to complete the exercise, and there are no right or wrong answers.

After Exercise

Do you have any further questions? Thank you for taking the time to complete this exercise.

APPENDIX C: PARTICIPANT CONSENT FORM

Analysing the Organisational Size Construct in Information Systems Research

I agree to take part in the Analysing the Organisational Size Construct in Information Systems Research Project being conducted at the Australian National University. I have had the project explained to me and read the Explanatory Statement, a copy of which I have kept for my records. The exercise should take between five and ten minutes of my time. I understand that agreeing to take part means that I am willing to:

- Be interviewed by the researchers
- Allow the interviews to be transcribed
- Make myself available for a further interview should one be required

I understand that any information I provide is confidential, and that no information that could lead to the identification of any individual will be disclosed in any report on the project, or to any other party. If I choose not to participate in the interviews, I will not be required to give a reason. No findings identifying myself or my company title/affiliation will be published. A copy of the final project report will be stored for at least 5 years as prescribed by university regulations.

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project without being penalised or disadvantaged in any way.

I understand that a summary of findings will be made available to me if I so choose. I also understand that the researchers may use interview findings for analysis and publication purposes.

Signature.................................... Date.............................

Please tick this box if you would like to receive a summarised copy of the results: ☐

APPENDIX D:
COVER LETTER AND SURVEY INSTRUMENT

The next five pages contain material related to the questionnaire survey. The next page contains the cover letter, and the following four pages contain the survey instrument itself.

THE AUSTRALIAN NATIONAL UNIVERSITY

Sigi Goode
Lecturer (Information Systems)
School of Business and Information Management
Faculty of Economics and Commerce

Canberra ACT 0200 Australia
T: +61 2 6125 5048
F: +61 2 6125 5005
E: sigi.goode@anu.edu.au
www.anu.edu.au

<<FIRM_NAME>>
<<POSTAL_ADDRESS>>
<<STATE>> <<POSTCODE>>

<<DATE>>

Dear Sir / Madam,

As part of my PhD research at the ANU, I am studying appropriate ways to measure and compare organisations. This research should assist policy makers, among others, to develop appropriate and equitable classifications of different types of firms.

We would *really* value your firm's brief and anonymous participation in this study. All information provided in this questionnaire will remain strictly private and confidential as far as possible. The survey solicits no personal information, and data cannot be traced to individuals. No specific individuals or organisations will be identified or identifiable in any publication involving the information supplied in the questionnaire. The information will not be used for any purpose other than the research and will not be available to any other organisation. You are under no obligation to participate.

The attached questionnaire should take no more than a few minutes to complete. If you are unsure as to any answer, please provide *the answer you think is appropriate*. Where you cannot provide an answer to a question or the question is not applicable, please indicate such. Feel free to add whatever comments you wish. Your feedback is most valuable.

While this letter has been addressed to the manager, if you feel someone else would provide a more accurate view of your organisation then please pass the survey onto them. A pre-addressed, reply-paid envelope has been enclosed for your convenience.

If you require any further information or assistance please do not hesitate to contact either Mr. Sigi Goode (ph: (02) 6125 5048) or Prof. Shirley Gregor (Supervisor) (ph: (02) 6125 3749).

I thank you in advance for your time and effort.

Mr. Sigi Goode

Lecturer, School of Business and Information Management

Any ethical concerns with respect to this study can be directed to the ANU Human Research Ethical Committee c/o The Human Ethics Officer, Research Office, (02) 6125 2900 or email Human.Ethics.Officer@anu.edu.au

THE AUSTRALIAN NATIONAL UNIVERSITY

Canberra ACT 0200 Australia
T:+61 2 6125 5048
F:+61 2 6125 5005
E:sigi.goode@anu.edu.au
www.anu.edu.au

Section 1: Organisation Details

1. What is your job title? ______________________________
2. How long have you been employed in the organisation? ______________________________
3. How many equivalent full time staff does the organisation employ? ______________________
4. In what year was the organisation founded? ___________________________
5. What is the organisation's primary business activity? ______________________________
6. For how many years has the firm been in this line of business? ______________________
7. In how many Australian states does the firm operate? ___________________________
8. In how many countries does the firm operate? __________________________
9. How many suppliers does the firm have? _________________________
10. How many divisions does the firm have? _________________________
11. How many departments does the firm have? _________________________
12. How many levels of management does the firm have? _________________________
13. How many operational levels does the firm have (from shop floor to top management)? __________

Section 2: Information Technology (IT) Details

14. Does the firm currently use computers? ☐ Yes ☐ No (*go to Section 3*)
15. For how many years has the firm been using computers? _________________ years
16. What percentage of your annual budget is spent on IT? ________________%
17. What percentage of your annual IT budget is spent on hardware *alone*? ____________%
18. Approximately how much time elapsed between the first feasibility/exploration of IT and the actual implementation of that IT? _______________
19. Approximately how long does it take to implement a decision to purchase IT products? ____________
20. How dependent on external IT services would you say the firm is?

    Not dependent at all 1 2 3 4 5 Completely dependent

21. What has been your biggest problem with the use of IT for business purposes?

____

____

____

____

22. The maintenance of the firm's computers on a day to day basis is predominantly undertaken by:

☐ User/Office Staff ☐ Internal - IT Personnel (No. of People__________)

☐ Consultant ☐ Vendor ☐ Outsourcer ☐ Other:____________________

23. Does the firm use open source software (such as Linux or Apache)? ☐ Yes ☐ No

If Yes which software?________________________________

____

____

If No why not? __________________________________

____

____

Section 3: Organisational Characteristics

24. Do you consider your organisation to be small, medium or large?______________

Why?____

____

____

25. To what extent do you agree with the following statements (1= totally disagree, 5 = totally agree)

The firm has sufficient financial resource slack for operation	1	2	3	4	5	☐ N/A
The firm has sufficient human resource slack for operation	1	2	3	4	5	☐ N/A
The firm has sufficient technical support capability for operation	1	2	3	4	5	☐ N/A
The firm has the ability to scan for valuable knowledge in other organisations	1	2	3	4	5	☐ N/A
The firm has the ability to exploit gathered knowledge from other organisations	1	2	3	4	5	☐ N/A
The firm has the ability to assimilate found knowledge from other organisations	1	2	3	4	5	☐ N/A
The firm has the ability to acquire needed knowledge from other organisations	1	2	3	4	5	☐ N/A

26. Which of the following statements comes closest to the amount of financial risk that the firm is willing to take when it makes investments?

- ☐ Take substantial financial risks expecting to earn substantial returns
- ☐ Take above average financial risks expecting to earn above average returns
- ☐ Take average financial risks expecting to earn average returns
- ☐ Take below average financial risks expecting to earn lower than average returns
- ☐ Not willing to take any financial risks

27. To what extent are the following statements correct (1= totally incorrect, 5 = totally correct)

The firm has rules and procedures that show how staff can make suggestions for changes	1	2	3	4	5	☐ N/A
The firm has rules and procedures that show how staff can trial innovative approaches to their job	1	2	3	4	5	☐ N/A
The firm considers it wise to put some portion of savings in uninsured investments to get a high yield	1	2	3	4	5	☐ N/A
The firm gives employees flexibility in work life	1	2	3	4	5	☐ N/A
The firm has rules and procedures that guide quality improvement efforts	1	2	3	4	5	☐ N/A
The choice of work methods staff use is determined by themselves and not by the firm	1	2	3	4	5	☐ N/A
The firm has rules and procedures that guide creative problem solving	1	2	3	4	5	☐ N/A
The firm is willing to take substantial risks to realize financial gains	1	2	3	4	5	☐ N/A
This firm restricts employees' choice of approaches to work	1	2	3	4	5	☐ N/A

28. Describe the importance of the following issues in the organisation (1= not important at all, 5 = very important)

Resource co-ordination within the organisation	1	2	3	4	5	☐ N/A
Communication within the organisation	1	2	3	4	5	☐ N/A
Resource control within the organisation	1	2	3	4	5	☐ N/A
Personnel co-ordination within the organisation	1	2	3	4	5	☐ N/A

29. To what extent are the following statements correct (1= totally incorrect, 5 = totally correct)

There are more than 4 management layers between shop-floor staff and the CEO	1	2	3	4	5	☐ N/A
Our staff handle job-related problems by themselves	1	2	3	4	5	☐ N/A
Our staff are required to work in cross-functional teams	1	2	3	4	5	☐ N/A
Our staff cannot take significant actions without supervisors' or managers' approval	1	2	3	4	5	☐ N/A
There are very few layers in our organizational hierarchy	1	2	3	4	5	☐ N/A
Our managers are assigned to lead various cross-functional teams	1	2	3	4	5	☐ N/A
Our staff have the authority to correct problems when they occur	1	2	3	4	5	☐ N/A
Our staff have total control over their own jobs	1	2	3	4	5	☐ N/A
Communications are easily carried out among staff	1	2	3	4	5	☐ N/A

Section 4: Organisational Demographics

30. Approximate total ASSETS of the organization:

- ☐ Under $250,000
- ☐ $250,001 - $500,000
- ☐ $500,001 - $1,000,000
- ☐ $1,000,001- $2,000,000
- ☐ $2,000,001 - $3,000,000
- ☐ $3,000,001 - $5,000,000
- ☐ $5,000,001 - $10,000,000
- ☐ $10,000,001 - $50,000,000
- ☐ $50,000,001 - $100,000,000
- ☐ $100,000,001 - $250,000,000
- ☐ $250,000,001 - $500,000,000
- ☐ $500,000,001 - $1,000,000,000
- ☐ $1,000,000,001 - $5,000,000,000
- ☐ $5,000,000,001 - $10,000,000,000
- ☐ $10,000,000,001 - $20,000,000,000
- ☐ $20,000,000,001 - $50,000,000,000
- ☐ More than $50,000,000,000
- ☐ Not sure

31. Approximate Annual REVENUES of the organization:

- ☐ Under $250,000
- ☐ $250,001 - $500,000
- ☐ $500,001 - $1,000,000
- ☐ $1,000,001- $2,000,000
- ☐ $2,000,001 - $3,000,000
- ☐ $3,000,001 - $5,000,000
- ☐ $5,000,001 - $10,000,000
- ☐ $10,000,001 - $50,000,000
- ☐ $50,000,001 - $100,000,000
- ☐ $100,000,001 - $250,000,000
- ☐ $250,000,001 - $500,000,000
- ☐ $500,000,001 - $1,000,000,000
- ☐ $1,000,000,001 - $5,000,000,000
- ☐ $5,000,000,001 - $10,000,000,000
- ☐ $10,000,000,001 - $20,000,000,000
- ☐ $20,000,000,001 - $50,000,000,000
- ☐ More than $50,000,000,000
- ☐ Not sure

32. Approximate Annual EXPENSES of the organization:

- ☐ Under $250,000
- ☐ $250,001 - $500,000
- ☐ $500,001 - $1,000,000
- ☐ $1,000,001- $2,000,000
- ☐ $2,000,001 - $3,000,000
- ☐ $3,000,001 - $5,000,000
- ☐ $5,000,001 - $10,000,000
- ☐ $10,000,001 - $50,000,000
- ☐ $50,000,001 - $100,000,000
- ☐ $100,000,001 - $250,000,000
- ☐ $250,000,001 - $500,000,000
- ☐ $500,000,001 - $1,000,000,000
- ☐ $1,000,000,001 - $5,000,000,000
- ☐ $5,000,000,001 - $10,000,000,000
- ☐ $10,000,000,001 - $20,000,000,000
- ☐ $20,000,000,001 - $50,000,000,000
- ☐ More than $50,000,000,000
- ☐ Not sure

Section 5: Final Comments

Please add any further comments ______________________________

____

____

____

____

____

Thank you very much for your time!

If you would like a copy of the final report, please supply a postal address or enclose a business card.

APPENDIX E:
VARIABLE BOX PLOTS FOR TWO-STEP CLUSTER ANALYSIS

This section contains the box plots for each size construct variable. For each variable, the figure shows the 95% confidence intervals for that variable's mean in both of the two clusters.

Figure E1: Need for Co-ordination Simultaneous 95% Mean Confidence Intervals

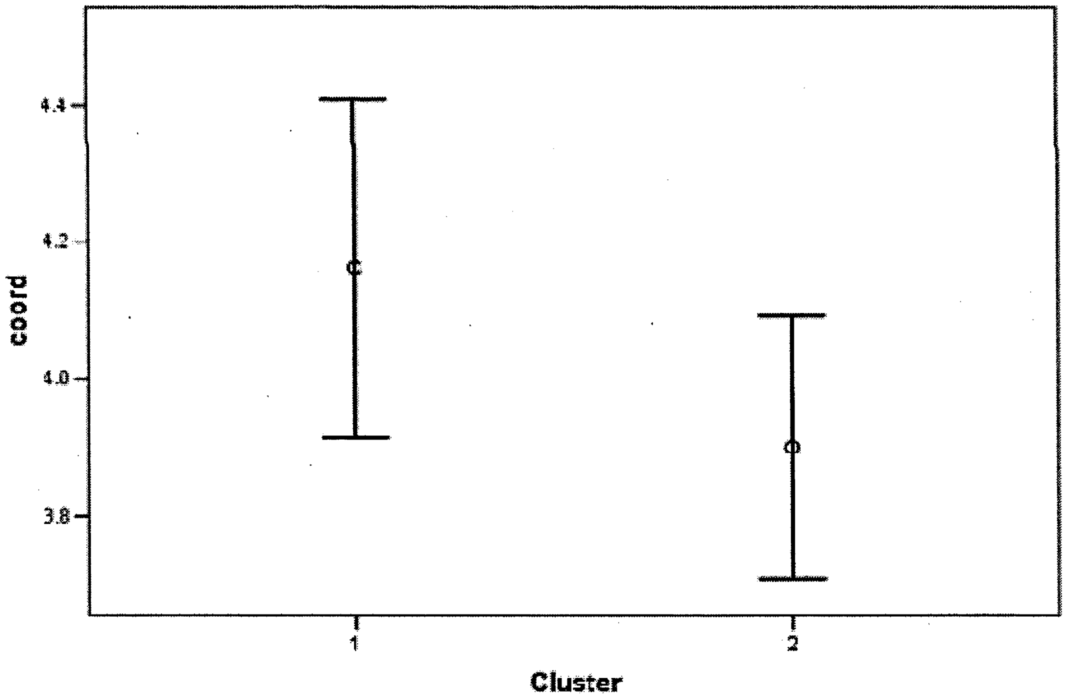


Figure E2: Resources Simultaneous 95% Mean Confidence Intervals

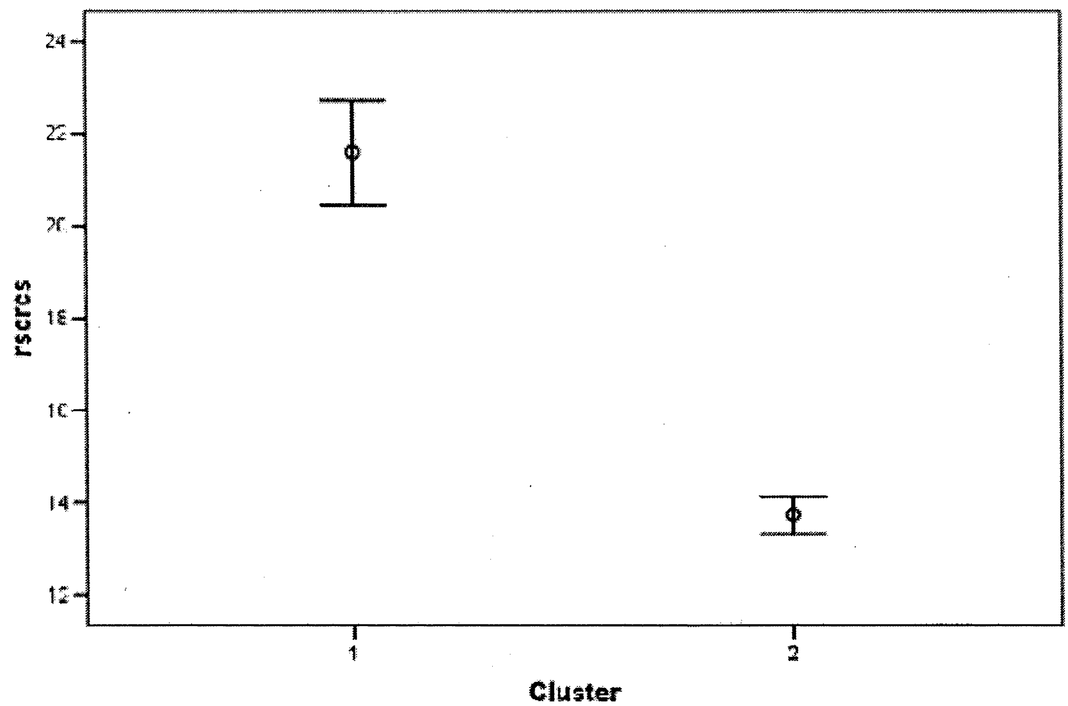


Figure E3: Need for Communications Simultaneous 95% Mean Confidence Intervals

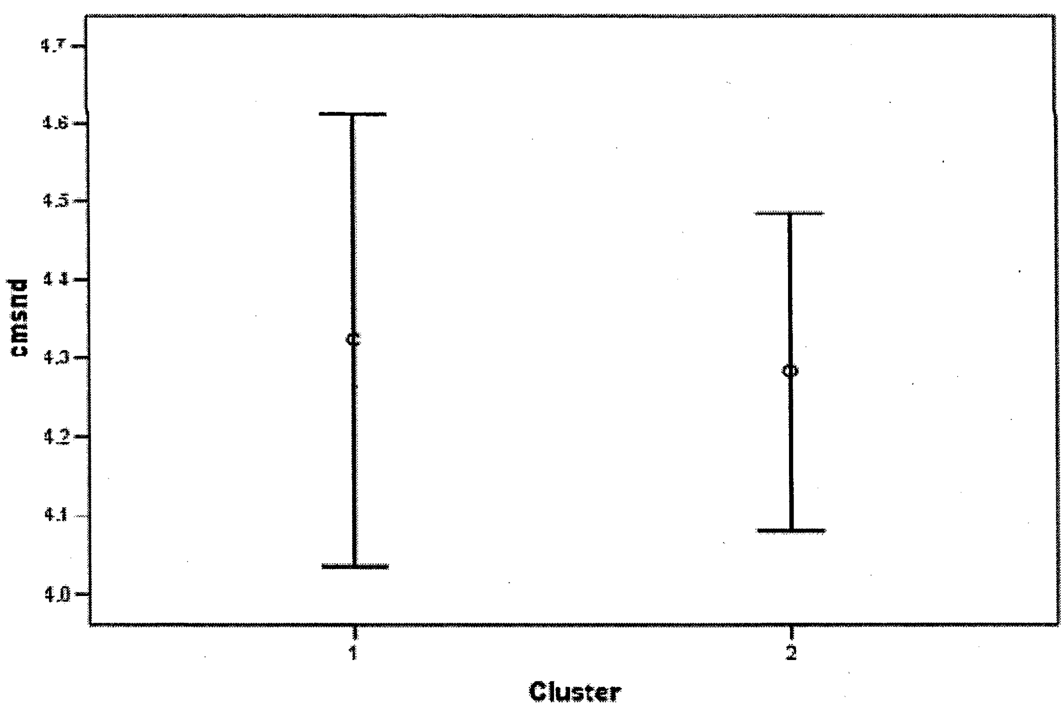


Figure E4: Organisation Levels Simultaneous 95% Mean Confidence Intervals

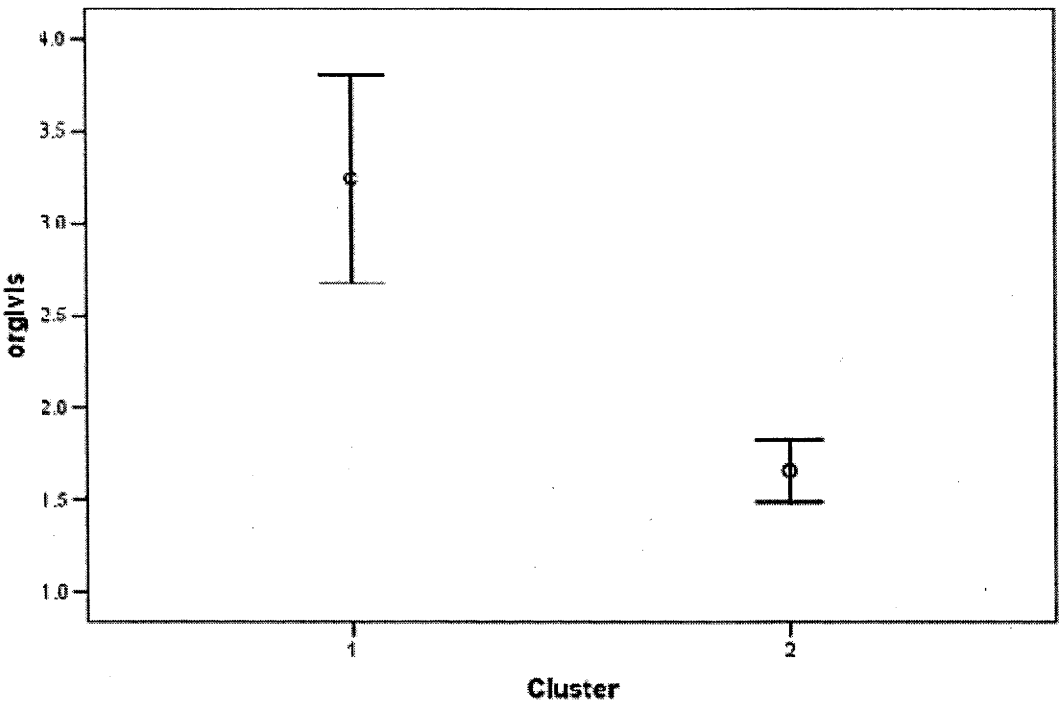


Figure E5: Expertise Simultaneous 95% Mean Confidence Intervals

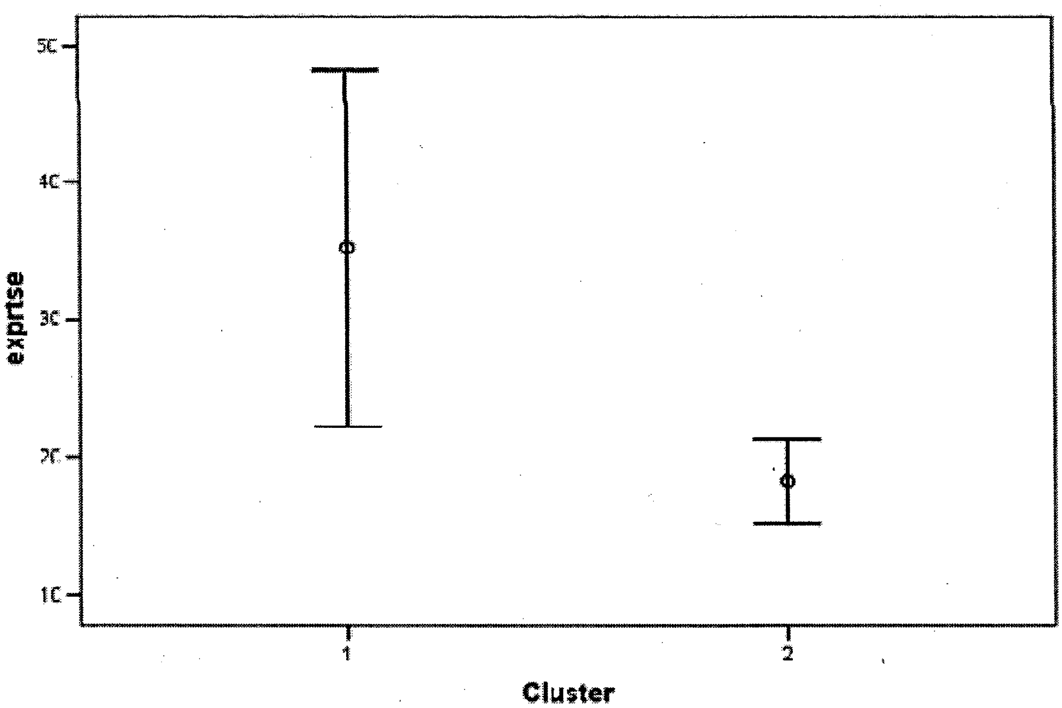


Figure E6: Need for Control Simultaneous 95% Mean Confidence Intervals

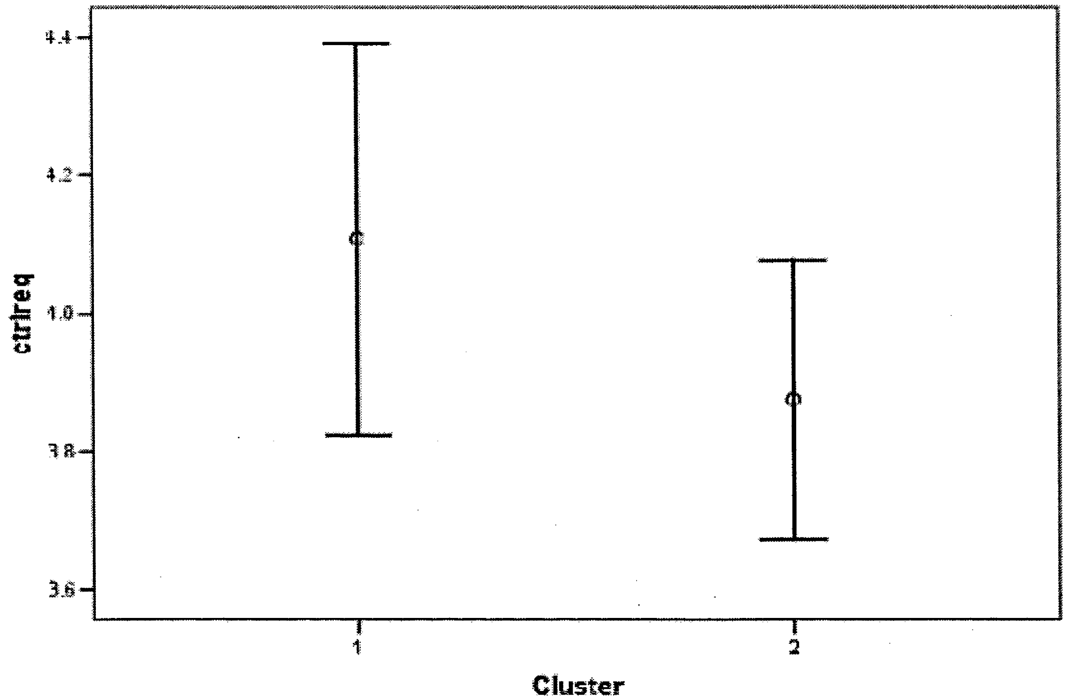


Figure E7: Slack Resources Simultaneous 95% Mean Confidence Intervals

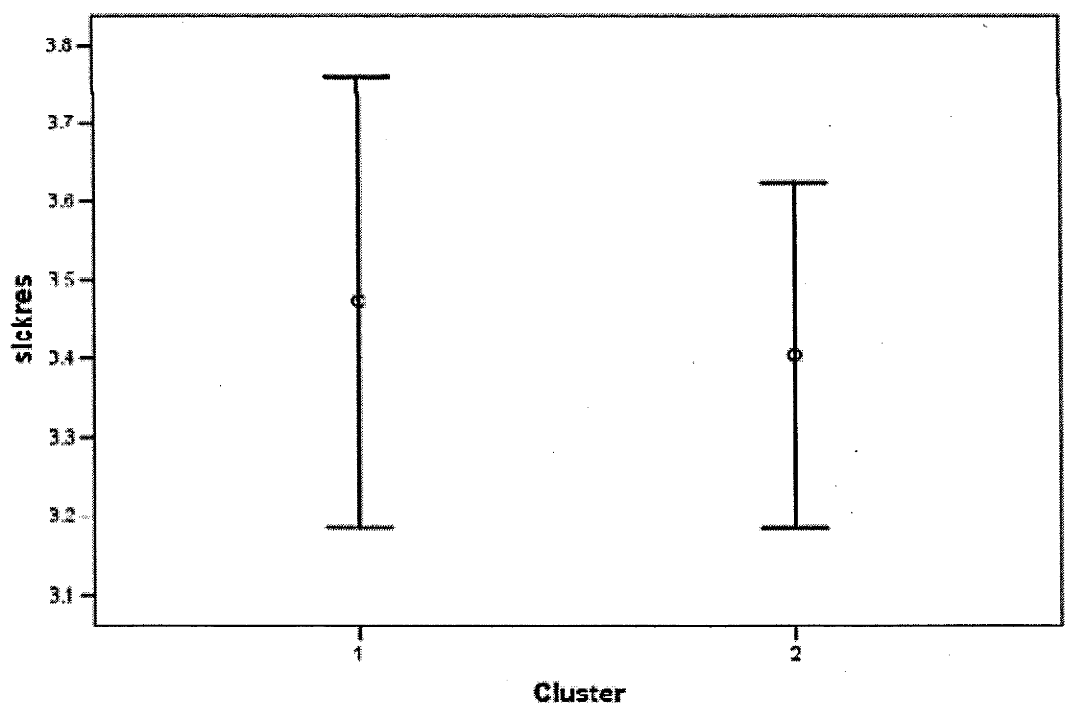


Figure E8: Risk Aversion Simultaneous 95% Mean Confidence Intervals

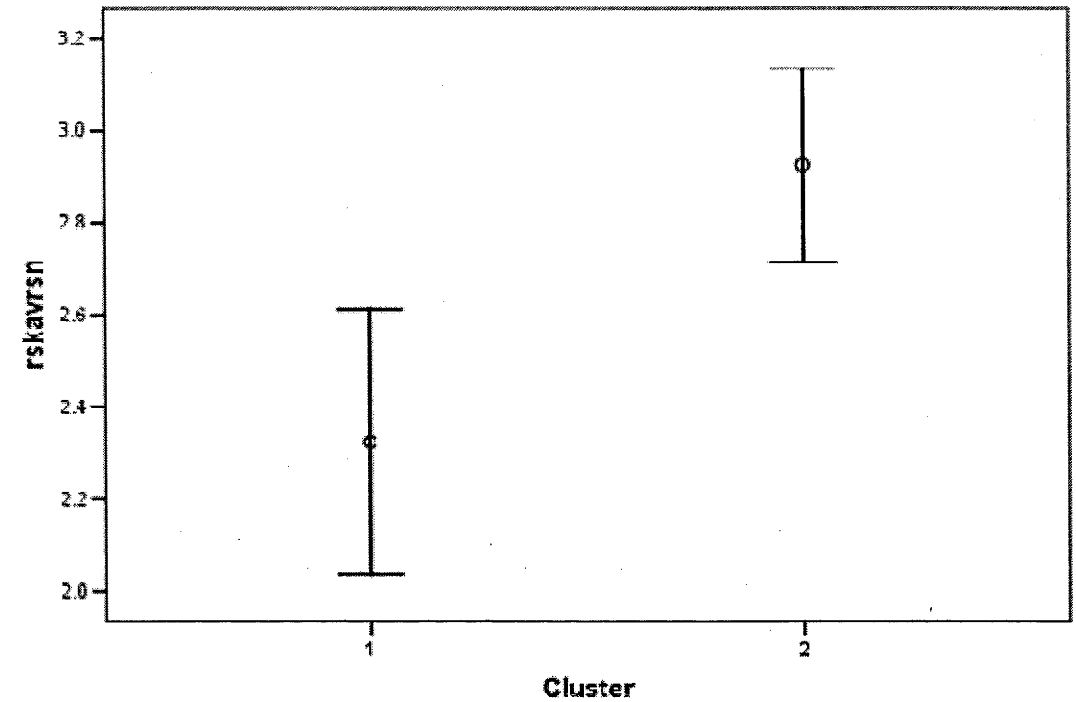


Figure E9: Risk Tolerance Simultaneous 95% Mean Confidence Intervals

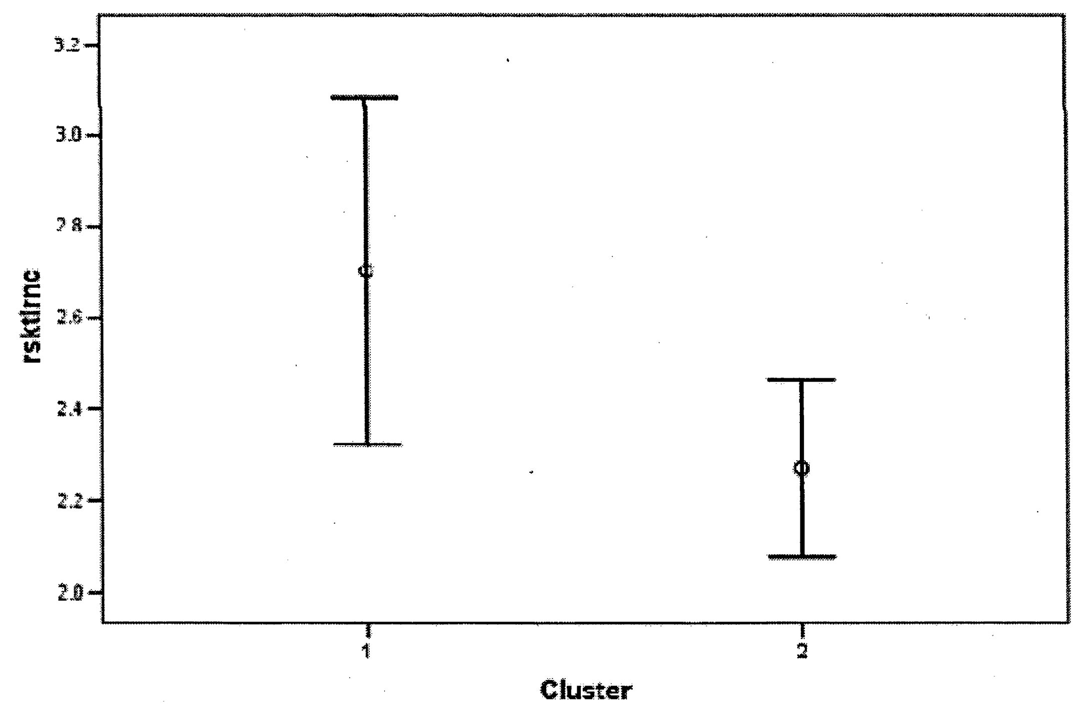


Figure E10: Scale Simultaneous 95% Mean Confidence Intervals

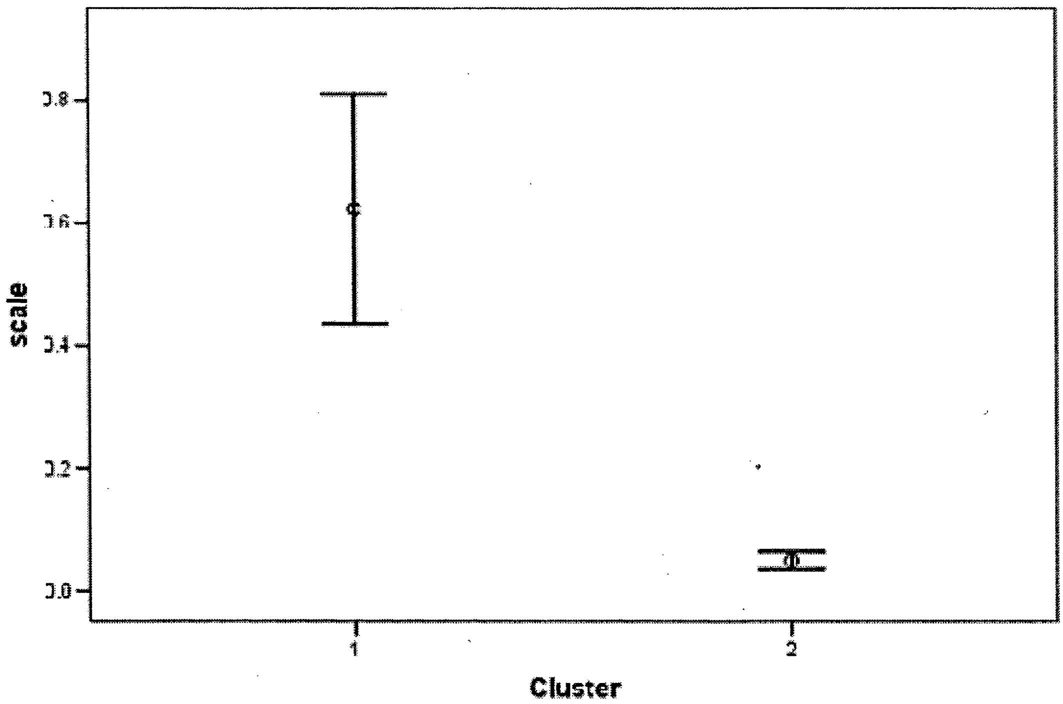


Figure E11: Flexibility Simultaneous 95% Mean Confidence Intervals

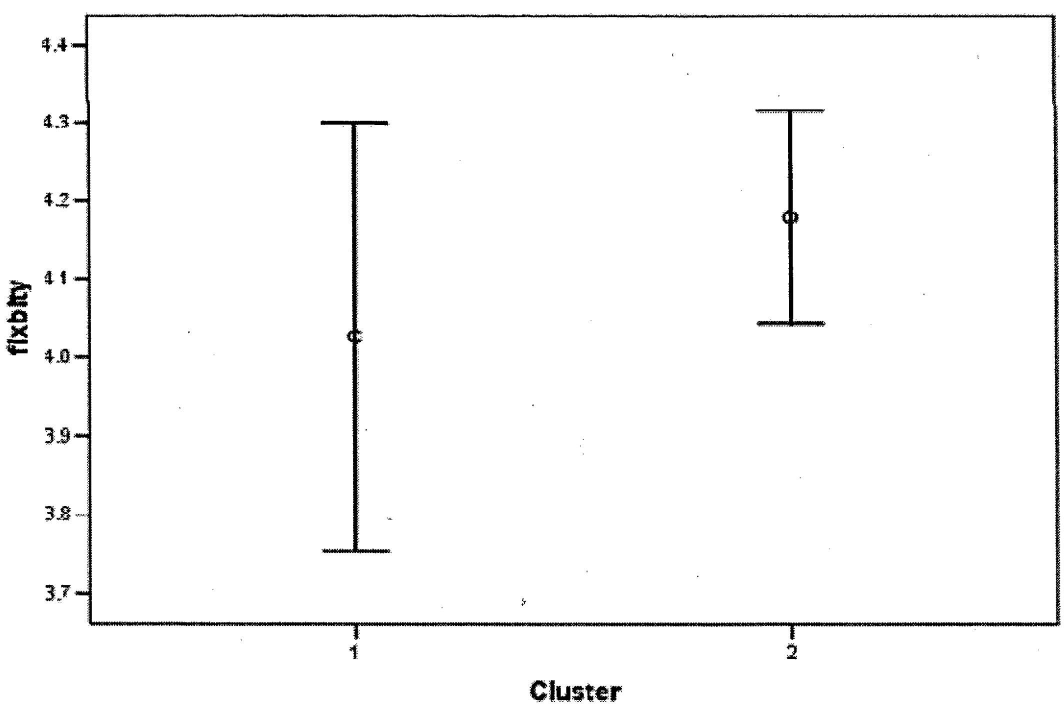


Figure E12: Expenditure Simultaneous 95% Mean Confidence Intervals

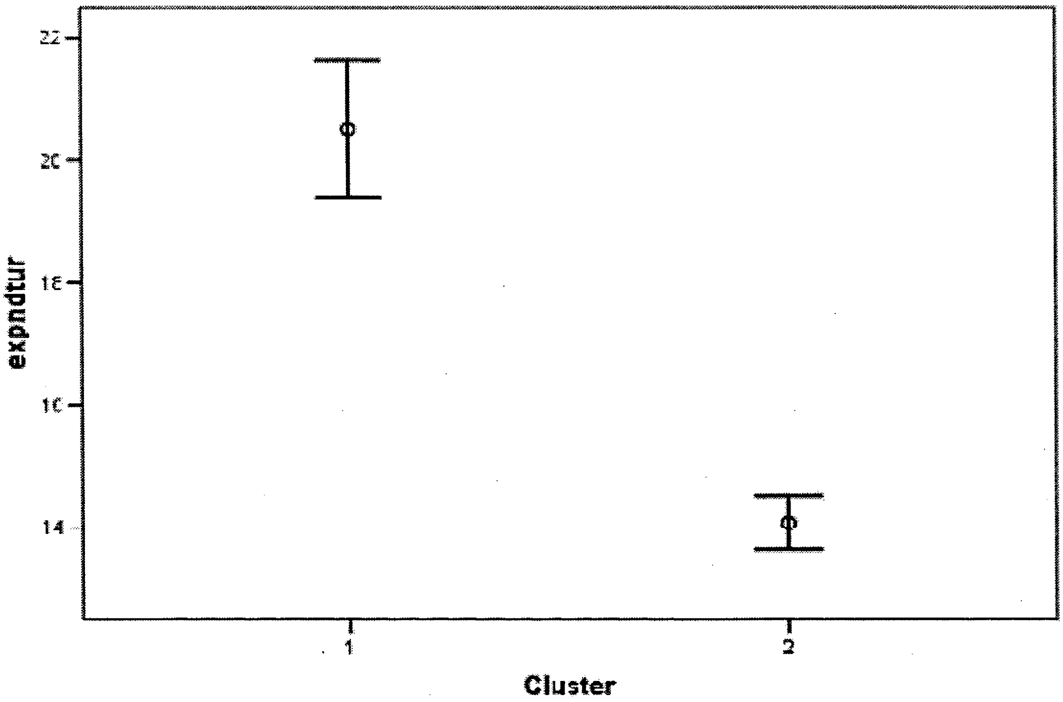


Figure E13: Capability Simultaneous 95% Mean Confidence Intervals

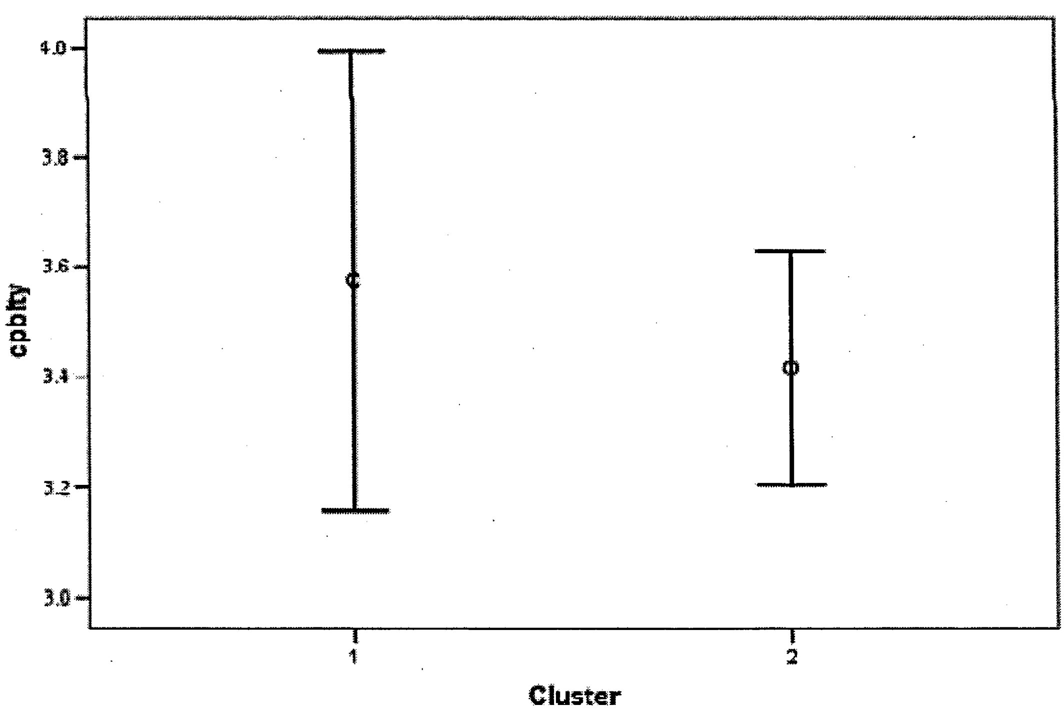


Figure E14: Investment Simultaneous 95% Mean Confidence Intervals

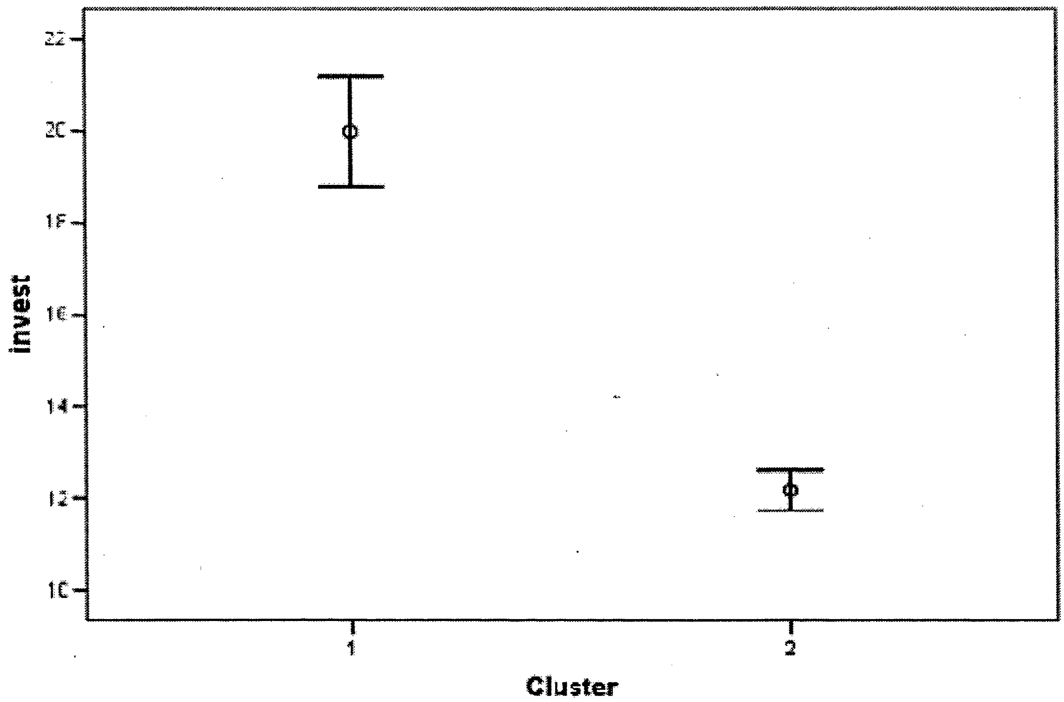


Figure E15: Structure Simultaneous 95% Mean Confidence Intervals

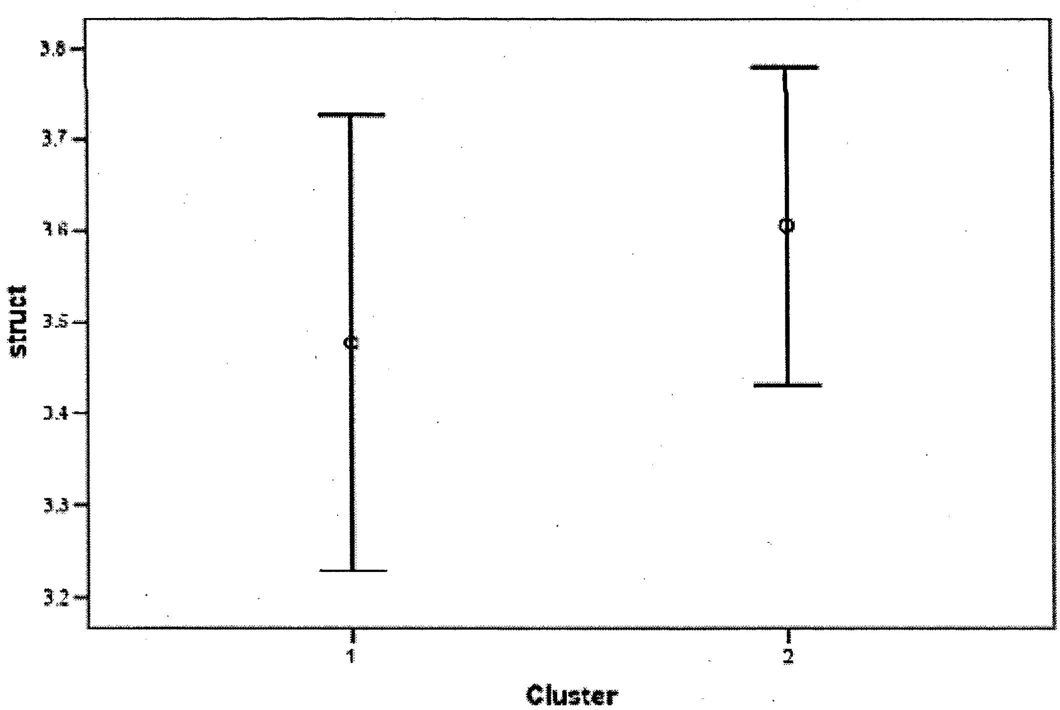


Figure E16: Complexity Simultaneous 95% Mean Confidence Intervals

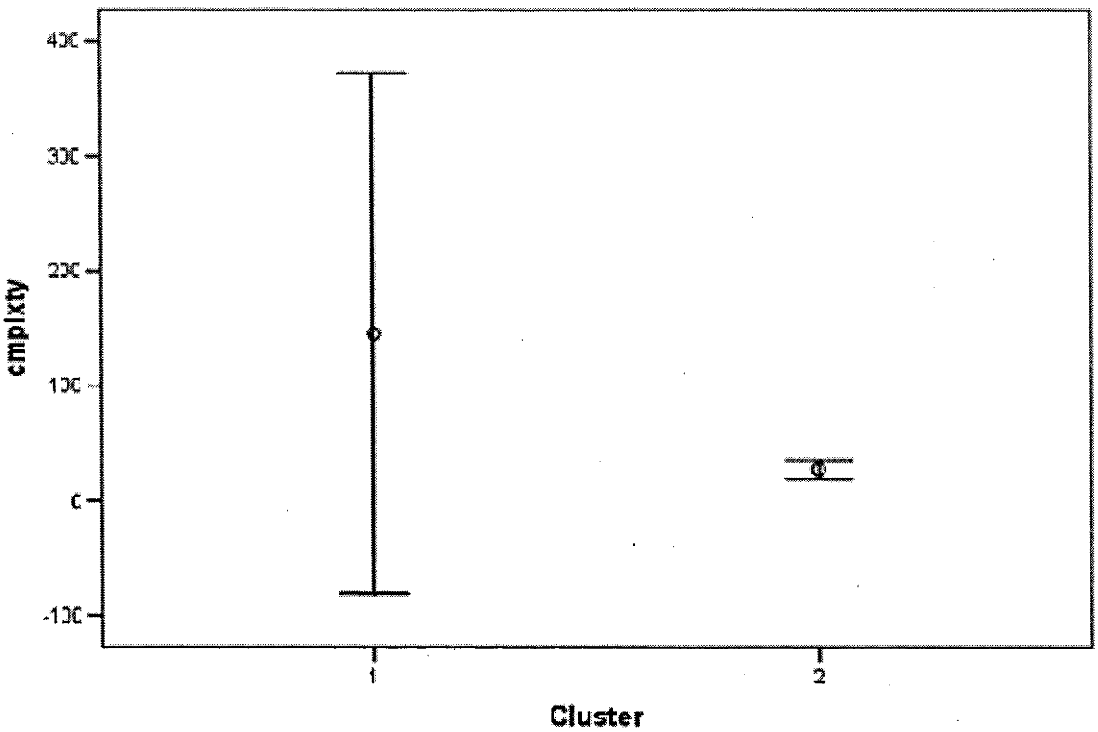


Figure E17: Distribution Simultaneous 95% Mean Confidence Intervals

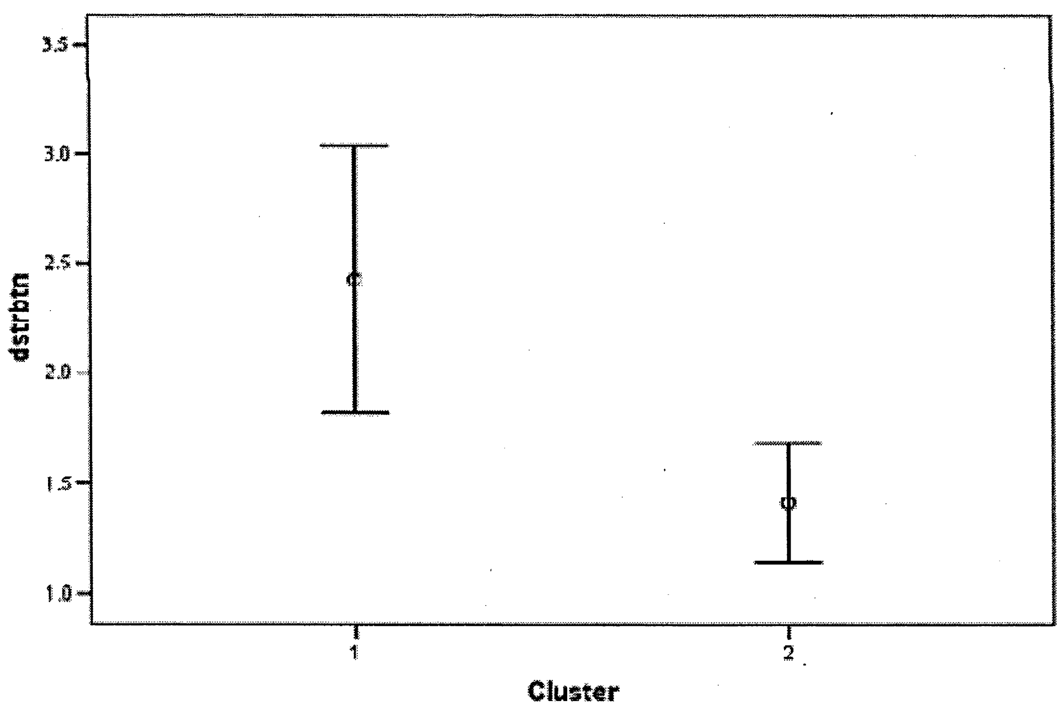


Figure E18: Employment Simultaneous 95% Mean Confidence Intervals