What have you done lateley to excite your users?

a scenario based exploration for including customer value in new product development at Siemens VDO

Meulepas, E.J.

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SIEMENS VDO

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Eindhoven, June 2006

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Abstract

The object of this Master thesis is to create a framework for New Product Development based on the Customer Value of the Third Party Data (TPD) features, in order to generate more revenues for Siemens VDO Trading B.V. The background for this assignment is that Siemens VDO believes that they are not utilising the full potential of TPD, and thus they are not offering their customers maximum functionality regarding TPD. In order to solve this problem, a detailed scenario-based exploration was performed. Three scenarios are developed for creating Customer Value, and strategic management is undertaken, leading to a detailed description of the New Product Development framework for the preferred scenario. The most important implication is that the Siemens VDO organisation is not ready to make a common strategic choice for TPD, and therefore no scenario selection was made. Nevertheless, this report indicates that a strategic choice is necessary for TPD, it provides the strategic options available to Siemens VDO, and gives insight into the consequences for the organisation.

Management Summary

Research problem

This assignment was performed as a final project for the study program: Industrial Engineering and Management Science. The main cause for the assignment was that Siemens VDO Trading B.V. believes that they are not getting the full potential out of the TPD products. Therefore the following research problem was formulated:

How can Siemens VDO organise itself in order to offer maximum functionality to their customers, with regard to the Customer Value of the TPD products, and generate revenues for Siemens VDO?

Methodology

In order to provide an answer to this question, this report forms a scenario based exploration for creating Customer Value in the development of new products and services at Siemens VDO. The research is divided in the phases: Orientation, Analysis, Design, Implementation and Evaluation. The orientation phase has lead to the research problem introduced above, and will not receive further attention in this summary.

Analysis

The analysis phase serves two goals: The situation analysis and the literature review.

- Situation analysis

The main conclusions from the situation analysis for the TPD department and its forthcoming problems are:

- There is no clear view of what the TPD products are,
- There is no insight into the Customer Value of the TPD products,
- There is no clear strategy for the TPD products,
- There is no adjustment between the IIS and SSO TPD-teams,
- All the development is done in projects,
- No advanced development is performed at the DCE.

These can be seen as the most important design parameters for this assignment.

- Literature review

Companies have to innovate to remain competitive. New Product Development is the complete process of bringing a new product to the market. Adoption of innovative products takes time; therefore innovative companies should be aware of the translation of technology innovation into Customer Value in order to influence the adoption of an innovation.

Customer Value (CV) can be defined as 'the trade-off between the benefits received from the offer versus the sacrifices to obtain it (e.g. costs, stress, and time)'. It is the customer's perception of fulfilment of a specific need. A company must have insight into how their offered features influence this perceived CV. Product features can be classified as (see Figure 0.1):

- '***Basic features***'; without these a product would simply be unacceptable.
- '***Performance features***'; the features that provide a real benefit to the customer.
- '***Excitement features***'; features that respond to hidden needs and may surprise and please the customer.

The starting point for innovation is to understand what your customers value in an offering.
Certain aspects of a product or service represent value to the purchaser; the *value criteria*. A list of criteria is provided in Figure 0.2.

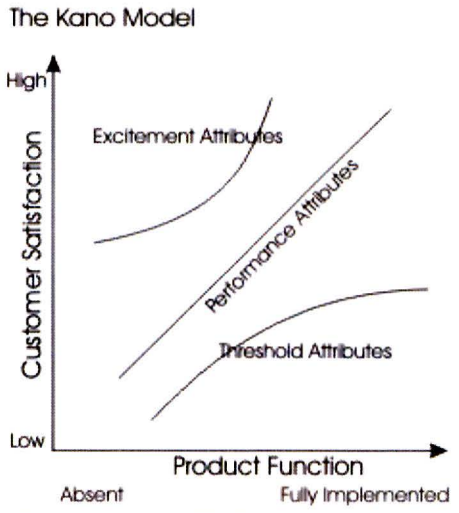

Figure 0.1: Feature classification

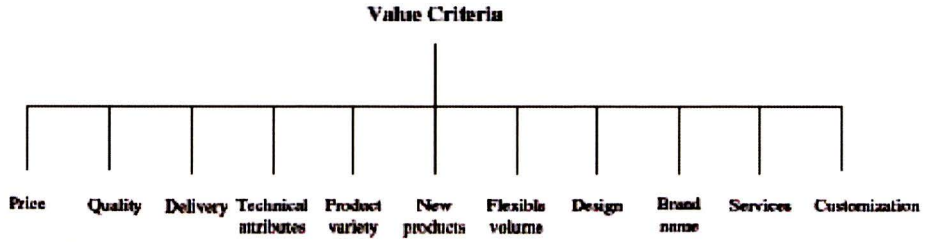

Figure 0.2: Value criteria

Design

To become a market leader and to create Customer Value, three scenarios can be formulated:
- ***Operational excellence***: Superb operations and execution often by providing reasonable quality at a very low price. The offered product contains currently known features (basic and performance features). The goal of the NPD process is on creating these known features in a more optimal way, so the focus is on process development.
- ***Product leadership***: Very strong in innovation and brand marketing, operating in dynamic markets. The organisation tries to appeal to the customer by offering new products and services. The focus of the innovation process is on product development, and the goal is the development of excitement features.
- ***Customer intimacy***: Excel in customer attention and service. The organisation does anything to satisfy the individual customer. The input for the innovation process is market driven, and the focus is on service development.

For each scenario a value preference map can be generated, as can be seen in the Figures 0.3 - 0.5. For success, a company must choose one of these value disciplines and act upon it consistently. This strategic choice determines the way companies have to organise their NPD-process.

Implementation

To select the most appropriate scenario for the Siemens VDO TPD organisation, strategic management is performed. This consists of the elements Strategic Analysis, Strategic Choice, and Strategic Implementation.

From the empirical reserach conducted for the Strategic Analysis, it can be concluded that there is no unambiguous view of the primary value criteria Siemens VDO TPD offers its customers. This

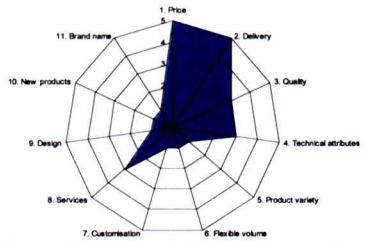

Figure 0.3: Value criteria for operational excellence

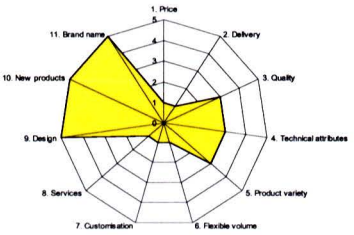

Figure 0.4: Value criteria for product leadership

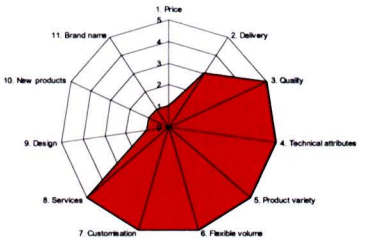

Figure 0.5: Value criteria for customer intimacy

indicates the need for a selection between the scenarios. The outcomes of the SWOT analysis and the confrontation matrix indicate that it is absolutely necessary for Siemens VDO to make a Strategic Choice for TPD, and that the scenario of ***product leadership*** is preferred. For the Strategic Implementation of the preferred scenario an innovation pentathlon is designed (Figure 0.6) that can be used for the development of valuable, innovative TPD products.

Evaluation

Currently the Siemens VDO organisation is not ready to make a change. This research indicates that making a scenario selection is necessary for staying competitive on the market. Based on the selected scenario, a common roadmap for TPD can be developed which will guide the development of new TPD features. To act in accordance with a scenario, it is important to be aware of the Customer Value of the TPD features, and to create awareness of TPD and its possibilities in the Siemens VDO organisation.

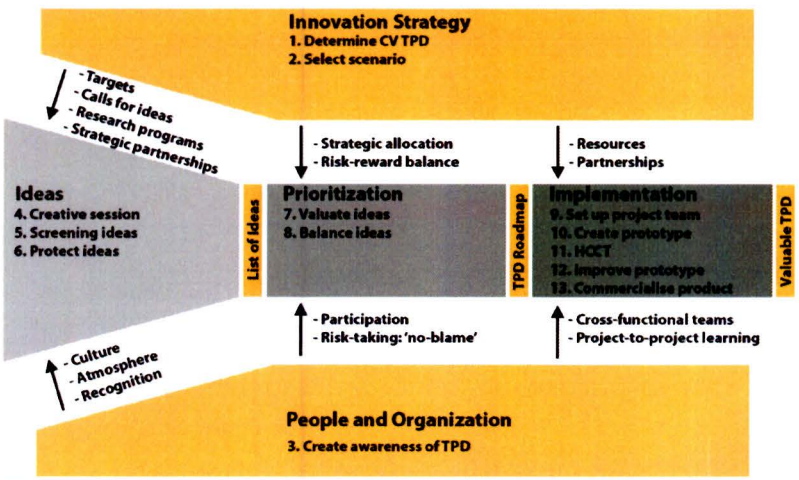

Figure 0.6: Innovation Pentathlon for product leadership

Preface

This report is the final result of my Masters assignment, performed at Siemens VDO Trading B.V. from September 2005 until June 2006. This period has been a great ending to my study of Industrial Engineering and Management Science, at the Eindhoven University of Technology.

Over the past nine months I gathered a lot of theoretical knowledge, and I had the opportunity to put this theory into practice. One of the most important aspects I learned is that it is always the customer who makes the decision to buy; therefore it is the customer who decides what creates value, no matter how innovative or superior a technology is. Furthermore, I learned how important support from different layers of the organisation is in adopting new ideas. I have experienced this whole process as educational, challenging and inspirational and my interest in the adoption of technology was further stimulated by this project.

I could not have achieved this result without the help of others. First of all, I would like to thank Stefan de Hoog and Harald Hagenaars for giving me the opportunity to perform this assignment at Siemens VDO, and for all the support and guidance they gave me during these nine months. Furthermore, I would like to thank all of the employees of Siemens VDO who helped me in any possible way, for their information, cooperation, support or guidance. Specifically, I would like to thank my colleagues of the Third Party Data team for the stimulating working atmosphere and the enjoyable months I had in the office.

I also would like to thank my supervisors from the Eindhoven University of Technology, Jimme Keizer and Gijs Mom, for their pleasant cooperation, passing a critical eye over my work, giving guidance where needed and giving me confidence in every meeting we had.

Last but not least, I would like to thank my family, for giving me the opportunity to go to university and for all the support they gave me during these years, and my friends and girlfriend, for providing me with the necessary distraction to clear my mind of the project and to freshen my view. In particular, Niels, who without our daily e-mail conversations I could never have achieved this result.

Erik Meulepas

Eindhoven, June 2006

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Introduction

Every company should be focussed on creating Customer Value. When the current processes do not lead a company to their preferred future, there is a need for innovation. The focus of this need for innovation depends on the Customer Value a company wants to create. But what is Customer Value precisely? What are the options for a company? How should a company be organised to be able to realise the required Customer Value?

Creating Customer Value gives direction to the development of new products and services through the New Product Development process. Many companies do not include the concept of Customer Value in their New Product Development approach, resulting in an unfocused process. This research provides a scenario based exploration of creating Customer Value in the New Product Development process. This must lead to a more focused and customer-oriented process at Siemens VDO, regarding the development of valuable TPD products. In this, attention is paid to the acceptance of technology innovation and to the criteria that create value to the customer.

The structure of this report tries to correspond to the structure of the research. The following phases can be identified: *orientation*, *analysis*, *design, implementation*, and *evaluation* (according to Kempen and Keizer (2000). These phases also form the basics for this report, and are discussed in Chapter 1.

Chapter 1. Research project

The first chapter is dedicated to the assignment performed at Siemens VDO Trading B.V. and the forthcoming report structure. Firstly, the background of the assignment will be described (Section 1.1), followed by the derivation of the assignment in Section 1.2. Section 1.3 provides the research model that has been followed for the assignment. This chapter will be concluded with an overview of the report structure in Section 1.4.

1.1. Background of the assignment

The market for navigation systems is one of growing globalisation, strong competition for market share, and innovative technological developments. Originally, in-car navigation was only considered with route planning. Over the years, an increasing number of functionalities became available on a wider range of navigation systems, and it is likely that even more will become available in the future. Siemens VDO, a leading international automotive supplier of electronics and mechatronics, would like to explore the market potential for TPD products and services, a specific type of service for navigational use based on Third Party Data (TPD) (e.g. hotel information, speed traps, scenic routes), on their future navigation systems. Oversimplified, these kinds of services consist of two parts: The software and the data. In this lies the main need for the assignment: The software is developed in the Interior & Infotainment Solutions (IIS) department of the organisation, and the data is acquired at the Service & Special Solutions (SSO) department. The focus of the IIS department is on the Original Equipment Manufacturer (OEM) market (the in-car systems), and the SSO department focuses on the aftermarket (the portable systems). Ergo, conflicts arise in the organisation, since IIS and SSO depend on one another for the development of the new TPD functionalities. Sub optimisation and the loss of valuable business opportunities may be a consequence of these conflicts.

Considering this, Siemens VDO feels that they are not serving their customers optimally, or getting the full potential out of the TPD products. The following question has therefore arisen: How should Siemens VDO be organised in order to be able to offer their customers maximum functionality, regarding the Customer Value of these (potential) TPD products?

1.2. Problem definition

With the background of the assignment as a starting point, necessary insight into the problem was gained via numerous interviews which were held with key persons from different layers of the organisation (see Appendix A). Based on the outcomes of these interviews, a cause and effect diagram was constructed. This diagram aims to give a structured overview of causes, problems, and effects. As it is based on opinions, it is of a qualitative nature, and it has not been validated with quantitative data. It does not pretend to be true or complete; it only shows a perception of the relations between the opinions of the interviewed persons.

The complete diagram can be found in Appendix B, Figure 1.1 highlights the most important items. A box can represent a cause as well as an effect. For instance, '*Conflicting roadmaps*' is the cause for '*Autonomous development of innovative ideas*', but it is an effect of '*Contradictory objectives IIS and SSO*'. An arrow represents a relation between a cause and an effect.

On the left of the diagram, the limitations of the survey are presented. The Siemens VDO organisation has its main focus on the OEM market, so therefore the IIS organisation is focused on selling products specifically for this market. Since there is a substantial and important aftermarket for portable navigation devices, Siemens VDO wants to be present there too. Therefore, SSO has its focus on both markets. The strong competition and the highly innovative environment, in combination with the buying power the OEMs have on their systems, cause Siemens VDO to work under constant time and budget

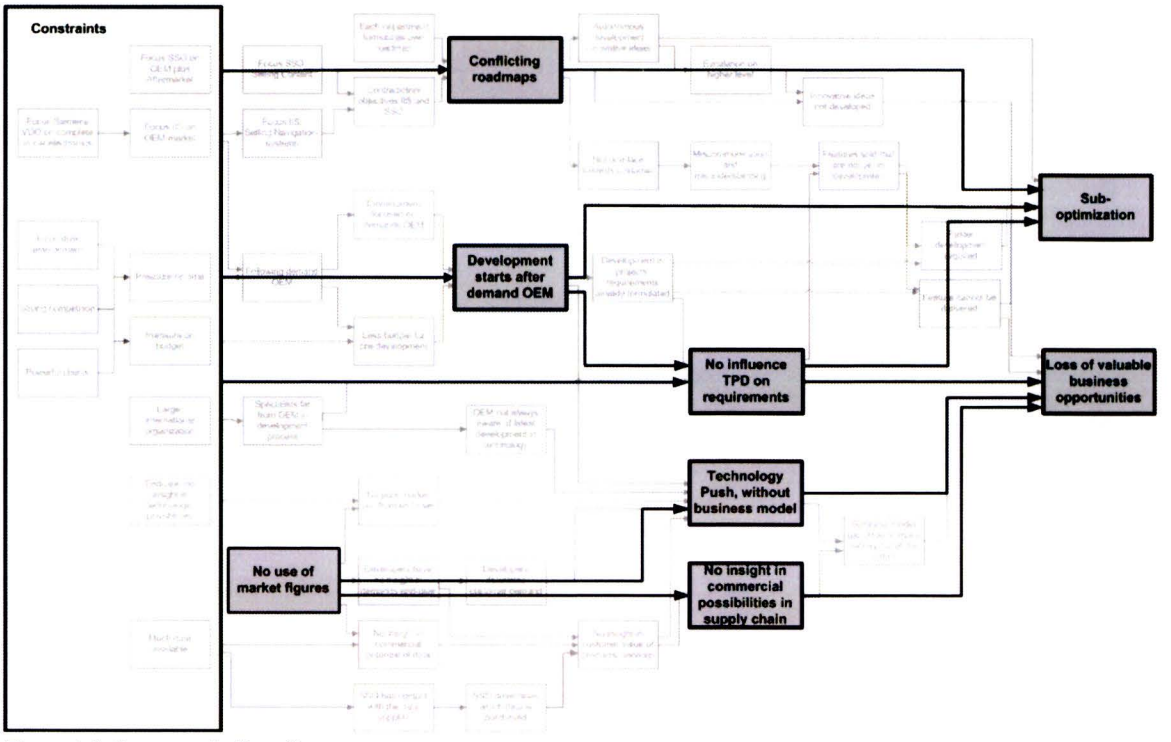


Figure 1.1: Cause and effect diagram

pressure. An enormous amount of data is available from the data suppliers; one of the main questions is therefore, which data is of commercial value? Furthermore it must be taken into consideration that Siemens VDO is a subsidiary company of Siemens, which is a large organisation with its activities widespread over Europe. A last limitation is that the end-user, the motorist, has no insight into the latest developments in the technological field.
The major effects, or the problem areas, can be seen at the right end of the diagram. These are '*Sub optimisation*' and '*Loss of valuable business opportunities*'.

The main problem for this assignment, as identified by Siemens VDO in the background of the assignment and confirmed in several interviews, is the '*Loss of valuable business opportunity*'. For this problem, several reasons can be given, as shown in the diagram. The main problems are (as highlighted in Figure 1.1): '*Conflicting roadmaps*', '*Development starts after demand OEM*', '*No influence TPD on requirements*', '*No use of market figures*', '*Technology push without business model*', and '*No insight in commercial value of products and services*'. So, interwoven within the diagram a lack of a structured, customer oriented New Service Development approach can be recognised.

In discussion with Siemens VDO and the Eindhoven University of Technology, several goals based on the aforementioned were formulated which led to the following **research problem**:

How can Siemens VDO organise itself in order to offer maximum functionality to their customers, with regard to the Customer Value of the TPD products, and generate revenues for Siemens VDO?

For further clarification, the key terms are described as follows:

Functionality: The quality of the action for which a person or thing is particularly fitted or employed (Robertson & Robertson, 1999).

Customer Value: The trade-off between the benefits received from the offer versus the

sacrifices to obtain it (e.g. costs, stress, and time). Value is created when product and user come together within a particular use situation (Johnson & Weinstein, 2004).

The research should gain insight into the current way of thinking about Customer Value (CV) and New Product Development (NPD) in the organisation, and also the cash flows in the supply chain to identify strong and weak points of the current situation. From this analysis, combined with the latest scientific insights in the fields of CV and NPD an improved NPD-approach will be formulated.
Therefore, the **assignment** can be formulated as follows:

Analyse the Customer Value of the TPD products that can be offered, the way new products are developed, and the cash flows in the supply chain, and give recommendations on how to improve the organisation based on this analysis, and write a plan for the implementation of the recommendations.

The main **goal** of this assignment is to gain insight into the Customer Value of the TPD products and the way New Product Development is and can be done, and to enable the organisation to offer the market maximum Customer Value regarding TPD products, so that satisfactory revenues are generated for Siemens VDO.

Based on this assignment and goal, the **deliverables** (the expected results) for this research project can be formulated:

1. Insight and better understanding of the concept of Customer Value,
2. Insight into the Customer Value of the TPD products,
3. Insight and better understanding in the concept of New Product Development,
4. Insight into the cash flows in the supply chain,
5. An appropriate New Product Development approach based on the Customer Value of the TPD products,
6. Implementation plan for the New Product Development approach.

In order to be able to fulfil these deliverables, the following **research questions** need to be answered:

(Insight and better understanding of the concept of Customer Value)
- What is Customer Value?
- What is the relevance of Customer Value for an organisation?
- How should an organisation adapt to the concept of Customer Value?

(Insight into the Customer Value of the TPD products)
- What are the TPD products?
- What is the Customer Value of the TPD products?

(Insight and better understanding in the concept of New Product Development)
- What is New Product Development?
- What is the relevance of the concept of New Product Development for an organisation?
- How should an organisation adapt to the concept of New Product Development?

(Insight in the cash flows in the supply chain)
- What does the supply chain look like?
- What are the cash flows in this supply chain?

(An appropriate New Product Development approach based on the Customer Value of the TPD products)

- In what way is the concept of Customer Value currently implemented in the organisation?
- In what way is the concept of New Product Development currently implemented in the organisation?
- What are the shortcomings of these?
- In what way can these be improved?

(Implementation plan for the New Product Development approach)

- How can this new approach be implemented in the Siemens VDO organisation?
- Which obstacles might arise with this implementation?
- What is the expected result of a successful implementation of the new approach?

1.3. Methodology

This assignment is a scenario based exploration for creating Customer Value in the development of new products and services at Siemens VDO. To provide the research with the necessary structure, a **research model** has been created. It defines logical steps and phases that ought to lead to the realisation of the goal of this assignment (previously mentioned). In Figure 1.2, the research model is presented (based on Verschuren & Doorewaard (1995)). During the assignment several methods for gathering information are used; Literature review, interviews, expert interviews, observation and empirical research.

In the ***orientation phase***, internally available information is gathered so as to gain insight into the project. Besides document research, several interviews were held with employees from different layers of the organisation, in order to tackle the matter from different viewpoints. By means of a literature review, understanding of the key terms and insight into the latest developments was gained.

This literature review continues in the ***analysis phase***, in parallel with the in-depth situation analysis. On one hand, this phase leads to specifications of points for improvements of the current situation, and on the other hand, the concepts of Customer Value and New Product Development are subject of an in-depth research.

These specifications form the input for the ***design phase***, in which different scenarios for a New

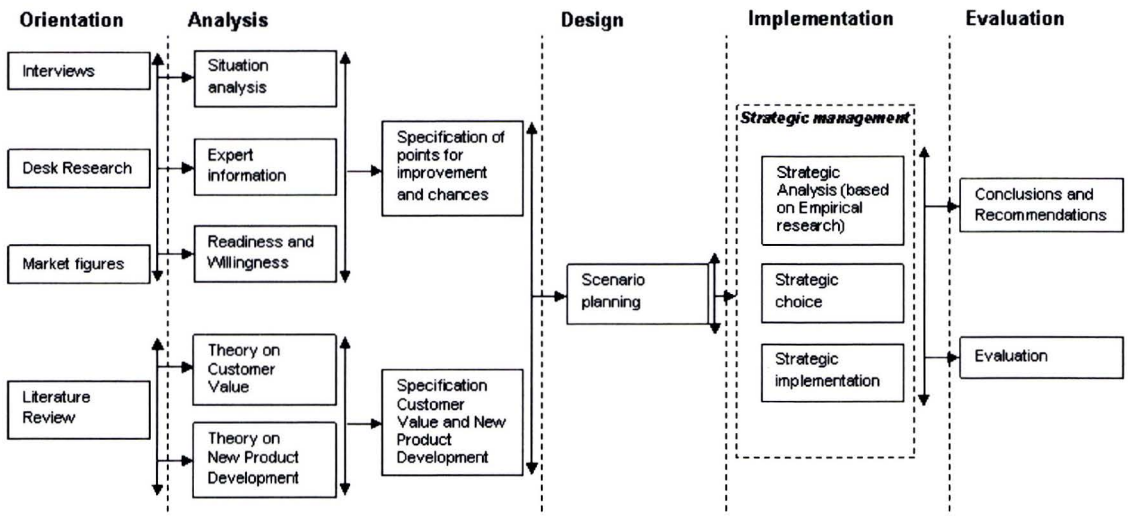


Figure 1.2: Research Model

Product Development approach are elaborated to illustrate the different opportunities the organisation has regarding the development of new or innovative TPD products.

In the ***implementation phase***, this leads to selection of the most appropriate scenario following the process of *strategic management*. This involves three elements, namely *strategic analysis*, *strategic choice*, and *strategic implementation*. Where the previous phases were of a reflective nature, this phase uses empirical research performed at Siemens VDO in order to select the most appropriate scenario.

In the ***evaluation phase***, the conclusions and recommendations are formulated, plus an evaluation of the assignment and results is given.

1.4. Structure of the report

The structure of this report is based on the model described above; the corresponding successive steps form the content of the chapters. The analysis phase is described in Chapter 2, 3, and 4. Chapter 2 gives a description of the situation analysis, by describing the Siemens VDO organisation, regarding the development of TPD products and the design parameters. In Chapter 3, the theory on New Product Development receives attention by discussing the adoption of technology innovation. Chapter 4 provides insight in the concept of Customer Value. The formulation of the different scenarios that can be followed for the development of TPD, the design phase, is described in Chapter 5. Chapter 6 describes the implementation phase; the process of strategic management regarding these scenarios for the development of new TPD products and the consequences for the Siemens VDO organisation. The final phase also forms the completion of the report by formulating the main conclusions and recommendations in Chapter 7. This structure of the report is also represented in Figure 1.3. After every chapter the progress is indicated in this same figure. It provides insights in the steps taken so far, the next step, and the future steps.

As can be seen in Figure 1.3, the orientation phase is now finalized. The next chapter provides the situation analysis.

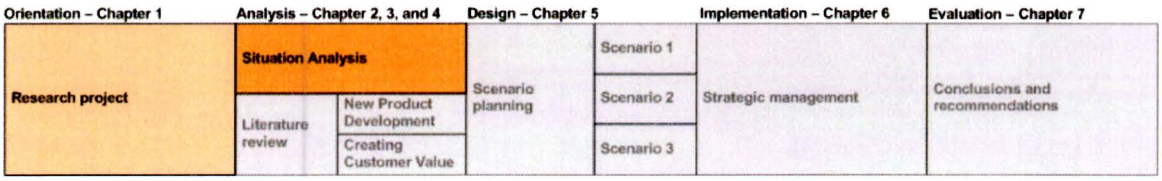


Figure 1.3: Structure of the report

Chapter 2. Project Environment

This chapter gives a description of the project environment. It starts with an introduction of Siemens VDO Trading B.V., the company where the assignment is performed, in Section 2.1. A description of the Development Center Eindhoven is given in Section 2.2, followed by a further introduction of navigation systems in Section 2.3, and the Travel Service in Section 2.4. Section 2.5 concludes the chapter by giving some insight into the market for navigation systems.

2.1. The company: Siemens VDO Trading B.V.

Siemens is one of the world's largest electrical engineering and electronics companies. In their organisation, several fields of business are identified; one of them is transportation, in which Siemens VDO Automotive is responsible for all automotive developments. Siemens VDO Automotive is a supplier of electronics, electrical engineering and mechanics for the automotive industry, and achieves a yearly turnover of several billion, with around 45,000 employees. Siemens VDO Automotive is clustered in four technological areas, namely:

- Chassis & Car body,
- Powertrain,
- Interior & Infotainment Solutions,
- Service & Special Solutions.

As stated in Chapter 1, the areas Interior & Infotainment Solutions (IIS) and Service & Special Solutions (SSO) form the main point of departure for this report.

In the Netherlands, most activities of Siemens VDO Automotive are clustered in Siemens VDO Trading B.V, which is a part of Siemens VDO Automotive. The following entities are located at the site in Eindhoven:

- Development Center Eindhoven,
- Digital Maps Program,
- Support functions of the Siemens VDO Trading B.V. (HRM, IT, Purchasing, F&A),
- Benchmark navigation,
- +++-group (MS2000).

Siemens VDO Trading B.V. is at a split in the Siemens VDO organisation, as can be seen in Figure 2.1. The Development Center Eindhoven (DCE) is part of the IIS organisation, and is structured according to a cost centre structure, where the Digital Maps Program is part of the SSO organisation, and is structured as a profit centre (Kerssens et al., 2003). The Digital Maps Program produces CD's

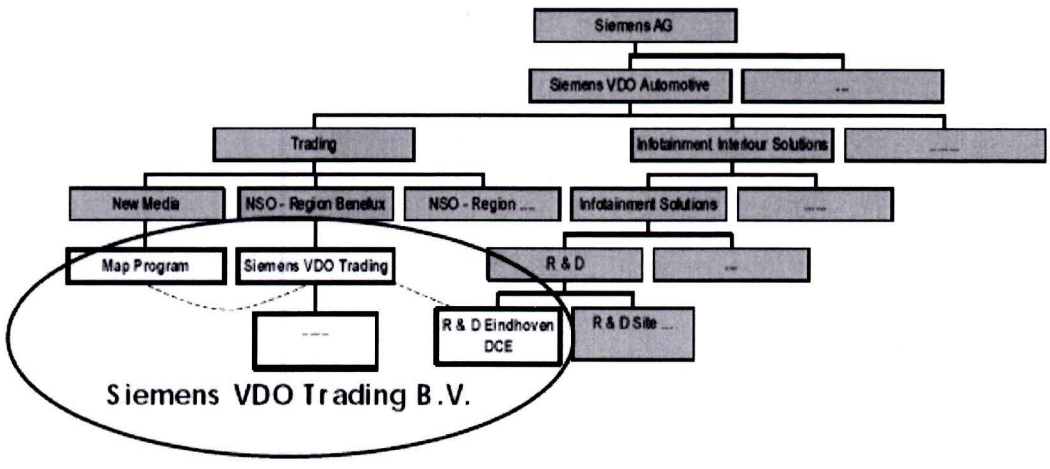


Figure 2.1: Relation Siemens VDO Trading B.V. – Siemens VDO I IS

and DVD's with map details. The DCE will be explained in more detail in the next section. The +++-group is a recently initiated profit centre which searches for new product market combinations, and is placed separately from the IIS and SSO organisation.

2.2. Development Center Eindhoven

At the DCE, where this project is performed, car-infotainment systems are developed, specifically in the field of navigation, audio and a combination of both. The activities performed in the DCE are financed by, and under the responsibility of, Siemens VDO IIS Research and Development (R&D) Organisation. This is performed in multidisciplinary and international projects, in cooperation with (among others) development centers in Germany, France, Romania, and Singapore. This development covers all aspects of navigation, such as positioning, route planning, and man-machine-interface.
DCE employs about 200 people, notably in the fields of software and electronics. Its structure is based on the international matrix organisation of Siemens VDO IIS and has two axes, the program axis and the discipline axis, as can be seen in Figure 2.2.

In the program axis, the (international) programs are managed. A program can be seen as a large (multi-site) multi disciplinary project which is managed by a Project Manager who has full responsibility for the program, from program initiation until product delivery. In the discipline axis, the resources of the different competences are managed. In Eindhoven, seven competences are identified, which are represented with the vertical bars. Each competence is managed by a Team Leader, which work is coordinated by the Group Leader. In this matrix organisation, the members of the disciplines are allocated to the activities in the program-axis, the projects.
Besides this matrix structure, the Advanced Development organisation exists. The Advanced Development Manager, who reports to the International Advanced Development Manager, manages the DCE Advanced Development organisation.

2.3. Navigation products

The main task of a navigation system is to reduce the driver's workload by taking over tasks like reading the map and planning a route to the destination. Navigation systems come in different forms:

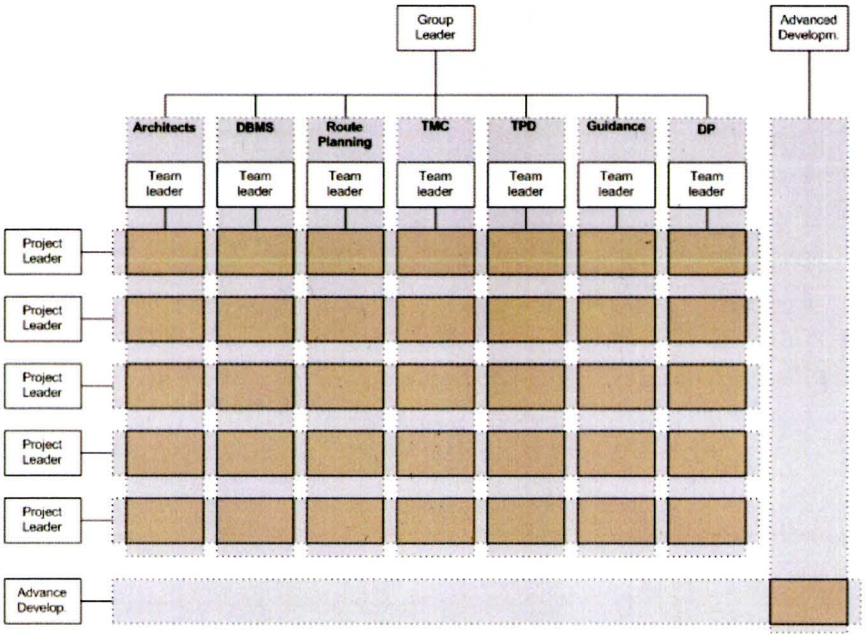


Figure 2.2: Matrix organisation Siemens VDO IIS

- Monitor navigation,
- Navigation radio,
- Portable navigation,
- Mobile navigation.

Appendix C gives an overview of the complete range of Siemens VDO navigation systems available on the aftermarket. According to the Benchmarking department at the DCE, there were over 90 different systems available on the European aftermarket in the summer of 2005. More information about the market will be given in Section 2.5.

There are three main differences between the alternative systems:
- *Price*: For instance, the monitor navigators are available at prices starting from € 1.000,-, whereas the portable systems start at € 300,-. This difference in price arises because the portable products often have fewer functions.
- *Precision*: The portable and mobile navigation products only navigate using information from the GPS-satellite network. An advantage of the in-car monitor and radio navigation systems is that several functions are delivered which help to navigate in case the GPS-reception fails. For example, the in-car system can connect the speed measure to a gyroscope in order to make a precise estimate of the location of the car.
- *Mobility*: The portable and mobile systems are easier to carry around. If the user changes cars regularly, a portable navigation system is preferable as it saves on the build-out costs when the car is sold.

Nowadays, navigation systems are not only able to plan routes, display the current car position and calculate the predicted time of arrival; they contain many more functionalities such as warnings of traffic jams and mobile police controls, and the notification of Points of Interest (POIs). The components of a modern navigation system are introduced and explained in more detail in Appendix D.

2.4. Third Party Data

As stated above, one of these additional functionalities is the notification of POIs. For navigational use, a wide spectrum of detailed information about interesting places (the POIs, for instance: hotels, restaurants and petrol stations) can be offered to guide the motorist to its destination. In order to be able to give a notification of POIs, two things need to be made available: the database and the software.
- The *data* is acquired from various external content providers (third parties) so is therefore called Third Party Data (TPD) and has to be converted to the Siemens VDO specific format. For each product, specific conversion tools are maintained or developed that convert the data into an internal generic format. The Digital Maps department (part of the SSO-organisation) is responsible for this data product.
- The *software* required to search the database for the desired POIs is developed at the DCE. The data products from the Digital Maps group are represented on the navigation system in a HTML-based format that is used by the TPD-browser of the navigation system, supported by a Man-Machine Interface (MMI). The development of these subsystems is performed by the TPD-team at the DCE, which is part of the IIS organisation.

TPD is offered in two forms:
- The Levelled POIs; the basic database of POIs.
- The Travel Guides; the special TPD products. These are offered on the market with the C-IQ mechanism. This is further explained in Appendix E.

The current developments in TPD are aimed at providing a more seamless integration of the TPD with the navigation functionality. Examples of this are 'alert point functionality', 'POI along the route', and 'scenic routes'. More about TPD can be found in Appendix F.

2.5. The market

As stated in Chapter 1, the market for navigation systems is one of growing globalisation, strong competition for market share, and innovative technological developments. It is a relatively young market, where many competitors are fighting over market share. Table 2.1 gives an overview of the most important milestones in the development of in-car navigation.

Nowadays, the market for in-car navigation can be divided into two segments (oversimplified):

- The OEM-market,
- The aftermarket.

The OEM-market

For the OEM-market, fully integrated in-car systems are delivered directly to the automotive industry (the Original Equipment Manufacturers). Built-in navigation systems are geared to the specific requirements of the automotive industry. Based on these requirements, the systems are available in different designs, each with their own (car brand specific) layout. With regard to this market, it must be noted that the customer of Siemens VDO is not the end-user of the delivered product. The OEM determines the requirements, and therefore the functionalities, of the navigation systems their customers buy. For this market, the OEM is the decision making unit.

The aftermarket

Siemens VDO Trading B.V. is the supplier of a complete range of audio and navigation systems, which are brought to the market under the brand names VDO, VDO Dayton and Siemens VDO.
At the aftermarket, the complete range of navigation systems is offered.

Both the OEM market and the aftermarket for navigation systems are of considerable size. In addition to this, both markets can be characterised as highly competitive - there are numerous competitors competing for market share. It is forecasted that both markets will continue growing in size and profitability for the foreseeable future. Siemens VDO is an important player in both markets, as can be seen from the market figures in Appendix G.

2.6. Design parameters

In the analysis phase more in-depth interviews are conducted with key players in the development of TPD functionalities. The results of the orientation phase (Chapter 1) formed the input for this analysis. From this internal analysis the following can be concluded for the development of TPD and its forthcoming problems:

Time Period	Milestone
Early 1980's	First car navigation invented (Japan), using analog-map and gyrocompass.
1987	Introduction of navigation equipement with digital CD-ROM.
1990	Introduction of the worlds's first GPS car navigation system.
1994	Launch of the BMW 7 Series, first to the market with factory-installed navigation system fully integrated into the cockpit as an optional accessory.
1997	Introduction of the first DVD car navigation system.

Table 2.1: History of in-car navigation

- There is no clear view of what the TPD products are
Within the organisation and even in the two TPD teams on each side of the organisation, there is no clear view of what the TPD-department exactly does, and what the functionalities are TPD adds to the Siemens VDO navigation systems.

- There is no insight into the Customer Value of the TPD products
Creating CV is not included in the strategy of Siemens VDO. Moreover, the concept of CV is not used within the organisation. This means that the TPD teams do not know how their products and services are valued by the customer; there is no insight in the usage of TPD by the customer. At IIS, they deliver what the customer asks for, and on the SSO side business is done on intuition.

- There is no clear strategy for the TPD products
As the TPD product requires cooperation between two departments with a different focus, there is no unambiguous strategy for the overall TPD products. This results in different priorities set by the two TPD teams.

- There is no adjustment between the IIS and SSO TPD-teams
In the development of new functionalities no adjustment is done between the two TPD-teams. In the current organisation, TPD is structured according to a functional structure, with top-down direction. Moreover, both TPD teams have individual roadmaps for future developments and functionalities. In practice, this results in not being able to deliver requested functionalities from both sides in the organisation.

- All the development is done in projects
When a customer is requesting a new feature, budget is made available for the required development. New features are only developed after customers' demand, all the development is done in projects. This holds back pure technology push. Moreover, the full development costs are assigned to that single project, not considering future usage of the new development feature.

- No advanced development for TPD is performed at the DCE
There is a budget available for advanced development regarding TPD at the DCE. Nevertheless, this budget may currently not be touch for this cause, so no advanced development (the development of functionalities without customer demand) is currently performed for TPD.

These form the conclusions from the internal analysis regarding the development of TPD features at Siemens VDO, and can be seen as the most important design parameters for this assignment. As can be seen in Figure 2.3, in parallel with this internal analysis an external analysis was performed regarding New Product Development and Customer Value. The next chapter will discuss the theory of the first part of this literature review; the adoption of technology innovation and its influence on the development of new products.

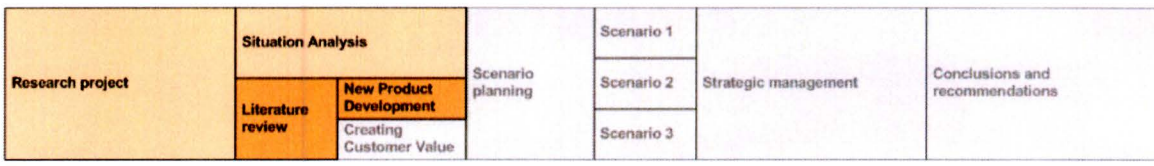


Figure 2.3: Progress update

Chapter 3. Technology innovation

Companies have to innovate; if one does not innovate, someone else will. So, in order to remain competitive an organisation has to innovate. Section 3.1 describes the concept of innovation, followed by the reasons to innovate in Section 3.2. In Section 3.3 the theory of diffusion of innovation is discussed, Section 3.4 focused on a framework for New Product Development. The input for and the adoption of innovation are discussed in Section 3.5 and 3.6. Section 3.7 deals with the question of intended behaviour can be used as a predictor of usage, followed by the theory on the acceptance of a technology in Section 3.8. In Section 3.9 the focus is on Total Quality Management. The chapter is concluded in Section 3.10 by discussing the organisation of Research and Development.

3.1. The concept of innovation

Rogers (2003) defines an innovation as '*an idea, practice, or object that is perceived as new by an individual or other unit of adoption*'. The term innovation refers to both radical and incremental changes to processes, products, or services (Burgelman et al., 2004).

Incremental innovations involve the adaptation, refinement, and enhancement of existing products and services (e.g. the next generation of a microprocessor). Radical innovations involve entirely new product and service categories (e.g. the introduction of wireless communication).

A ***process*** is 'a naturally occurring or designed sequence of operations or events, possibly taking up time, space, expertise or other resource, which produces some outcome'.

A ***product*** can be seen as 'a physical object that is available in the marketplace'.

Several scholars argue that ***services*** are 'activities, deeds or processes and interactions, where the customer plays the complex role of both contemporary consumer and producer'.

The vagueness of the concept of services is perfectly illustrated by the definition that The United Nations give for services (Goffin and Mitchell, 2005):

> '*A service is a heterogeneous range of intangible products and activities that is difficult to encapsulate within a simple definition*'.

Service researches have identified distinctive characteristic of services that have been used to contrast services with products. These characteristics are discussed in Appendix H. Because of the characteristics of a service New Service Development (NSD) has a different outcome than New Product Development (NPD). In product development the outcome is a physical 'thing', while in service development the outcome is a service delivery process (Kuylman, 2005).

3.2. Reasons to innovate

To remain competitive, companies have to adapt their offering continuously to changing market demands. Highly successful new products and services produce multiple benefits (Schilling and Hill, 1998):

1. The minimization of time-to-market,
2. The maximization of fit between customer requirements and product characteristics as being critical objectives for NPD processes,
3. The minimization of the total development costs.

Time, cost, and quality (the features and characteristics of the offering) are typically viewed as the central objectives for and operational outcomes of a development effort (Tatikonda and Montoya-Weiss, 2001).

Storey and Easingwood (1999) emphasize that the benefits that accrue from providing new services in particular, include:

1. Enhancing the profitability of existing offerings,
2. Attracting new customers to the firm,
3. Improving the loyalty of existing customers,
4. Opening markets of opportunity.

Services can be used to differentiate manufactured products; manufacturers' services play a key role in the achievement of high customer satisfaction levels. So manufacturers need to concentrate on developing high quality services. Services are not only important for achieving customer satisfaction, they can also make a significant contribution to revenue, and profit margins on after sales services can be higher than those on the products themselves.

For the remainder of this document the term NPD represents both New Product Development and New Service Development.

In order to survive and stay competitive companies have to be flexible and able to adopt and react on market influences. Differences in the organisation of the product development process will influence the amount of flexibility a company has on enacting on these changes. Over the last decades four major market trends can be distinguished, which are presented in Figure 3.1. As indicated in this figure, these four trends are of important influence on the product development process (De Ruiter, 2005). A further discussion of these trends can be found in Appendix I.

As a reaction to these trends, business is extending its products and services. Therefore, companies have an increasing focus on innovation and NPD and NSD are receiving increasing attention (De Ruiter, 2005). Firms innovate in order to generate products and services which customers want to buy at price levels that maintain or improve competitive positions. Taking into account that innovation is important, but that only a limited number of innovations succeed, it is essential to understand how organisations might achieve greater efficiencies and predictability in their innovation activities. This understanding can lead to (Dodgson et al, 2005):

- Better allocation of resources to meet organisational aims,
- Benefiting consumers and users through better utility, functionality, and quality of products and services,
- Increasing range of future options available to businesses.

Without innovation, companies will quickly lose their competitive edge. Recognising the need for innovation is not difficult, as this is part of being innovative. The critical question is how to actually

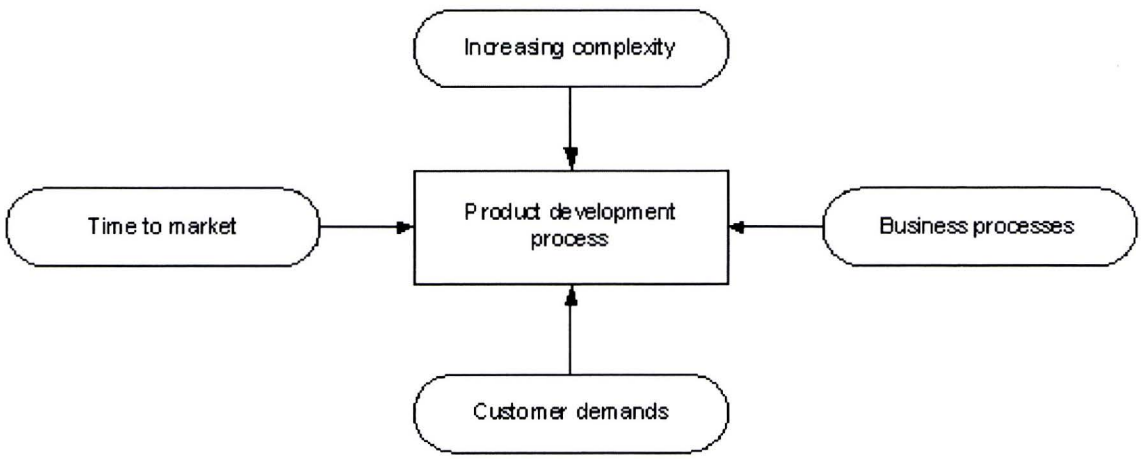


Figure 3.1: Market trends influencing the product development process, source De Ruiter (2005)

achieve innovation. Managing innovation is complex and requests a highly situation-specific approach. Nevertheless, the fact that so many investments in innovations are made shows that high returns are possible (see Appendix J). The opposite is even more risky. If a company does not innovate, another will. The challenge is to manage the risk (the cost and uncertainty) associated with innovation, by accepting that the outcomes of innovation can be highly ambiguous, and that the notions of success and failure are not always clear-cut (Dodgson et al, 2005). Risk management in innovation is further discussed in Appendix K.

3.3. Diffusion of innovation

Diffusion of innovation is 'the process in which an innovation is communicated through certain channels over time among the members of a social system' (Rogers, 2003). It is a special kind of communication, in that the messages are concerned with new ideas.

Communication is a process in which participants create and share information with one another in order to reach a mutual understanding. The newness of the idea in the message content gives diffusion its special character. It means that some degree of uncertainty is involved in diffusion. Uncertainty is the degree to which a number of alternatives are perceived with respect to the occurrence of an event and the relative probability of these alternatives. Uncertainty implies a lack of predictability, of structure, or of information. Information is a means of reducing uncertainty. Information can make a difference that affects uncertainty in a situation where a choice exists among a set of alternatives. A technological innovation embodies information and thus reduces uncertainty about cause-effect relationships in problem solving (Rogers, 2003).

The four main elements of the diffusion of innovation are (also indicated in Figure 3.2):
- The innovation,
- The communication channel,
- Time,
- The social system.

An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption. A communication channel is the means by which messages get from one individual to another. Time is involved in diffusion in (1) the innovation-diffusion process, (2) innovativeness, and (3) an innovation's rate of adoption. A social system is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. The members of a social system may be individuals, informal groups, organisations, or subsystems. The main questions rising by diffusion are:
- How do early adopters differ from later adopters of an innovation?
- How the perceived attributes of an innovation affect its rate of adoption?

These questions are answered in the remainder of this chapter.

3.4. New Product Development

The concept of NPD has received wide attention in modern literature. NPD is the complete process of bringing a new product to market. A firm's strategy is expressed in the products and services it brings to the market. Technological innovations are the result of product, process, and market development activities. Wheelwright and Clark (1992) designed the development funnel, a widely accepted process for innovation via idea generation and selection of the most promising options (see Figure 3.3).

There are some divergent models, but they only differ in the details; some include more phases, or name the phases in a different way. Nevertheless, in general this model is accepted in business and literature regarding the process of NPD.

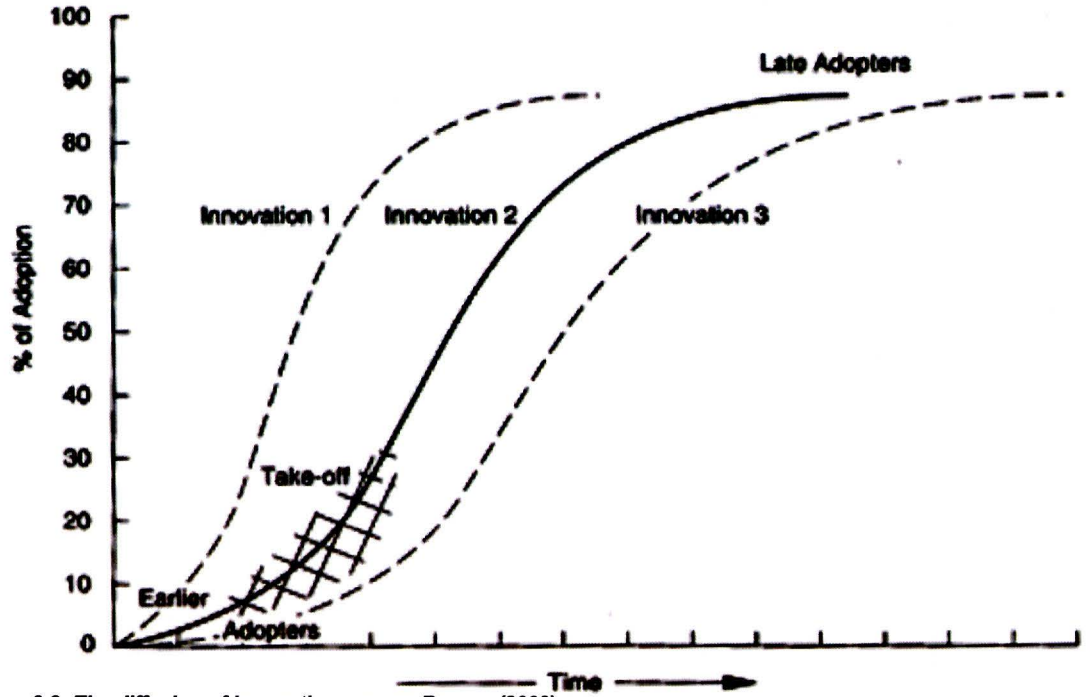


Figure 3.2: The diffusion of innovation, source Rogers (2003)

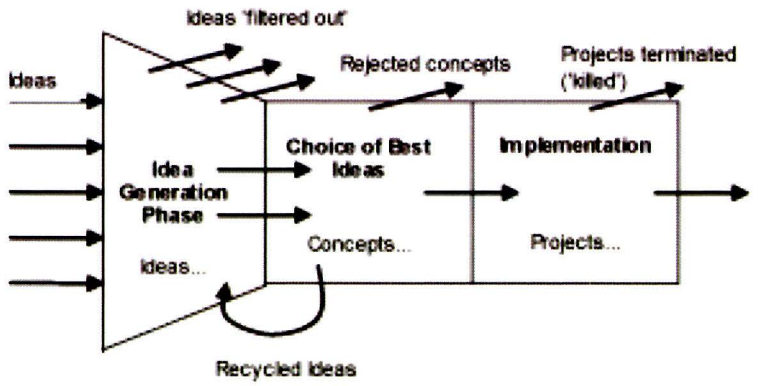


Figure 3.3: The development funnel, source Wheelwright and Clark (1992)

The development funnel offers a simple and useful visual representation of the key business process innovation. However, it does not show the link to a firm's strategic intension or to a company's culture. By adding the elements 'innovation strategy' and 'people and organisation', Goffin and Mitchell (2005) build on the funnel, introducing the innovation pentathlon framework. This framework identifies five elements of innovation management, as can be seen in Figure 3.4. In each of the five elements a number of key topics are to be managed, these are discussed in Table 3.1.

3.5. The input for innovation

In the most general sense the need for innovation comes from a mismatch between the aims of an organisation and what it actually expects to achieve by continuing with its present policies (Goffin and Mitchell, 2005). A NPD process has to be started up, with a new product, service or process as the outcome, in order to close this gap.

The input of a development process can be dual:

- *Market pull*; Identifying a marketplace need and then developing a new product to meet that need.

Figure 3.4: The innovation pentathlon, source Goffin and Mitchell (2005)

Element	Focus
Innovation Strategy	Developing and achieving the goals of the innovation strategy is the responsibility of top management and this requires a focus on a number of issues. Assessing market trends and determining how these drive the need for innovation in the company's chosen sector(s) is the first step. The role of technology, the opportunities it can open, and how to acquire expertise in the relevant technologies needs to be considered. Management needs to communicate the role of innovation within a company – product, service, process and business process innovation – and match the resources to the strategy. Lastly, gauging innovation performance, through the use of appropriate measures is essential.
People and Organization	Underlying innovation are many issues related to the management of human resources. These include hiring and training policies, job design, and creating effective organizational structures, which will increase innovation outputs. Creating a company culture in which employees are motivated to be constantly innovative is also fundamental. Effective reward and recognition programs will need to be maintained.
Ideas	Ideas are the raw material for innovation and managers need to focus on creating an organizational environment that supports creativity at both the individual and team level, and the use of suitable creativity techniques. Creativity should harness the knowledge both within and outside the organization. A large enough volume of creative ideas needs to be generated, which addresses either existing or latent customer requirements for products and related services, or streamlining processes that serve customers. Good ideas blend technical, customer and market requirements. As innovation includes new products, services, and new or improved processes, the scope for idea generation needs to be kept wide.
Prioritization	An efficient process is required to ensure that the best ideas are chosen for development into new products, services and process innovations. This requires the use of suitable tools to analyse the risk and return of individual projects. Limited resources for the implementation of innovation projects need to be carefully assigned. Managers need to collate the information from across the range of projects, to check that the portfolio of innovation projects is appropriately balanced and matched to the company's innovation strategy, and to collect information on portfolio decisions, so that in the future management teams can review and learn from their previous decisions.
Implementation	This phase should focus on quickly and efficiently developing new products, services or processes, or a combination of these. Faster development times can be achieved through effective cross-functional teams, prototyping and testing. Commercialization is the last step in implementation and, for example, a successful market launch is essential for new products. The implementation process is an area where companies can learn from each project, so that the future performance can be greater.

Table 3.1: Focus per element in the innovation pentathlon, source Goffin and Mitchell (2005)

- *Technology push*; Identifying an interesting technology, making a product and then searching for a marketplace.

Based on this duality, companies can be market-driven or technology-driven.
- *Market-driven companies* are aware of their marketplace and try to develop products that meet the needs of that marketplace. They are concerned with growing their market share by concentrating on using the technologies they already have in-house or that are readily available from the outside.
- *Technology-driven companies* look beyond the limitations imposed by their current technologies. They assume that the needs of tomorrow's customers will not be met with today's technologies. They try to develop new technologies without necessarily knowing what markets the products developed from these technologies will serve. They believe that, once the new technologies are developed, a search for market opportunities will yield commercially successful products.

Strictly market-driven companies have a risk of losing out when their market experiences a downturn because they will have no new technology available to enable them to move rapidly into other markets. They also have a greater risk that their competitors will pull ahead of them with a new product line that is driven by a new technology. Strictly technology-driven companies have a greater risk that they will not find a market for their technologies and that they will have wasted all the time and money that went into the development of that technology. So it is highly important that the technology innovation is translated into market potential.

3.6. The adoption of innovation

All adoption of innovation by users and consumers takes time. The rate of adoption is the relative speed with which an innovation is adopted by the individuals of a social system, which do not all adopt an innovation at the same time (Rogers, 2003). Rather they adopt in an over-time sequence, so that individuals can be classified into adopter categories on the basis of when they first begin using an innovation. Adopters of new technology can be categorised as shown in Figure 3.5.

Marketing theory explains that the members that are quickest to adopt have particular characteristics. Some of the characteristics of each category of adopters include (Rogers, 2003):
- Innovators (2,5%) – venturesome, educated, multiple info sources, greater propensity to take risk,
- Early adopters (13,5%) – social leaders, popular, educated,
- Early majority (34%) – deliberate, many informal social contacts,
- Late majority (34%) – sceptical, traditional, lower socio-economic status,
- Laggards (16%) – neighbours and friends are main information sources, fear of debt.

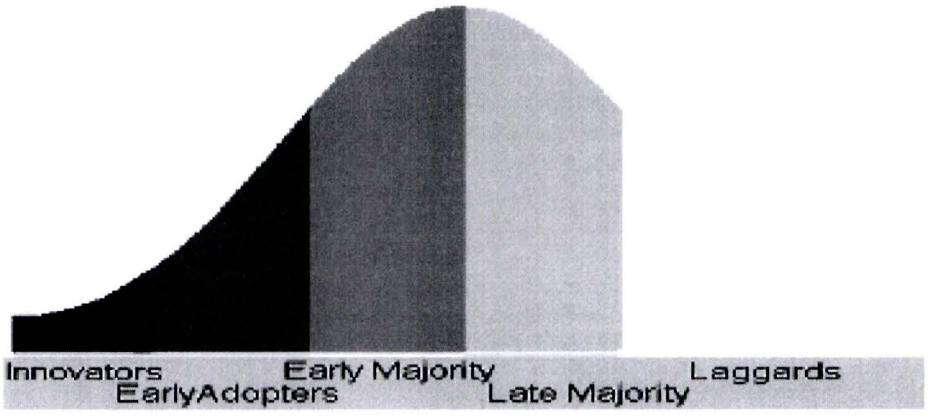


Figure 3.5: Adopters of new technology, source Rogers (2003)

The identified groups (with the percentage of the population between brackets) adopt innovations for different reasons. Early adopters are technology enthusiasts looking for a radical shift, where the early majority wants a 'productivity improvement'. The latter group wants a whole product, where the earlier group only needs the core product, and has the technical competence, and financial resources to make the rest themselves.

Most of the variance in the rate of adoption of innovation is explained by five attributes, namely (Rogers, 2003):

- Relative advantage,
- Compatibility,
- Complexity,
- Trialability,
- Observability.

In addition to these five perceived attributes of an innovation, other variables affect an innovation's rate of adoption, e.g. (Rogers, 2003):

1. The type of innovation-decision,
2. The nature of communication channels diffusing the innovation at various states in the innovation-decision process,
3. The nature of the social system in which the innovation is diffusing,
4. The extend of change agents' promotion efforts in diffusing the innovation.

This is illustrated in Figure 3.6.

The most difficult step in bringing new technology to the market is making the transition between early adopters and early majority. This is the chasm Moore refers to in his book 'Crossing the Chasm' (2002). Moore argues that this is because early adopters and the early majority have very different

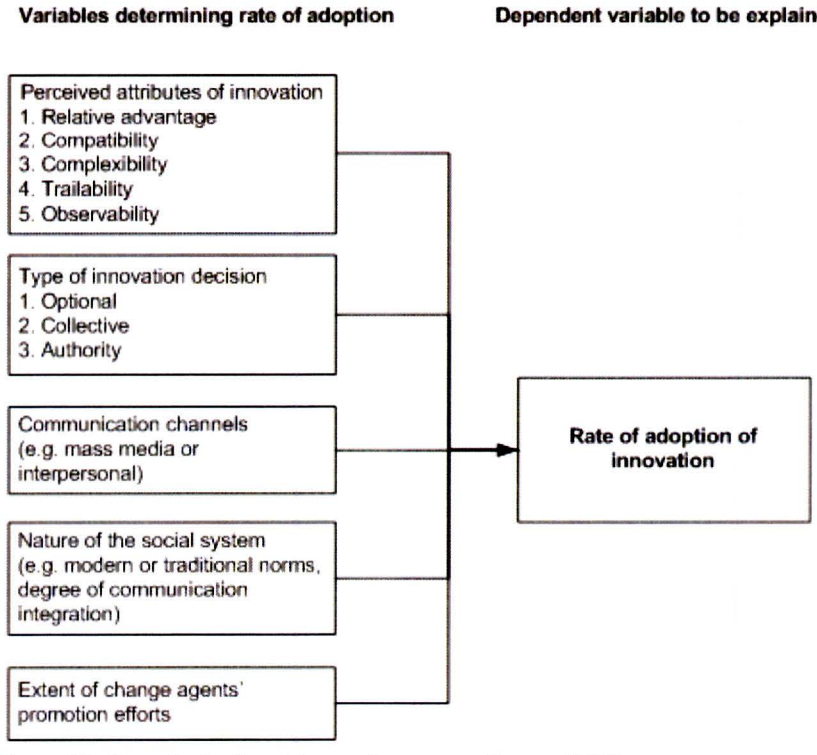


Figure 3.6: Rate of adoption of innovation, source Rogers (2003)

expectations, and attempts to explore those differences and builds from there to suggest techniques to successfully cross this chasm, including choosing a target market, understanding the whole product concept, positioning the product, building a marketing strategy, choosing the most appropriate distribution channel, and pricing.

3.7. Intended behaviour as predictor of usage

The main question for technology-driven companies is how to decrease the risk of not finding a market for their technology. To better predict, explain, and increase user acceptance, an organisation needs to understand why people accept or reject innovation. Therefore the ability to predict people's acceptance of innovation from a measure of their intentions, and the ability to explain their intentions in terms of their attitudes, subjective norms, perceived usefulness, perceived ease of use, and related variables needs to receive attention (Davis et al., 1989).

According to Mom (2006) adopters of a technology choose a function, not a technology. There is a vague relationship between the technical properties of the product and the functions it offers to the user. Therefore producers have to create a functional concept, based on what they assume the functions to the user will be, and translate this concept into a set of properties allowing these functions (Mom, 2006).

People use products that enable and constrain certain activities, but in a pure technology push, it is unknown what these activities precisely are. This means that the exact characteristics of a product or service only become shaped through the use of the products. In short, users constantly change their activities while using the product and the product is constantly changing to allow for these new activities (Mom, 2006).

From the behavioural point of view it is worthwhile to explain the adoption of any technology. Because each individual or organisation operates under its own set of political, administrative, scientific, technological, and economic constraints, Schiffer (2005) states that is it not surprising that many new technologies are adopted differently. Different users adopt a new technology in a different way, based on the use of different aspects of this technology. Because every technology has a unique mix of performance characteristics (PCs), no single technology can satisfy every group's preferences. Thus an adoption decision of a technology may result in some group's performance preferences being realized at the expense of others, depending on which PCs are weighted.

But what to do when it is unclear what the PCs are? This is mostly the case with an entirely new technology, of which the use and its performance is still unknown. According to Mom (2006) there is no one-to-one relationship between the properties and functions, nor is the selection process totally random (see Figure 3.7). All technical change is 'directed'; defined by the desires and needs of both producers and users, and subjected to the 'path dependencies', which are influenced by factors like culture, rules and legislation, etcetera.

Also indicated in Figure 3.7, and most relevant in this discussion is the role of the producers (the engineers). Based on their view of current technology, they create products and services with intended applications and functionalities. The true functionality arises in real user cases, in contact with the user. The product or service's properties direct and constrain the possible activities, but new, unintended functions can be realized as well by creative users (Mom, 2006).

The increasing tensions between the engineer and the user can be characterized as a 'struggle of command over functions'. Functions become properties, hardware becomes software; Engineers 'steal' the functions from the user, to restrict the freedom of use. In most cases, this struggle is won

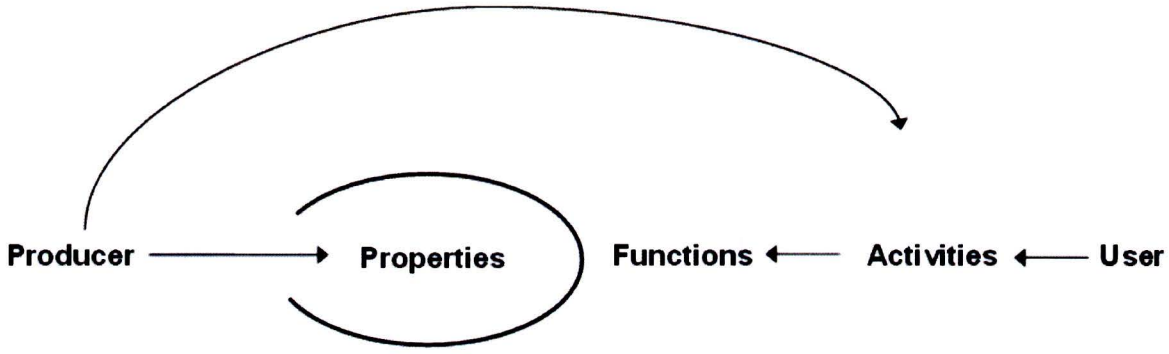


Figure 3.7: The dual nature of technology, source Mom (2006)

by the engineer, and they think for the customer (Mom, 2006). Contrasting, since the buy-decision is not made by the engineer, but by the customer, the question is whether or not the engineer can be the decision maker in complex technical problems.

3.8. Technology acceptance

Davis et al. (1989) state that it is difficult for designers and engineers to recognize and specify the right system requirement based on their own logic and intuition, and therefore methods for evaluating the acceptability of systems as early as possible in the design and implementation have to be used. Davis (1986) introduced the Technology Acceptance Model (TAM) which is specifically meant to explain computer usage behaviour. The goal of TAM is to provide an explanation of the determinants of computer acceptance. It posits that two particular believes, perceived usefulness and perceived ease of use are of primary relevance for computer acceptance behaviour, as can be seen in Figure 3.8.

A key challenge facing 'user acceptance testing' early in the development process is the difficulty of conveying to users in a realistic way what a proposed system will consist of. Davis et al. (1989) conclude that ease of use is clearly important, but that the usefulness of the system is even more important and should not be overlooked. Measures of the determinants of user acceptance early in the development process are important for the ability to weed out bad systems, to refine the rest, and to cut the risk of delivering finished systems that get rejected by users.

Therefore the question remains how and why individuals adopt new technologies. Venkatesh et al. (2003) identify four key moderating variables that have been found to be significant in answering these questions, namely experience, voluntariness, gender, and age, and developed the Unified Theory of Acceptance and Use of Technology (UTAUT). UTUAT, an improved model based partly on TAM, posits three direct determinants of intention of use (performance expectancy, effort expectancy, and social influence) and two direct determinants of usage behaviour (intention and facilitating conditions)

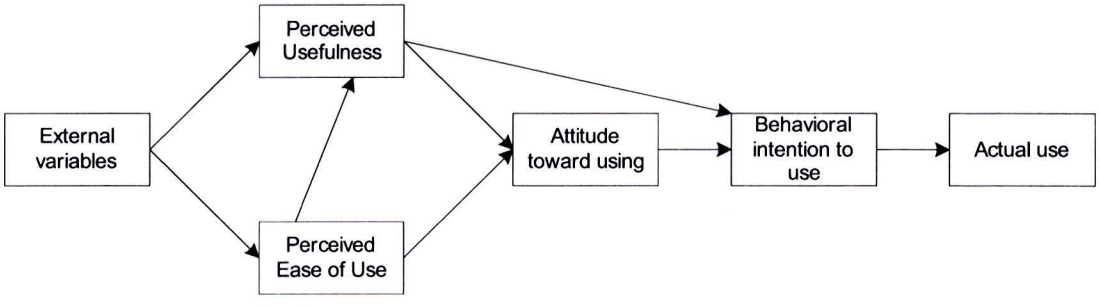


Figure 3.8: Technology Acceptance Model (TAM), source Davis et al. (1989)

as indicated in Figure 3.9. According to Venkatesh et al (2003) UTAUT explains as much as 70 percent of the variance in user intention.

Now the only question remains is how the technical requirements of a technology innovation can be translated into customer requirements. To answer this question, the next section discusses the concept of Total Quality Management.

3.9. Total Quality Management

Organisation strategy determines organisation structure, which in turn influences organisation performance (Prajogo and Sohal, 2006). Porter (1980) has emphasized that each strategy requires different resources and organisational arrangements to be successful in achieving the primary goal.

Total Quality Management (TQM) is a management strategy aimed at embedding awareness of quality in all organisational processes. It can be defined as 'a set of systematic activities carried out by the entire organisation to effectively and efficiently achieve company objectives so as to provide products and services with a level of quality that satisfies customers, at the appropriate time and price'.

TQM requires that the company maintains this quality standard in all aspects of its business. This requires ensuring that things are done right the first time and that defects and waste are eliminated from operations.

Prajogo and Sohal (2006) identified two competing arguments regarding the implementation of TQM in innovative organisations. The first argument suggests that TQM is positively related to innovation performance because it establishes a system and culture that will provide a fertile environment for organisations to innovate. The opposing argument holds that the implementation of TQM principles and practices could hinder organisations from being innovative. The principles of customer focus could trap organisations into captive markets where they will focus on meeting the needs of existing customers and therefore view their business only through their current customers' eyes. As a result, these companies could fail to drive the search for innovative and novel solutions by ignoring the 'unserved' potential in their markets.

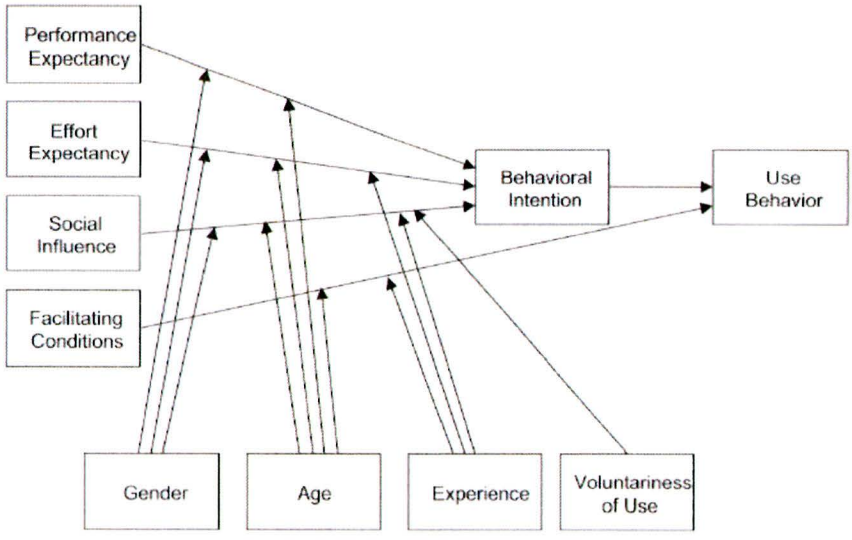


Figure 3.9: The Unified Theory of Acceptance and Use of Technology, source Venkatesh et al. (2003)

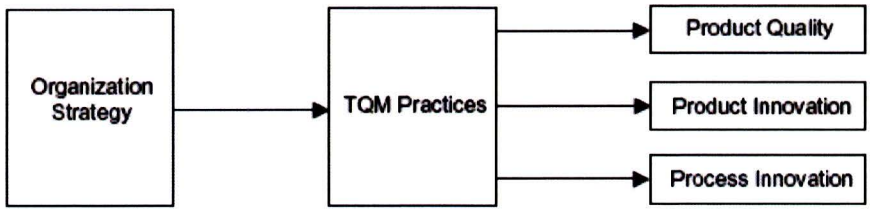


Figure 3.10: TQM practices in relation with organisation strategy and performance measures, source Prajoho and Sohal (2004)

The question is therefore in what way TQM can be associated to an innovative strategy. The adoption of TQM practices is driven by a differentiation strategy, and can be of influence on the organisational performance measures. This is indicated in Figure 3.10.

TQM can be employed as an effective means for deploying a differentiation strategy to achieve satisfactory organisational performance, if suited to the specific performance measure required to the strategy of the organisation.

An approach to TQM is Quality Function Deployment (QFD). QFD was born as a method or concept for NPD under the umbrella of TQM. Quality Deployment (QD) is defined as (Akao and Mazur, 2003) '*a methodology that converts user demands into substitute quality characteristics, determines the design quality of the finished goods, and systematically deploys this quality into component quality, individual part quality and process elements and their relationship*'.

The two-fold purpose of QFD is to assure that true customer needs are properly deployed throughout the design, build and delivery of a new product or service, and to improve the product development process itself (Akao and Mazur, 2003).

The House of Quality forms the central tool of Quality Function Deployment (QFD). It is utilised by a multidisciplinary team to translate a set of customer requirements (the Voice of the Customer) and technical requirements (the Voice of the Company) into a number of prioritised engineering targets to be met by a new product design. The House of Quality consists of six main elements, as can be seen in Figure 3.11. The elements are described in more detail in Appendix L.

Customers expect to get products with an extensive functionality and a high reliability for a reasonable

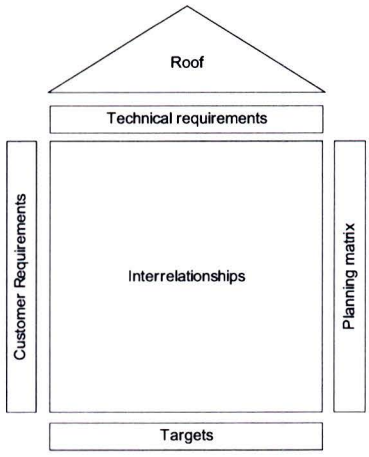


Figure 3.11: The House of Quality

price. Therefore, in general the goal of NPD is transforming customer requirements into a product that satisfies the customer needs (Seligman, 2006). QFD makes it is possible to connect customer requirements with technical requirements, and to set priorities in the development of new products or product features. In a market pull environment, it is usually the case that the requirements of the customers are known. For technology push, as discussed earlier this chapter, this lies different. The new product or service is unknown to the user, and therefore the users' requirements are unknown to the engineers. Therefore, QFD in its pure form is not useful for technology push innovations.

However, for a technology innovation a selected group of users can be used to predict the user adoption to certain extend. The concept of High Contrast Consumer Testing (HCCT) is a consumer test which tries to deal with unexpected consumer behaviour (Boersma et al, 2003). HCCT observes critical and extreme customers using a product in realistic operation conditions, in an early phase of development, to improve the understanding of how the product would be used by customers. Appendix M describes the concept of HCCT in more detail.

3.10. Organising Research and Development

The constant challenge for management is to obtain the technology it requires to support strategic objectives as quickly and economically as possible. In this the organisation of the Research and Development (R&D) businesses plays a central role. The dynamic developments in technology and related business environment require an appropriate responsibility centre type and the optimum balance between centralisation and decentralisation. There are notable differences between cost and profit-oriented R&D structures relating to the degree of freedom in decision making on research management topics, the balance among types of R&D activities, strategy formulation, performance evaluation, marketing and management demands imposed on the capabilities and attitude of the staff (Kerssens-van Drongelen, 2003).

Cost and profit centres are accounting concepts, which specify for which financial aspects of a unit's activities the managers of that unit are held responsible.
- In *cost centres* managers are financially accountable for the costs of the inputs they use to produce the outputs.
- In a *profit centre* a manager is responsible for both the costs of the inputs used and for generating an acceptable amount of revenues with these inputs, the difference between the two being the profit or loss.

Traditionally, industrial R&D laboratories have been classified as cost centres. For an R&D organisation, being a profit centre would mean that it cannot count on a more or less secured annual budget, but would have to establish prices for its R&D services and sell them via customer-contractor arrangements to internal or external customers in order to generate at least enough revenues to cover the costs. The type of responsibility centre and the degree of decentralisation are theoretically separate issues. While the responsibility centre type refers to the responsibilities of a unit manager, the decentralisation issue refers to the degree of freedom for managers at lower levels of the organisation to make business decisions. Total decentralisation means minimum constraints and maximum freedom for these managers. Profit centres can be coupled with a highly centralised organisation, and cost centres can be coupled with a highly decentralised organisation. (Kerssens-van Drongelen, 2003).

Effective product and process development requires the integration of specialized capabilities. Such integration is difficult in most circumstances but particularly challenging as organisations grow and mature and as functional groups become more specialised. Different team structures are available for development projects; from those that are largely functionally oriented, with only loose connections

across the functions, to those that are autonomous and integrated, with only loose connections to the individual functions (Goffin and Mitchell, 2005, Burgelman et al, 2004):

- Functional team structures,
- Lightweight cross functional teams,
- Heavyweight cross functional teams,
- Autonomous teams,
- Virtual teams.

Each project team structure has its own advantages and limitations. Thus it is important to consider the most suitable structure at the beginning of every innovation project. Now, the different options are discussed into more detail. An overview can be found in Figure 3.12 and Table 3.2. A further description of the team structures can be found in Appendix N.

3.11. Technology innovation summary

This chapter provided the outcome from the literature review regarding the development of new products, in order to realise the third deliverable. What can be concluded from this review is that is it highly important for a company to understand that the adoption of technology innovation takes time, and that a structured New Product Development approach is necessary to be able to influence the diffusion of innovation.

It can also be concluded that it is impossible for the engineer to predict the real usage of a technology innovation. The goal of NPD is to transform customer requirements into a product that satisfies the customer needs. A company must be aware of the link between the technical requirements and the

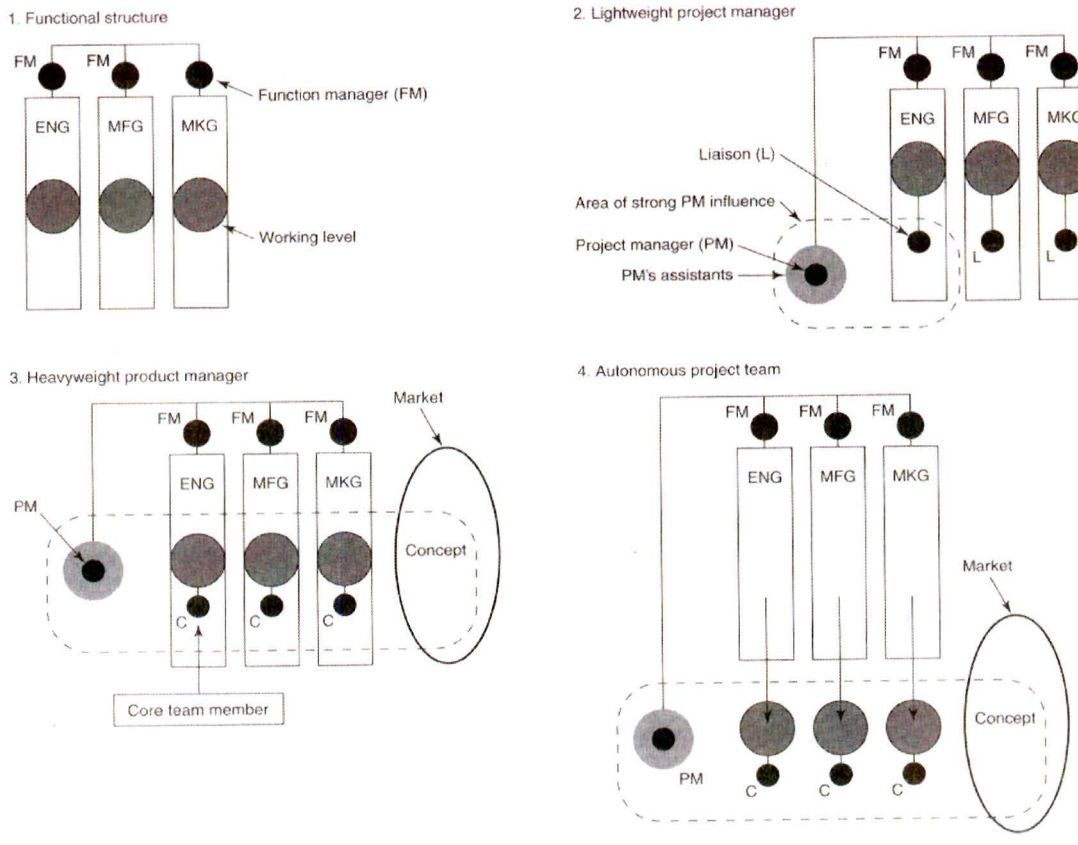
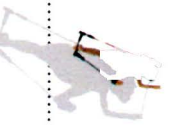


Figure 3.12: Team structures., source Clark and Wheelwright (1992)



	Functional teams	Leightweight cross functional teams	Heavyweight cross functional teams	Autonomous teams	Virtual teams
Advantages	- Simple to organise. Do not monopolise management time. - Responsibility and authority are usually aligned. - Ideal for 'tactical' improvements to the day-to-day process within a function.	- Bring together knowledge and responsibilities of functions. - Work well for projects where something similar has already been succesfully completed. - Require relatively low management commitment. - Improved communication and coordination.	- Due to an experienced manager taking responsibility for the heavyheavy weight team, it has more influence. - Ownership and commitment. - Can use existing processes and resources.	- Autonomous temas are freed of the bureaucracy and overheads of the parent organisation. - The main strength is focus. - Seperate location suppots the independence of the team. - The team spirit will quickly encourage entrepreneurship.	- Bring together levels of expertise not available in a single organisation. - Can be much faster moving than projects resourced internally. - Such teams are entrepreneurial in nature.
Limitations	- Team may miss opportunities, as they have a narrow perspective. - Team learning is not applicable to cross-functional projects. - The development process must be unpacked into separate, independent sub activities.	- Project manager has little formal power and so may not be able to control cross-functional differences. - In competition for resources, are likely to lose out to heavyweight teams.	- Require a very experienced manager to lead the project. - May require significant amounts of management time. - May not work well for new ventures, as they are too closely tied to the parent organisation.	- Radical approaches will test the capacity of the parent organisation to accept change. - Entrepreneurial management talent is hard to find.	- Are not co-located. - Need good communication and a simple, effective innovation process. - Sourcing outside expertise can be very expensive. - Intellectual property rights (IPR) need to be carefully managed.
Recommended applications	- Kaizen projects in all functions. - Developing a process orientation within the functions.	- Incremental innovation projects. - More complex kaizen projects, where a cross-functional view may add a better understanding.	- Radical innovation projects (not recommended for low complex projects). - Heavyweight teams offer a good training ground for managers with top potential.	- New ventures: new products in new markets. - Dealing with disruptive technology. - Cross-functional integration.	- 'Fast-track' projects. - Development of new technology, where the internal competence does not exist.

Table 3.2: Team structure, source Clark and Wheelwright (1992) and Goffin and Mitchell (2005)

customer requirements, to be able to set priorities in the development of new products or new product features. In this the organisation of the R&D businesses plays a central role, and must be adjusted to the required outcome of the NPD process.

This chapter reviewed the adoption of innovation from the supply side; the next chapter investigates the demand side, by discussing the concept of Customer Value. Again, the progress made is presented in Figure 3.13.

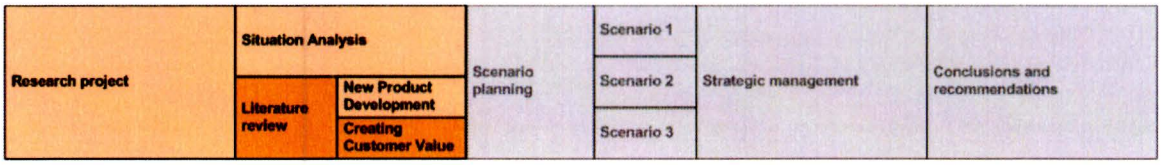


Figure 3.13: Progress update

Chapter 4. Creating Customer Value

As discussed in the previous chapter, market trends lead to more innovative companies. And because these trends also indicate an increasing competition between companies, the whole process of innovation is involved with creating value for the customer. This chapter explains what the concept of Customer Value is (Section 4.1), how this concept can be classified (Section 4.2), that Customer Value changes over time (Section 4.3) and what criteria determine Customer Value (Section 4.4).

4.1. The concept of Customer Value

In their book 'Strategic Management of Technology and Innovation' (2004) Burgelman et al. bring forward the question: What concepts, techniques, tools and management processes facilitate successful technological innovation? It is stated that the answer to this question is of great interest to practitioners who concern themselves with organisations in which technology and innovation are vitally important. First, the key terms are described:

Strategic management is *'the process of specifying an organisation's objectives, developing policies and plans to achieve these objectives, and allocating resources so as to implement the plans*'. It provides overall direction to the whole enterprise.

Technology and innovation are important elements of business definition and competitive strategy.

Technology refers to '*the theoretical and practical knowledge, skills, and artifacts that can be used to develop products and services as well as their production and delivery systems*' (Burgelman et al, 2004).

Innovations are the outcome of the innovation process, which can be defined as '*the combined activities leading to new marketable products and services and or new production and delivery systems*'. A technological innovation usually has at least some degree of benefit for its potential adopters, but this advantage is not always clear cut to those intended adopters (Rogers, 2003).

The concept of ***Customer Value*** (CV) can be defined as *'the trade-off between the benefits received from the offer versus the sacrifices to obtain it (e.g. costs, stress, and time)*'. Value is created when product and user come together within a particular use situation (Johnson and Weinstein, 2004). CV can be increased by developing new features with greater customer perceived value than the offerings of the competitors (Kuylman, 2005).

4.2. Classification of Customer Value

Johnson and Weinstein (2004) state that customers will not pay more than a product or service is worth. Albrecht (1994) states that CV is a mindset; it is the customer's perception of specific need fulfilment. The value is in the result perceived by the customer. This indicates that CV is a highly subjective concept; everyone weights the same aspects differently. Therefore, the trade-off between the benefits received from the offer and the sacrifices to obtain it will have a different outcome from person to person. Ergo, CV will always be defined by the customers. Nevertheless, a company must speculate about the value they create for their customers, since this forms the main reason for doing business.

Woodruff and Gardial (1996) have developed a three stage means-end value hierarchy model that consists of features, benefits, and desired values. These levels of abstraction describe the product or service, the user-product interaction, and the goals of the buyer (person or organisation):
- *Desired values* are at the top of the hierarchy and represent the user's guiding principles and ultimate

end-states that are served by the benefits and the product or service features (the means to the end state). The desired values are much broader than a specific purchase context.
- *Benefits*, the higher level, refer to the consequential benefits derived from the use of the product with specific features. The customer buys a product or service as a bundle of features, expecting them to provide certain outcomes (benefits). Relative to the objective feature level, benefits are more abstract, evaluative and subjective.
- *Features* are the lowest level of the hierarchy and correspond to the specific product or service features. They are typically used to describe the product by both customers and the provider company, and are normally specific, tangible items that can be measured.

This hierarchical view suggests the extent to which the desired values are met through the use of the product or service, again from the customer's perspective. A deeper understanding of not only specific features of the product or service, but also the benefits and underlying desired values that influence individual customers' expectations, satisfaction and their interrelationships can be obtained from this hierarchy. Such information is of considerable importance in strategic planning for gaining competitive advantage.

For a company, it is important to have insight into the desired end state of their customer, and how their offering contributes to attaining this state. In other words, are the benefits offered by the product or service a factor in creating the desired CV? In addition to its users and producers, a product is normally described in terms of its features. Therefore, a company must have insight into how their offered features influence the benefits of the product or service.

A useful framework for directing a strategy for creating customer satisfaction is developed by Kano. His work focused on how product features contribute to customer satisfaction, and he developed a customer satisfaction model that can be used for measuring client happiness regarding quality management or as a marketing technique. According to this model, the features of a product or service can be classified into three categories depending on the effect that they have on the benefits for the customer (see Figure 4.1 for Kano's classification in schematic form):
- '***Basic features***': These are the features without which a product or service would simply be unacceptable. The customer takes them as prerequisites and may not even mention them, though they are essential for a successful product. All of these features are expected nowadays. Failure to provide them would cause great dissatisfaction. However, providing extra performance beyond the basic requirements gives no extra satisfaction to the customer.
- '***Performance***' or '***One-dimensional features***': These are the features that provide a real benefit to the customer, and the more of them provided by a product, the better. For many products reliability or ease of use will be performance features.
- '***Excitement features***' or '***Delighters***': A customer is unlikely to demand these features because they are not part of the way the product is normally viewed but when offered they may surprise and please the customer. Such features often respond to hidden needs. They give an extra, unexpected benefit and may be attractive out of all proportion to the objective value the product gives.

In reality there are three more categories of features:
- '***Reverse features***': The reverse features have a negative influence on the CV. Customers value a product or service when this feature is not available.
- '***Indifferent features***': These are the features that do not directly influence the CV of a product or service. Customers do not value the product or service more when it is available, but also do not value it less when it is not available.
- '***Questionable features***': The influence of these features on the CV is unknown.
In creating CV companies therefore have to focus on the first three categories of features.

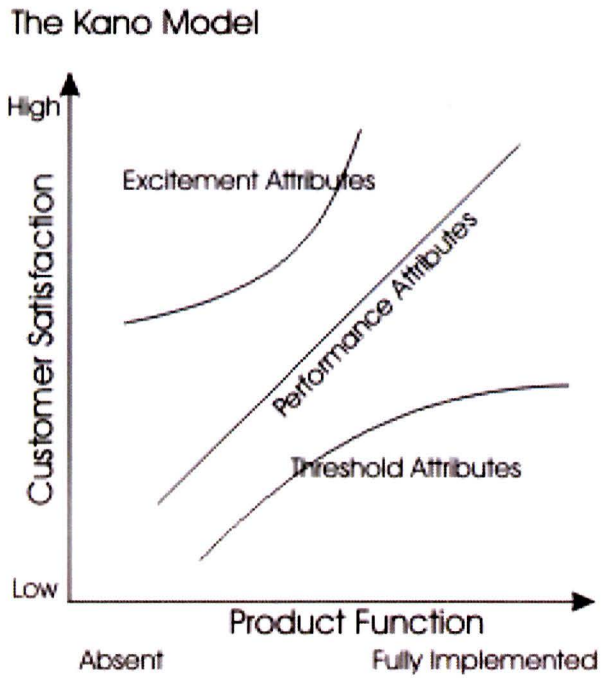


Figure 4.1: Kano's feature analysis, source Goffin and Mitchell (2005)

Companies that offer excellent CV are those who are aware of the relation between the technical requirements and the customer requirements. Therefore, the link between the desired CV and the features a company's product or service can offer must be clear. To determine the class a feature belongs to, a pair of questions needs to be asked. Each pair of questions includes the *functional question*, which asks the user how he or she would feel if a feature were present, and the *dysfunctional question* that asks the user how he or she would feel if the feature was not present. Asking only how desirable a feature is does not help to separate the basic features from the performance features from the exciters. To decipher which features customers view as basic, performance, and exciting, both the functional and the dysfunctional forms of the question need to be asked. From the combination of answers to both questions it can be derived to which category a features belongs, as can be seen in Figure 4.2.

Customer Requirements		Dysfunctional Question				
		Like	Expect	Neutral	Live with	Dislike
Functional Question	Like	Q	E	E	E	L
	Expect	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live with	R	I	I	I	M
	Dislike	R	R	R	R	Q

M Mandatory
L Linear
E Exciter
R Reverse
Q Questionable
I Indifferent

Figure 4.2: Classifying features, source Goffin and Mitchell (2005)

When dealing with prioritizing requirements or deciding what should be in or out of a product plan, each potential feature should be considered being a basic, performance, or excitement feature. Goffin and Mitchel (2005) state that it is probably true that customer satisfaction comes from the basic and performance features, while their loyalty depends on delivering superior performance together with some excitement. Excitement features are often needed to capture market share.

4.3. Changing Customer Value

The diffusion of technology innovation is often presented as a 'one-dimensional, monolithic process' (Mom, 2006), it is generally assumed that the adoption of an innovation always tends to follow the rate of adoption as described in the previous chapter.

An innovation strategy involves analysing the important features of the products and services that an organisation offers and asking how their value is to be maintained and enhanced in the future. The Kano diagram raises two main points (Goffin and Mitchell, 2005). Firstly, can the organisation continue to enhance the value of the products and services it offers at the rate required? Secondly, will the costumers continue to demand the same balance of features in the future?

This indicates a dual input for technology change; the supply side and the demand side. Since the supply side is subjected to change (technology push), the demand side is also constantly evolving (market pull).

The supply side

According to Foster's theory (Foster, 1986) viewed over a sufficient length of time, the progress of any technology is likely to follow a recognisable S-shaped path, going through the stages *emerging*, *pacing*, *key*, and *base*. In the early stages, when the technology is in its infancy, the performance is modest and the rate of progress is relatively slow. Each advance provides the basis for further improvement and so progress accelerates as performance increases. As the technology approaches its ceiling (all technologies have one), progress slows down and investment in it becomes decreasingly less productive. Further clarification of Foster's theory and the focus in the different technology phases can be found in Appendix O.

An organisation that relies on a capability which is approaching the top of its S-curve may be highly vulnerable to a competitor with a better approach. Therefore, a company must understand its key capabilities well enough to know where their limits lie. According to Abernathy and Utterback (1978) the focus of innovation moves from product design towards process improvement as the technology evolves. The Pluto effect (Mom, 2006) states that dominant technologies tend to defend themselves against new, threatening alternatives by talking over as many functions from the alternative as possible, making it harder to opt in favour of the alternative.

The demand side

Customer requirements change with time in a regular and partly predictable manner. Features tend to move downwards from being delighters to performance features and from there to basic features, according to the hierarchy described earlier. This trend leads to important strategic challenges. Continuing to develop basic features as if they were still performance features can be hazardous for several reasons (Goffin and Mitchell, 2005):

- The extra but useless performance can add unnecessary cost to the product,
- The chance of pursuing features which are of real interest to the customer is foregone,
- The company may become vulnerable to an alternative technology.

The S-curve is an excellent tool to evaluate the adoption of technology, at the top of a technology's

lifecycle. Mom (2006) argues it can not be used as a predictor of adoption of technology due to 1) the insight that the functionality of technology innovation is not fully predictable in the early stages of its lifecycle, and 2) the total social system that will adopt the technology is not known beforehand.

Combining these insights from both sides leads to the graphs presented in Figure 4.3. At $t_{i,1}$ the first innovation starts to form a threat for technology 1. Then there are two options: Technology 1 increases its functionality by taking over the extra functionalities that the innovation can offer and keeps its market share, either the innovation takes the lead in functionality and market share.

Deming proposed in the 1950's that business processes should be placed in a continuous feedback loop in order to be able to identify the parts of the offering needing improvement. This diagram is known as the Deming Cycle (see Figure 4.4), and contains the stages:

- Plan: Design or revise business process components to improve results,
- Do: Implement the plan and measure its performance,
- Check: Assess the measurements and report the results to decision makers,
- Act: Decide on changes needed to improve the process.

The Deming cycle was originally developed as a business process improvement tool, but it is also applicable in NPD environments.

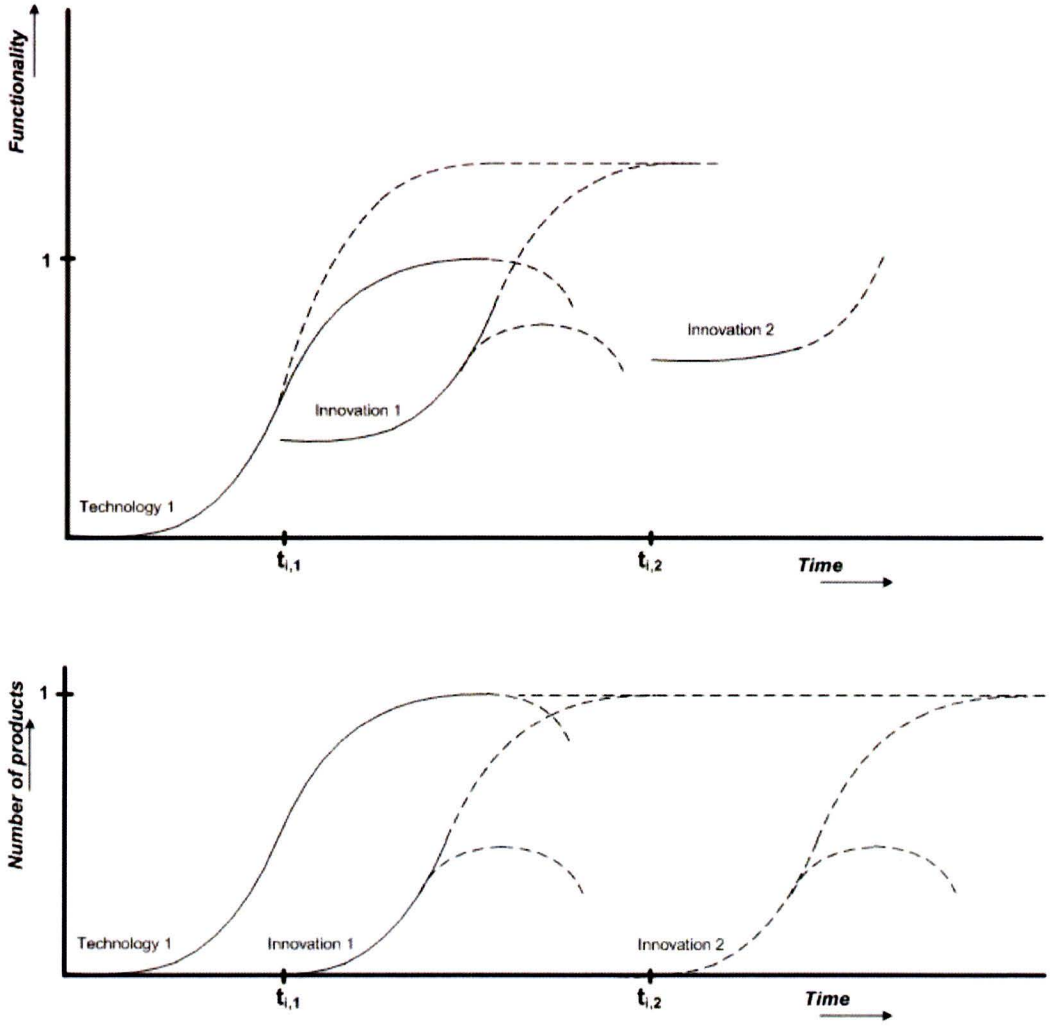


Figure 4.3: Changing customer needs

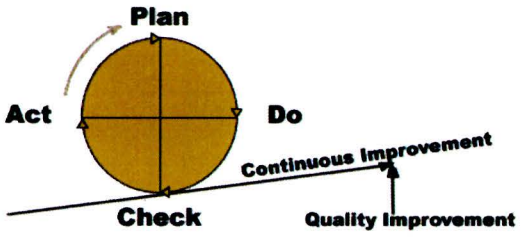


Figure 4.4: Deming Cycle

The above indicates that (the timing of) innovation is an important strategic choice. Thus, in an effective strategic plan all the components are linked together in a coherent way and the plan must clearly drive the actions that will make it happen. An effective way of achieving this is to construct a roadmap. A roadmap is a graphical representation of strategy which aims to display the key aims of the organisation, the means it will use to deliver them, and the new resources needed to make it all possible (Goffin and Mitchell, 2005).

4.4. Customer Value criteria

During any purchase situation, certain aspects or attributes of a product or service represent value to the purchaser. It is likely that a combination of attributes will represent value to the customer (Walters and Lancaster, 1999). It is critical that manufacturing firms understand what their customers (existing and potential) really value. According to Squire et al. (2004), the nature of customer demand is partly based in a set of prioritized criteria, the Customer Value criteria, which are developed to illustrate the diversity of modern markets. A CV criterion is defined as '*an attribute (or characteristic) of a product or service considered by a purchaser to be a primary reason for selecting a specific product (or service) because it enhances the value of the purchaser's output (business to business customer sales) or improves their lifestyle (business to consumer sales)*'.

Market fragmentation does not make such classification obsolete, but it further refines the dimensions to target specific markets. Whereas in the past CV criteria could be more easily defined, nowadays the fragmentation of markets means that the concept of value has expanded to include several further factors. Besides *price*, *quality*, and *delivery*, generic value criteria are now defined in terms of *variety*, *customisation*, and variations on themes related to *location*, *seasonality* and *marketing* (Squire et al, 2004). A possible, but not exhaustive, list of value criteria is given in Figure 4.5.

The starting point for innovation is to understand what your customers value in an offering. The identification of primary value criteria focuses the company to a particular product feature, but the customer may also value other criteria, hence the importance of secondary product features (Squire et al, 2004). Specific value criteria are important to specific individuals or customer groups (Walters and Lancaster, 1999), therefore three different scenarios are formulated in the next chapter.

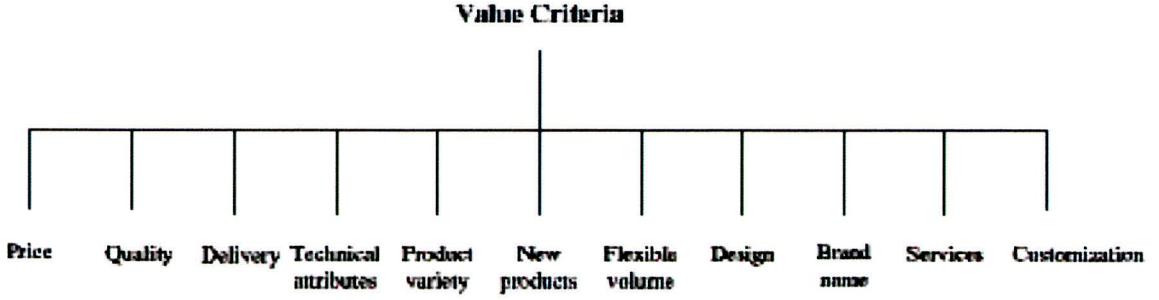


Figure 4.5: Customer Value criteria, source Squire et al. (2004)

4.5. Creating Customer Value summary

This chapter provided the outcome from the literature review from the market perspective, regarding the creation of Customer Value, and provides answers regarding the first deliverable of the assignment. What can be concluded from this review is that Customer Value is a highly individual concept, and that the true CV will always be defined by the customers. Nevertheless, a company must speculate about the value they create for their customers, since this forms the main reason for doing business.

Product features can be classified into different categories, regarding their contribution to the CV of the product. Every company should be aware of this contribution in creating a product and of the changing CV over time, due to influences from the supply side and the demand side.

A second aspect companies must be aware of is the aspects or attributes of a product or service that represent value to the purchaser, the so called Customer Value criteria. The starting point for innovation is to understand what your customers value in an offering; the identification of primary value criteria focuses the company on particular product features.

In Figure 4.6 the progress is presented again, and as can be seen the next chapter formulates three different scenarios for market leaders to create CV.

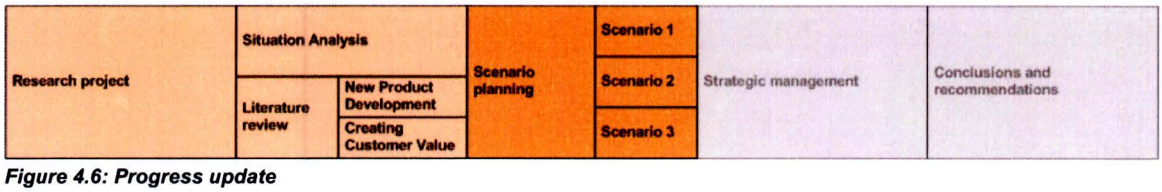


Figure 4.6: Progress update

Chapter 5. Scenario planning

According to Treacy and Wiersema (1995), there are several ways a company can become market leader. In this chapter three different scenarios are formulated based on these different options in order to explain the consequences of the strategic choice. First, the concept of scenario planning is introduced (Section 5.1), followed by a further explanation of the three scenarios (Section 5.2). The chapter is concluded in Section 5.3 by linking the value criteria to the different scenarios.

5.1. Why scenario planning

A tool for strategic planning is scenario planning (Schoemaker, 1995). The main purpose of scenario planning is not to predict the future but to consider a range of future possibilities (Orndoff, 2002). In contrast to other tools for strategic planning (e.g. contingency planning, sensitivity analysis, computer simulations), it takes into account that the business world is unpredictable, and that a strategy does not emerge retrospectively. In today's highly uncertain, turbulent business environments, scenario planning is the perfect tool to assist strategic decision-making for emerging technologies in emerging markets. A scenario is an integrated set of assumptions about the future that supports a given strategic option (Courtney, 2003). Scenario planning is a way of testing possible strategies against alternative futures. It is about making choices today with an understanding of how they might turn out (Wright, 2000). The value of scenario planning lies not in the numbers that emerge at the end but rather in the thought process that the model forces the users to go through to arrive at them. Strategic planning provides a vision of what one wants to become, a way of describing the end state toward a strategy will lead the company, and the process for getting there (Orndoff, 2002).

There are two types of scenarios (Courtney, 2003):

- *Vision-driven scenarios* aid management teams to think "outside the box" and question their assumptions about the future,
- *Decision-driven scenarios* are used to inform a well-specified strategic choice, a choice where the best option is unclear due to uncertainty over the impact of that choice.

5.2. Identifying different scenarios

Depending on the vision a company has for itself and the future, a strategic choice must be made in order to fulfil that vision. To remain competitive, according to Porter (1980), there are three possible strategies, or 'visions', for a company to follow: *cost leadership*, *differentiation*, and *focus*. Treacy and Wiersema (1995) modified Porter's three strategies to describe three basic value disciplines that can create CV and provide a competitive advantage (also indicated in Figure 5.1):

- ***Operational Excellence***: Superb operations and execution often by providing reasonable quality at a very low price. The focus is on efficiency, streamlining operations, Supply Chain Management, and volume counts.
- ***Product Leadership***: Very strong in innovation and brand marketing, operating in dynamic markets. The focus is on development, innovation, design, time-to-market, and high margins in a short timeframe.
- ***Customer Intimacy***: Excel in customer attention and service. Tailor products and services to individual or almost individual customers. The focus is on Customer Relationship Management, delivery of products and services on time and above customer expectations, lifetime value concepts, reliability, and being close to the customer.

A company must choose one of these value disciplines and act upon it consistently and vigorously for success. However, contrasting with Porter, it is stated that a threshold value for the rejected strategies also must be realised. This is so that companies do not get 'stuck in the middle', as in Porter's strategy.

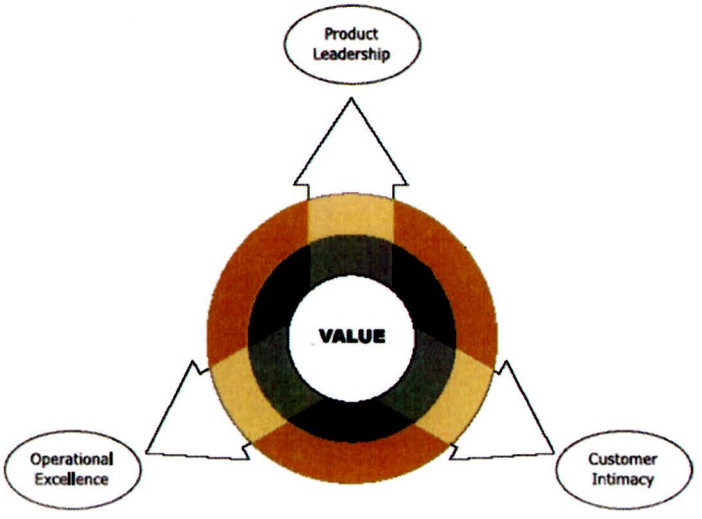


Figure 5.1: Value disciplines, source Treacy and Wiersema (1995)

This strategic choice largely determines the way companies have to organise their NPD-process. As such, this indicates that there are three different strategic options for a company, which can be regarded as separate scenarios (a further description of the scenarios can be found in Appendix P) (Treacy and Wiersema, 1995):

If a company is creating value for the customer following the first scenario '***operational excellence***', the organisation offers the current features (basic and performance features). The goal of the NPD process is on creating these known features in a more optimal way, so the focus is on *process development*.

When creating value for the customer following the second scenario '***customer intimacy***', an organisation follows the wishes and commands of the customer (market pull). The organisation does anything to satisfy the individual customer. Therefore these wishes are well-known to the organisation because customer intimate companies work in close cooperation with their customers. The input for the innovation process is market driven, and the focus is on *service development*.

With the third scenario '***product leadership***', an organisation tries to appeal to the customer by offering new products and services. This is therefore the only scenario that works for a real technology push driven company. A technology innovation is developed at the R&D department, but there is no direct need for this innovation. The focus of the innovation process is on *product development*, and the goal is the development of excitement features.

The question about how this innovation process has to be organised for the different scenarios still remains. As stated in Chapter 3, the QFD tool is a method for NPD. The first step of this tool is to determine the customer requirements. For two out of the three scenarios this step can easily be made.

For operational excellence, a benchmark of currently available competitive products, their features and usage, can lead to a clear overview of what is requested by the current users of this product. For customer intimate companies the customer is known, so therefore the customer requirements can be determined in consultation with this individual customer. The goal of the organisation must be to satisfy these needs and how this is done is of secondary importance.

Regarding the crossing of 'the chasm' (Moore, 2002) and the different adopters' categories, it can be concluded that the operational excellence companies wait with the development and implementation

of new features until they have crossed this chasm. Extra features only add extra costs; therefore they are not focused on the development of the delighter features, so they wait until these features become performance features. When they become performance features it is known what the customers value in these features thus they can be developed on.

Customer intimate companies do not bother either to be active on the left side of the chasm as they are only focused on satisfying customer needs. The delighter features do not respond directly to these needs, they only satisfy unknown or hidden needs.

In contrast with the other scenarios, product leaders are focused on the market before this chasm, the early innovators, and the early adopters form their target market. They are interested in developing products and features that provide an answer to the hidden needs of the customer.

As can be concluded from the previous chapter, product leaders can not predict the customer requirements based on the technology innovations alone. Therefore they need the help of a selective group of critical customers ('innovators') early in the NPD process (preferably in the prioritisation phase) to familiarise themselves with the requirements of the customer. The UTUAT model (described in Section 3.8) can be used to compose this selected group and to analyse the results.

This conclusion is summarised in Table 5.1.

5.3. Value criteria per scenario

Creating CV must be the central issue in a business strategy. Per scenario, a value preference map (Walters and Lancaster, 1999) can be generated, based on the theoretical insights of the scenarios. The importance of individual value criteria differs for each scenario. Each of the differentiation strategies focuses on specific value criteria for creating value for the customer. An overview of the value criteria linked to the scenarios based on theoretical insight can be found in Table 5.2, and is further illustrated in Figure 5.2 to 5.4.

Scenario	Left side in House of Quality determined by:
Operational Excellence	Critical users / innovators / early adopters
Product Leadership	The individual customer
Customer Intimacy	The competitors / The market

Table 5.1: Customer requirements under the different scenarios

Value Criteria	Operational Excellence	Product Leadership	Customer Intimacy
1. Price	5	1	1
2. Delivery	5	1	3
3. Quality	3	3	5
4. Technical attributes	3	3	5
5. Product variety	1	3	5
6. Flexible volume	1	1	5
7. Customisation	1	1	5
8. Services	3	1	5
9. Design	1	5	1
10. New products	1	5	1
11. Brand name	1	5	1

1. Not important, 2. Of minor importance, 3. Of medium importance, 4. Of major importance, 5. Essential

Table 5.2: Value criteria per scenario

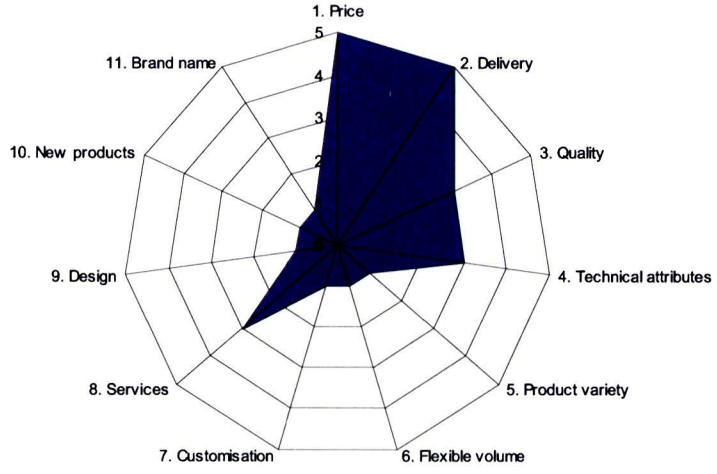


Figure 5.2: Value preference map for Operational Excellence

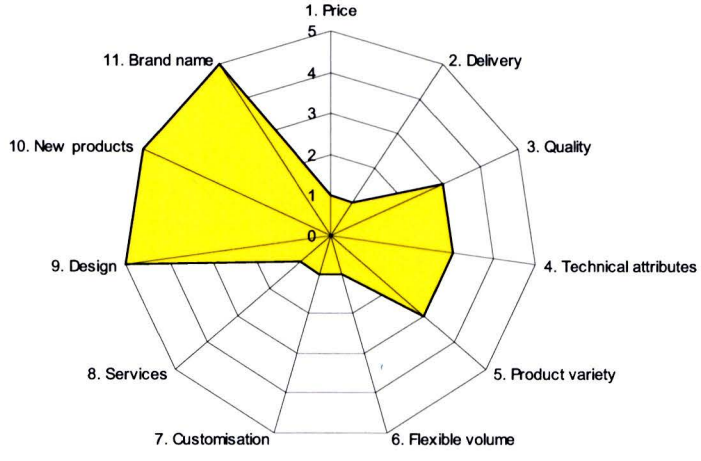


Figure 5.3: Value preference map for Product Leadership

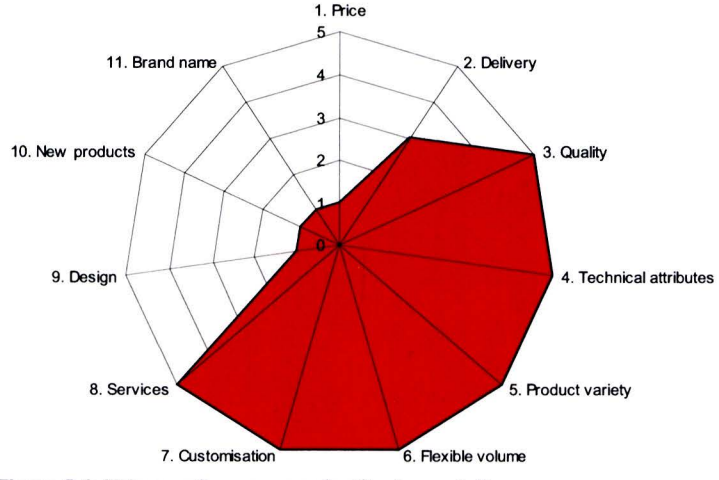


Figure 5.4: Value preference map for Customer Intimacy

5.4. Scenario planning summary

This chapter forms the bridge between theory and practice for Siemens VDO. It provides three possible scenarios, thus three possible future routes for creating CV. A company must choose one of these scenarios and act upon it consistently for success. This scenario selection influences the process for NPD because it provides guidance to the innovation required.

For each scenario, a value preference map was generated since they focus on specific value criteria in creating value for the customer. The next chapter will discuss the selection of a preferred scenario in the case of Siemens VDO, as can be seen in Figure 5.5.

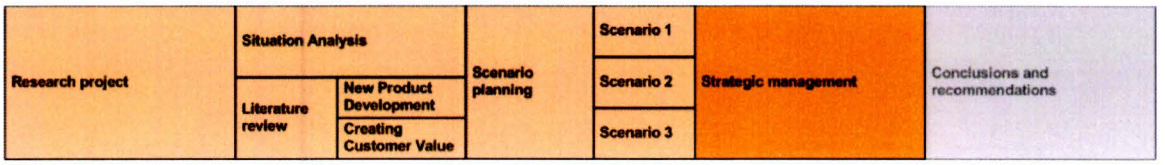


Figure 5.5: Progress update

Chapter 6. Strategic management

As stated in Chapter 4, strategic management is the process of specifying an organisation's objectives, developing policies and plans to achieve these objectives, and allocating resources so as to implement the plans. Based on the scenario analysis performed in Chapter 5, the next step is to perform strategic management based on empirical research performed at Siemens VDO. Section 6.1 provides a further introduction to strategic management. In Section 6.2 the first element of strategic management, strategic analysis, is discussed. Section 6.3 describes the second element; strategic choice. The third and final element, strategic implementation, is discussed in Section 6.4 based on the pentathlon of innovation. Section 6.5 discuses the steps necessary to adopt the change.

6.1. Introduction to strategic management

According to Goffin and Mitchell (2005) strategic management consists of three main elements (Figure 6.1):

1. ***Strategic analysis***; understanding the competences, assets and capabilities of the organisation, the environment it operates in (including competition), and the goals and expectations of the people with the power to guide it.
2. ***Strategic choice***; the broad choices the organisation makes about its activities.
3. ***Strategic implementation***; the resources, organisation and management processes that must be put together to implement the strategy.

Strategic management is not a linear process from analysis through choice to implementation, but rather a cyclic one, where all the elements interact and affect one another (Goffin and Mitchell, 2005). The next sections will discuss each element in detail for the Siemens VDO TPD situation.

6.2. Strategic analysis

As stated earlier, every company must focus on creating value for their customers. This also accounts for the TPD teams at Siemens VDO. Therefore, they need to ask themselves who they want to have as their customer; which market (segment) do they want to serve? In making this selection, it is vital to take into account the team's core competences (Kuylman, 2005). Core competences are the capabilities that the organisation controls and that provide competitive differentiation. These core competences are the foundation of the organisation, and form the reason for being in business (Meyer and DeTore, 1999). Kotler and Keller (2006) define a core competence as an attribute that (1) is a source of competitive advantage that makes a significant contribution to perceived customer

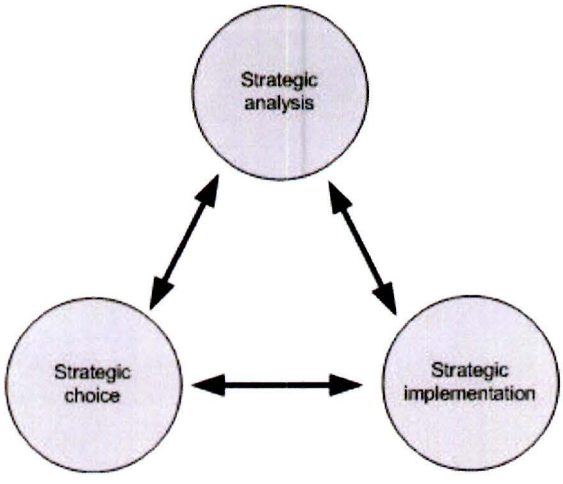


Figure 6.1: The strategy triangle, source Goffin and Mitchell (2005)

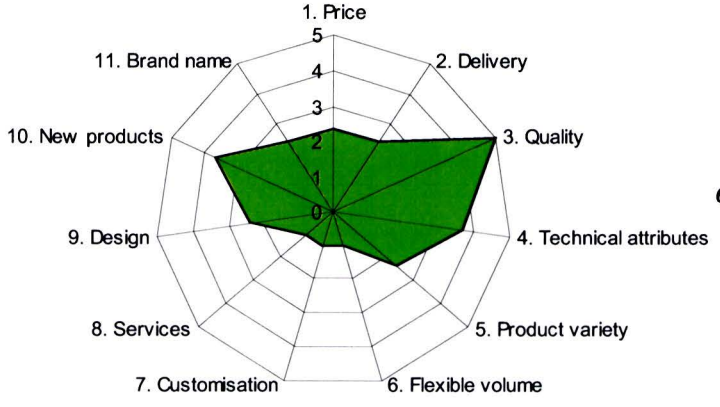
benefits, (2) has applications in a variety of markets, and (3) is difficult for competitors to imitate. Core competences are variables which management can influence through its decisions which can significantly impact on the competitive positions of the various firms in an industry (Walters and Lancaster, 1999). The core competences form the platform of doing business. They determine what kind of products and services are brought to the market and therefore form the input for selecting the best suited scenario for a company.

A questionnaire filled in by 75% of the decision makers of TPD at Siemens VDO resulted in a list of preferred value criteria (which can be regarded as core competences) for Siemens VDO TPD, represented in a value preference map (Walters and Lancaster, 1999) in Figure 6.2. The full questionnaire can be found in Appendix Q.

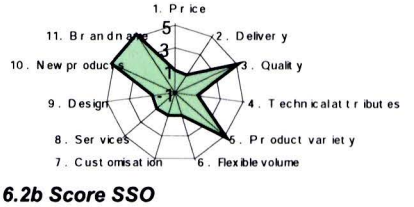
Figure 6.2 does not pretend to represent the true core competences of the TPD teams, or to represent the definite vision of the TPD teams. Nevertheless, it can be concluded from this figure that there is no unambiguous view amongst the TPD decision makers of the core competences (or most important value criteria) Siemens VDO TPD offers its customers. This means that it is almost impossible to set priorities in the development of (new) features, especially between the two departments.

A second conclusion is that Figure 6.2 does not match with one of the scenarios. This indicates that Siemens VDO does not set the right priorities in becoming a market leader according to one of the three scenarios, and explains the lack of strategy for TPD. Therefore, it can be concluded that the core competences of Siemens VDO, according to the TPD decision makers, do not indicate a preferred scenario for TPD. Siemens VDO does not have a clear view of the role of TPD; is it a way to differentiate their products from the competition, or do they regard it as excess baggage that only adds extra costs?

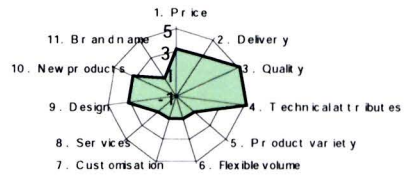
The next step in this strategic analysis is to conduct a categorisation of TPD features. As identified in Section 2.6, the lack of insight into what TPD is and what the CV of the forthcoming TPD features is, form two of the design parameters for this research. Through dialogue with representatives from both of the TPD-teams in the Siemens VDO organisation, a list of TPD functionalities was put together which forms the foundation of what TPD is and what the features TPD can deliver are. A second questionnaire, based on the Kano's feature analysis, is conducted to provide insight into the CV of the functionalities TPD has to offer, from an engineering point of view. This form was returned by 50% of the decision makers for TPD. More information about this questionnaire and it's results can be found in Table 6.1 and Appendix R.



6.2a Overall score



6.2b Score SSO



6.2c Score IIS

Figure 6.2: Core competences Siemens VDO TPD

TPD functionalities	IIS	SSO
1. TPD products	Performance	Indifferent
2. Levelled POIs	Performance	Indifferent
3. Travel Guides	Indifferent	Indifferent
4. Search for POIs in an area	Basic	Performance
5. Pre-defined routes	Excitement	Indifferent
6. Alert points	Excitement	Indifferent
7. Searchable attributes	Excitement	Indifferent
8. Facility pages	Excitement	Indifferent
9. Information attributes	Excitement	Indifferent
10. Category selection	Basic	Indifferent
11. Product selection	Basic	Indifferent
12. Language selection	Indifferent	Performance
13. Corridor functionality	Performance	Indifferent
14. Eject DVD and still search	Performance	Excitement
15. Intelligent typewriter	Indifferent	Excitement
16. Search along the route	Performance	Performance
17. Add, remove or update POIs	Excitement	Performance

Table 6.1: Categorisation of TPD features

The results do not provide enough information to draw conclusions on the categorisation. Moreover, it is stated earlier that CV is determined by the individual customer, and that the engineers are unable to make this consideration for the customer. However, it can be concluded from these results that there is no common insight from the engineering point of view to categorise the TPD functionalities. This indicates that there is no insight into the CV of the TPD features in the Siemens VDO organisation. For instance, it is unknown if the feature 'Searching for POIs in an Area' is a performance feature, or a basic feature. In conclusion, Siemens VDO does not know which features are required by their customers or which features could create extra CV.

A company's strategy is considered with regards to the adjustment of the organisation and it's environment. For this cause, a SWOT-analysis (Strengths, Weaknesses, Opportunities and Threats (Nijssen en Ligthart, 1999)) was conducted. The SWOT-analysis is a tool for mapping the strategic situation of a company, and to draw founded conclusions for the adjustment or choice of a strategic decision. The analysis consists of an internal and external analysis of the company and its environment, and highlights strategic problems or opportunities (Heene, 2001). It is about (potential) fits and misfits between the organisation and its environment (Nijssen and Ligthart, 1999) which also form the input for the innovation process.

A SWOT-analysis is performed for Siemens VDO TPD, based on facts, opinions and observations, conducted from interviews and documentation. An overview is presented in Table 6.2. The complete analysis can be found in Appendix S.

6.3. Strategic choice

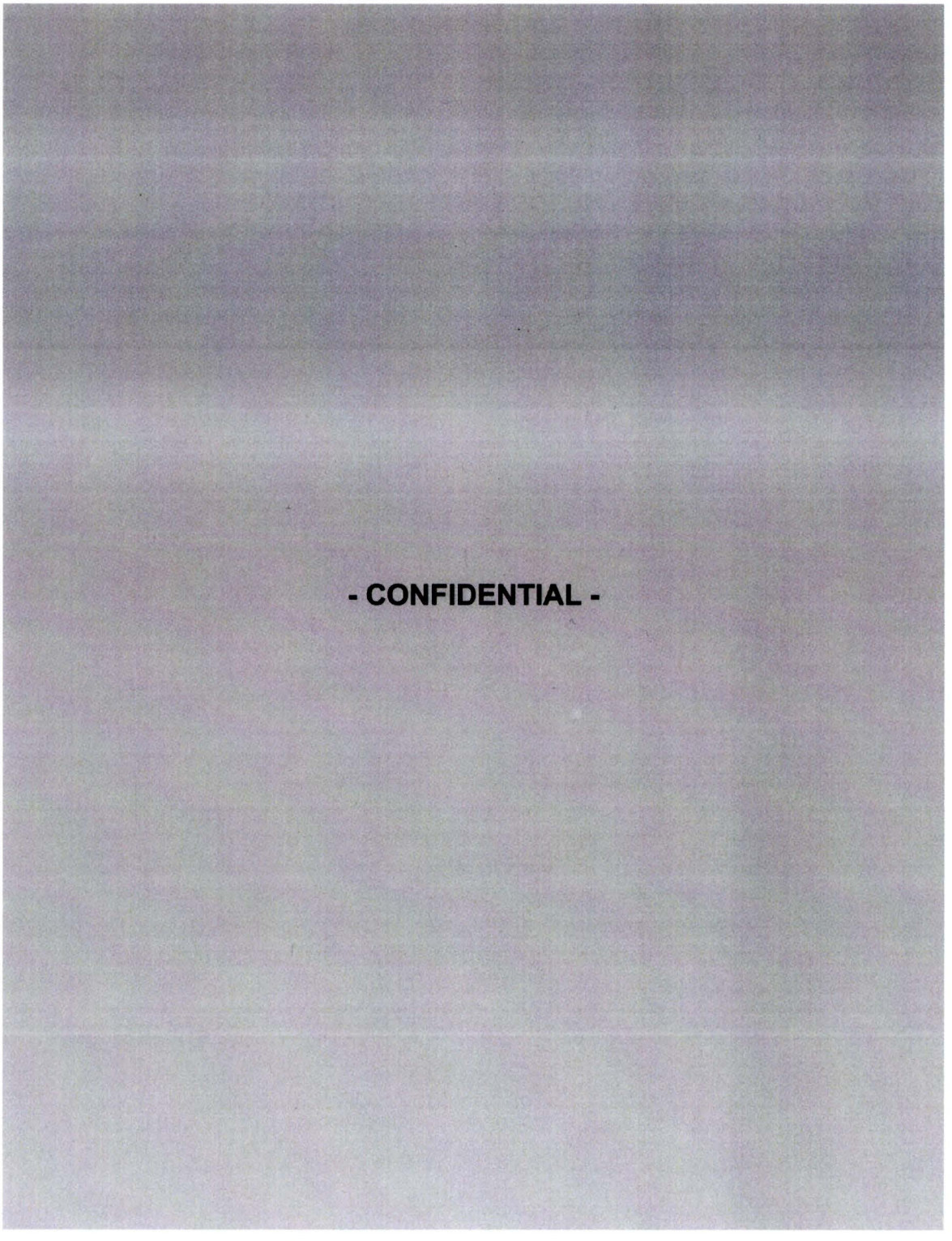


Table 6.2: SWOT analysis Siemens VDO

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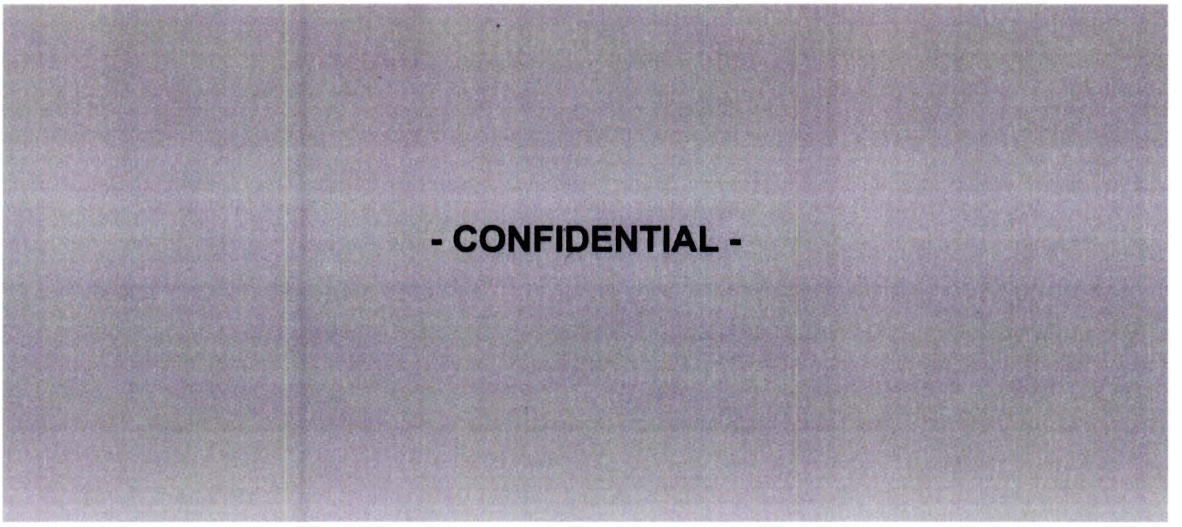
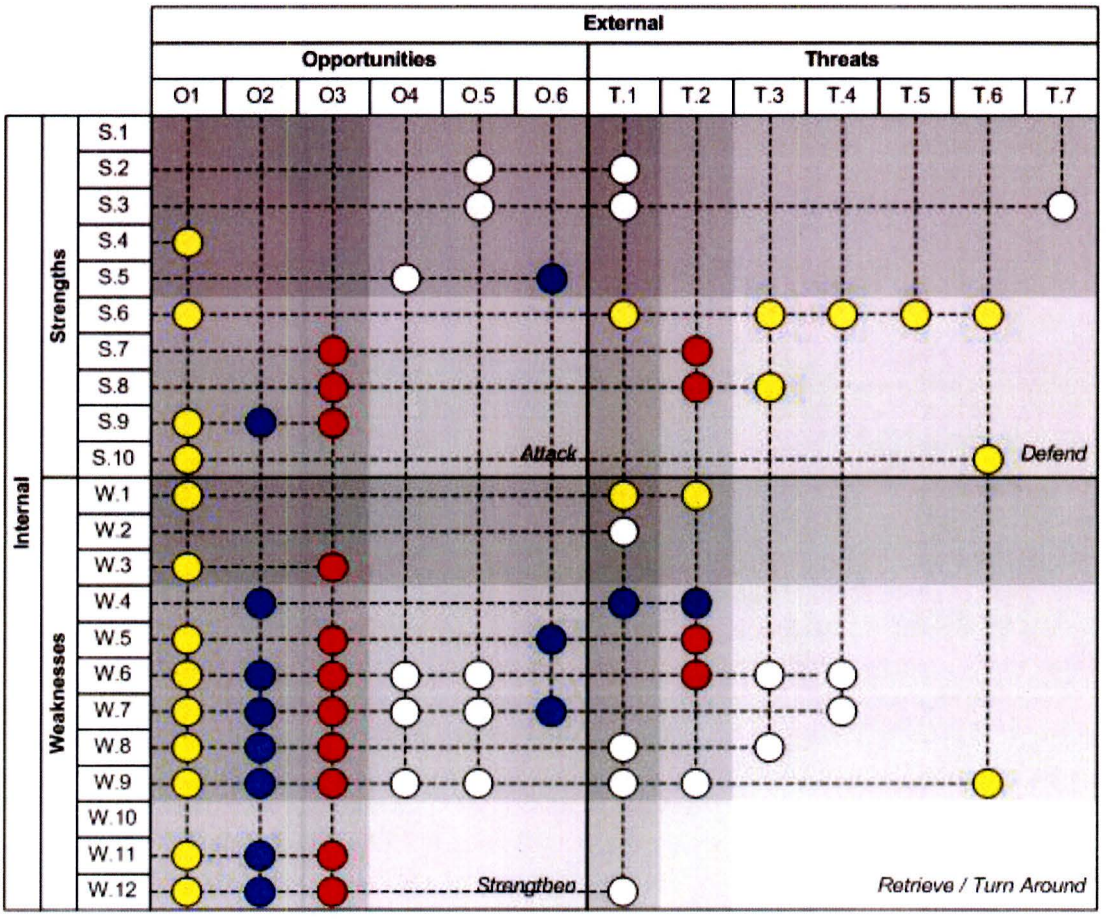




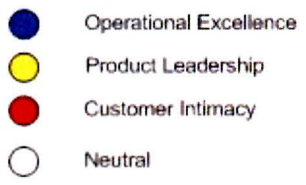
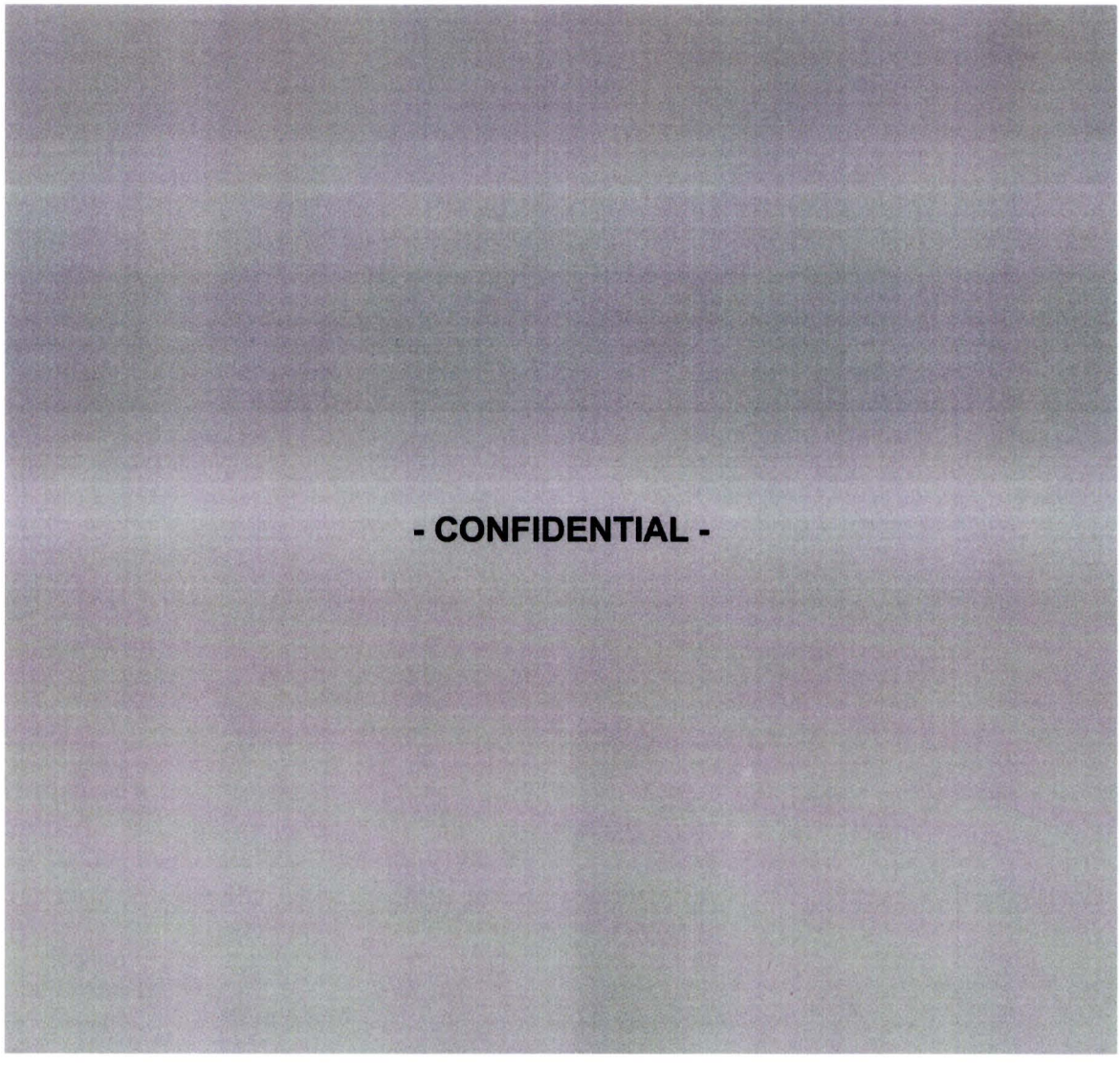


Figure 6.3: Confrontation matrix



6.4. Strategic implementation

The final element of strategic management is the strategic implementation. The goal of this assignment is to describe a NPD framework. Based on the strategic analysis and the strategic choice, all inputs are now available to describe the innovation pentathlon (introduced in Section 3.4) for the preferred scenario product leadership.

The strategic implementation of this scenario leads to the following implications:

1. *Resources* - The resources necessary for the scenario of product leadership are not available in the current organisation. No budget or personnel is made available for the development of new-to-the-world innovations. As stated earlier, budget becomes available after a customers' request, but not earlier. When following the scenario of product leadership, this is the most important insight that must change.
2. *Internal processes* - The current internal processes do not support product leadership. The strict functional separation only allows the organisation to work according to operational excellence. As argued in the previous chapter, for the development of performance or excitement features interaction between the teams and with the market or the customer is absolutely necessary.

The pentathlon for the product leadership scenario is described in Figure 6.4. The separate elements

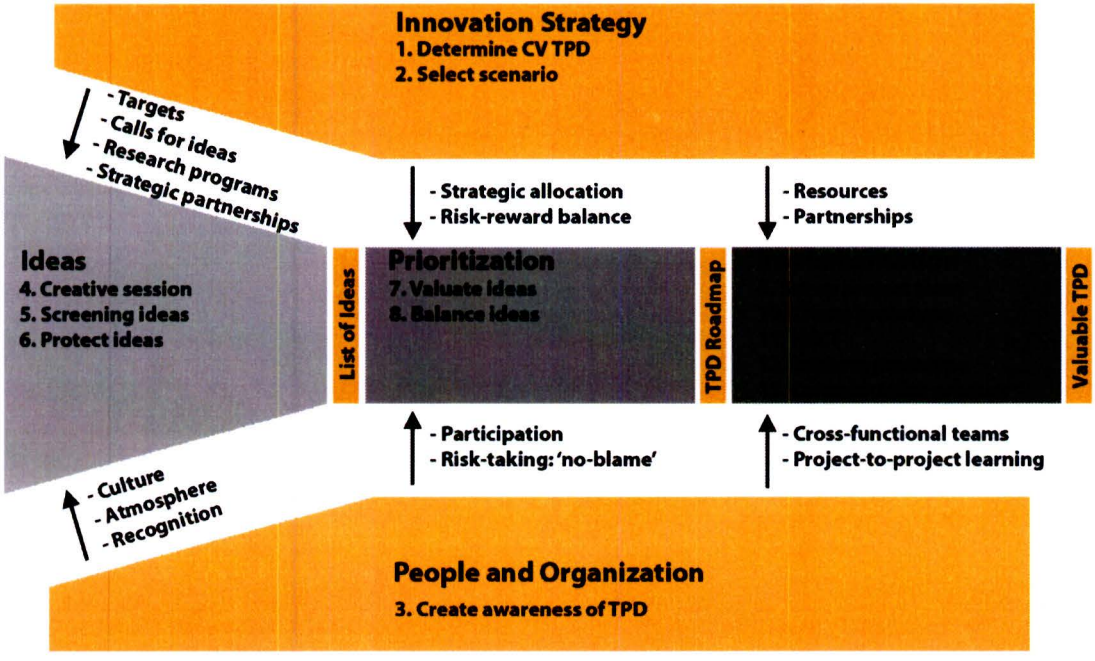


Figure 6.4: Innovation pentathlon for product leadership

and the sequential steps are described in more detail in the following sections. In Section 6.5 the necessary steps for adopting this change are discussed.

6.4.1. Innovation strategy

The scenario of product leadership requires a leading role for Siemens VDO on the market regarding new TPD functionalities. This indicates the development of excitement features.

- ***Step One**: Determine the Customer Value of the current TPD functionalities*

Siemens VDO must gain insight into the CV of their features. Which are basic features? Which are exciters? The selection of this scenario assumes that TPD has the intrinsic value of delivering excitement features to a navigational system. This assumption should be investigated further.

- ***Step Two**: Select a scenario*

The innovation strategy determines where and when innovation is required to meet the aims of the organisation. If the market research of Step One indicates that there is the possibility for TPD to develop excitement features, this research recommends this scenario for Siemens VDO.

The focus and the consequences of product leadership are already discussed earlier (Chapter 5 and Appendix P). The influences of this innovation strategy on the other elements of the pentathlon are indicated in Figure 6.4.

6.4.2. People and organisation

Without motivated, skilled employees and a suitable organisation with a creative atmosphere, companies will not be innovative. Finding effective ways to manage people, culture, teams and organisation is done on three levels (Goffin and Mitchell, 2005).

- ***Step Three**: Create awareness of TPD*

The role of TPD should be made clear in all layers of the organisation, as the innovation strategy reflects on this element regarding training, recruitment, and processes. People and organisation are relevant on different levels:

- Organisational level,
- Innovation project teams level,
- Employee level.

Organisational level
Product leadership requires creative and effective organisational structures, which increase the output of innovation. Both sides of the organisation required for TPD must be aware of the need for innovation. The organisational culture must therefore promote innovation. It is useful to cascade the top-level innovation down the organisation to each and every employee. High-level goals, like revenues for new products, can be linked to a project team's goals and in turn to the goals of each member of the team. In cascading goals it is important to check that the goals at each level are *specific*, *measurable*, *achievable*, *relevant* and *timed* (SMART) (Goffin and Mitchell, 2005).

Bratton and Gold (2003) define culture as 'the set of values, understandings and ways of thinking that is shared by the majority of members of a work organisation, and is taught to new employees as correct'. A simple and effective tool for assessment is the cultural web (Johnson and Scoles, 1999), identifying six partially overlapping aspects of culture (further illustrated in Appendix T). The cultural web for product leaders, including directions of change for Siemens VDO is also discussed in Appendix T.

Innovation project teams level
For the development of highly innovative TPD features, multi-functional development teams are required. Based on the team structures discussed in Section 3.10, the heavyweight project team can be regarded as the most suitable structure for the development, because interaction with the market is required.

Employee level
On the individual employee level, it is important to make clear what the responsibilities are of the project manager and the discipline manager. Furthermore, the individual engineers must be trained to work in multidisciplinary projects and with creativity techniques. The rewarding and recognition of innovation projects must be equal to that of the known projects.

6.4.3. Ideas
Product leaders have to develop many ideas since they aim to be the first in the market with a new functionality. As stated earlier, product leaders search for new functionalities before they have crossed 'the chasm'. The focus is on product innovation, as the CV for product leaders is highly influenced by the availability of innovative features.

- ***Step Four**: Have a creative session to generate ideas*
The first step in the idea phase is the generation of ideas. For a product leader, ideas can come from various internal and external sources; pure technology push innovations can be initiated everywhere. An innovative TPD feature requires both new software and new data, so both teams need to be involved in the idea generation phase in order to be able to deliver an optimal solution. The scope for idea generation needs to be kept wide:
- Technology push, from IIS or SSO. The idea can be based on the software or the data.
- Market research. Ideas can be based on hidden needs from customers. Therefore insight in the CV of current functionalities is essential.
- Benchmark. To be able to identify directions of change in the market and at competitors the output from the benchmark team, present at the DCE, should be used as input for this phase.

At the Siemens VDO Trading BV, a benchmark department is available which already compares the different systems available on the market. Nevertheless, the conclusions of this benchmark are not used at all to improve the current TPD functionalities, or to start the development of new features. At the DCE, no information about the customer is available at all. It is unknown who uses the TPD functionalities, when they are used, and why, not to mention the lack of insight into what determines the quality of the TPD products through the eye of the user. This indicates that the TPD teams have absolutely no insight into the CV of the TPD functionalities. Therefore, the results of the benchmark department as well as market information should be used as input for the idea generation phase.

In generating ideas, it is important to search in a structured way. A wide range of creativity methods are relevant to innovation techniques, e.g. brainstorming, left-right brain alternations, attribute association, five W's - one H technique. Choosing a technique to use depends on the type of creativity needed and the number of individuals involved (Goffin and Mitchell, 2005).

It is the task of the managers to organise creativity sessions on a regular basis, and to set targets for them. The targets result from the element 'organisation strategy'.

- ***Step Five**: Screening of the ideas*

This involves an extensive analysis of the 'knows' and 'unknowns' of the market, technologies, and competitors. The main goal is to position a competitive product in a profitable product-market combination. To be able to do this, an idea should always be considered in its wider environment, for instance an idea about showing POIs on a map requires a system that is able to show a map. If the idea can not be developed internally, strategic partners should be considered. For instance, when an innovative TPD feature requires new data not available at Siemens VDO yet, it should be considered where and how this data could be gathered.

The screening of the ideas can be done by utilising Risk Diagnosing Methodology (RDM) (Keizer et al., 2002) discussed in Appendix K. The generated ideas will be initially selected on feasibility, followed by an analysis of possible bottlenecks and problems. Once connected, the knowledge base assessment and the screening of ideas form the input for the next element of the pentathlon, prioritisation.

- ***Step Six**: Protection of the ideas*

Before continuing to the next element, the ideas need to be protected. In order to gain the maximum advantage from their innovations, companies need to protect and exploit their knowledge. The most obvious mechanism for protecting innovations are patents: a patent is a legal right granted to exclusive commercial use of an invention, normally for a limited period of time. There are many kinds of Intellectual Property Rights (IPR), among others: Copyright, design right, trademarks and patents. For an idea to be patentable: It must be novel; it must involve an inventive step; it must have a practical application; and it must not be in an excluded category (Goffin and Mitchell, 2005).

Patents have four main uses in a company:
- To enforce a monopoly,
- To license the patent to others in return for a fee, or royalties, or both,
- A bargaining counter in relations between companies,
- As objective proof of their technical depth in inventiveness so as to enhance their value on sale or flotation.

Key points for managers in the protection of the ideas are:
- Check carefully whether some product features are patentable,
- Check new product features to make sure they do not infringe on exisiting patents,

- Leave enough time to act on the results of these investigations before the product launch,
- Encourage staff to patent ideas which may be valuable.

6.4.4. Prioritisation

The prioritisation of the extensive list of ideas generated in the previous phase is based on two problems:

1. The valuation problem; deciding which projects are intrinsically worth doing themselves,
2. The balance problem; choosing a group or portfolio of ideas that best meets the overall needs of the organisation.

- ***Step Seven**: Valuate the ideas*

First, it should be investigated in what way an idea is worth developing and how it will generate a cash flow for Siemens VDO. Each individual project should represent good value to the organisation. To analyse this, the supply chain and the cash flows inside this chain regarding the idea should be involved. Which parties are necessary for the development of the ideas, e.g. how much has to be paid to receive the data and what will the software development cost? Who will pay for the development of new features; the OEM, the motorists, the data supplier? Based on the results of the previous phase, the Net Present Value (NPV) of a project can be calculated, and with a sensitivity analysis the payback time can be determined.

- ***Step Eight**: Balance the ideas (Roadmapping)*

The second key issue is that the projects must make efficient use of the resources available. Where projects compete for scarce resources, it must be clear how the resources will be allocated between them. The portfolio of ideas to be developed should be based on the overall needs of the organisation. A product leader wants to be the first in the market with innovative features; therefore the focus should be on valuable ideas for Siemens VDO that create CV to the user. Roadmaps enable the necessary timing of innovation. A roadmap is a graphical representation of strategy that aims to lay out the key aims of the organisation, the means it will use to deliver them, and the new resources needed to make it all possible, in a single document (Goffin and Mitchell, 2005).

One roadmap must be developed for TPD. This should represent the required development at SSO and IIS. In this portfolio management, a balance has to be found between the development of excitement, performance and basic features. It must be considered whether the portfolio represents a good balance of activities in strategic alignment, time and resources, and the risk/ reward profile.

For this balance problem, three situations need to be considered, as stated in Table 6.3. For each idea generated, the situation it deals with must be determined. Based on this classification, adjustments can be made for the development of the idea and the allocation of resources. In situations 1 and 2, the role and responsibilities are clear since development from only one part is required. Situation 3, which will be common in the scenario of product leadership, requires adjustment between the software and data in the development of the new functionality.
An important step in the prioritisation is to investigate the dependence of an idea on other elements of the environment. When a feature requires adjustment with other (internal or external) parties, the timing of the innovation becomes more important.

	Software (IIS)	**Data (SSO)**
Situation 1	New software	Old data
Situation 2	Old software	New data
Situation 3	New software	New data

Table 6.3: Different situations in the development of new TPD functionalities at Siemens VDO

6.4.5. Implementation
The last step is to convert the idea from an innovation to reality. The element 'implementation' focuses on quickly and efficiently developing new products, services or processes.

- ***Step Nine**: Set up project team*
As stated earlier, for the development of highly innovative TPD features, multi-functional development teams are required. The current functional structure does not allow an adjustment between the two departments on a working level, so development should therefore be done in a project team. Choosing between the three types of development teams, the heavyweight project team is preferred. In a lightweight project team, the team is not regarded equal to other development projects and it lacks the contact with the market which is required in pure technology push. The TPD teams are not large enough to create an autonomous team; moreover adjustment with other Siemens VDO development teams needs to be considered. The heavyweight project team combines the best of two worlds, and is therefore the preferred organisation for Siemens VDO.

This indicates a change in resource management at Siemens VDO. Currently, resources are made available upon customer demand. However, with technology push there is no customer demand so the organisation itself must be willing to invest in the development of new, innovative features. For each idea on the roadmap, a project team should be formed. Resources must be assigned to this team.

- ***Step Ten**: Create prototype*
The project team must create a prototype of the product. Regarding the development of highly innovative features this must be done fully on the ideas of the engineers, since the feature and its exact functions are unknown at this stage of the development.

- ***Step Eleven**: Test prototype using HCCT*
As stated in Chapters 3 and 4, for pure technology push it is unknown what the CV of a new feature is. In other words, engineers can not predict the use of this feature. Therefore the tool of HCCT (Appendix M) must be used after a prototype has been developed. This gives more insight into the real usage of the innovation. The design should be optimised based on this insight. It is possible to establish partnerships to develop new TPD features, e.g. for the development of truck functionalities a partnership with DAF could be valuable.

- ***Step Twelve**: Improve prototype*
Based on the outcomes of the previous step, the prototype can be improved. At this stage, more is known about the usage of the feature and this should form the input for the improvement of the prototype.

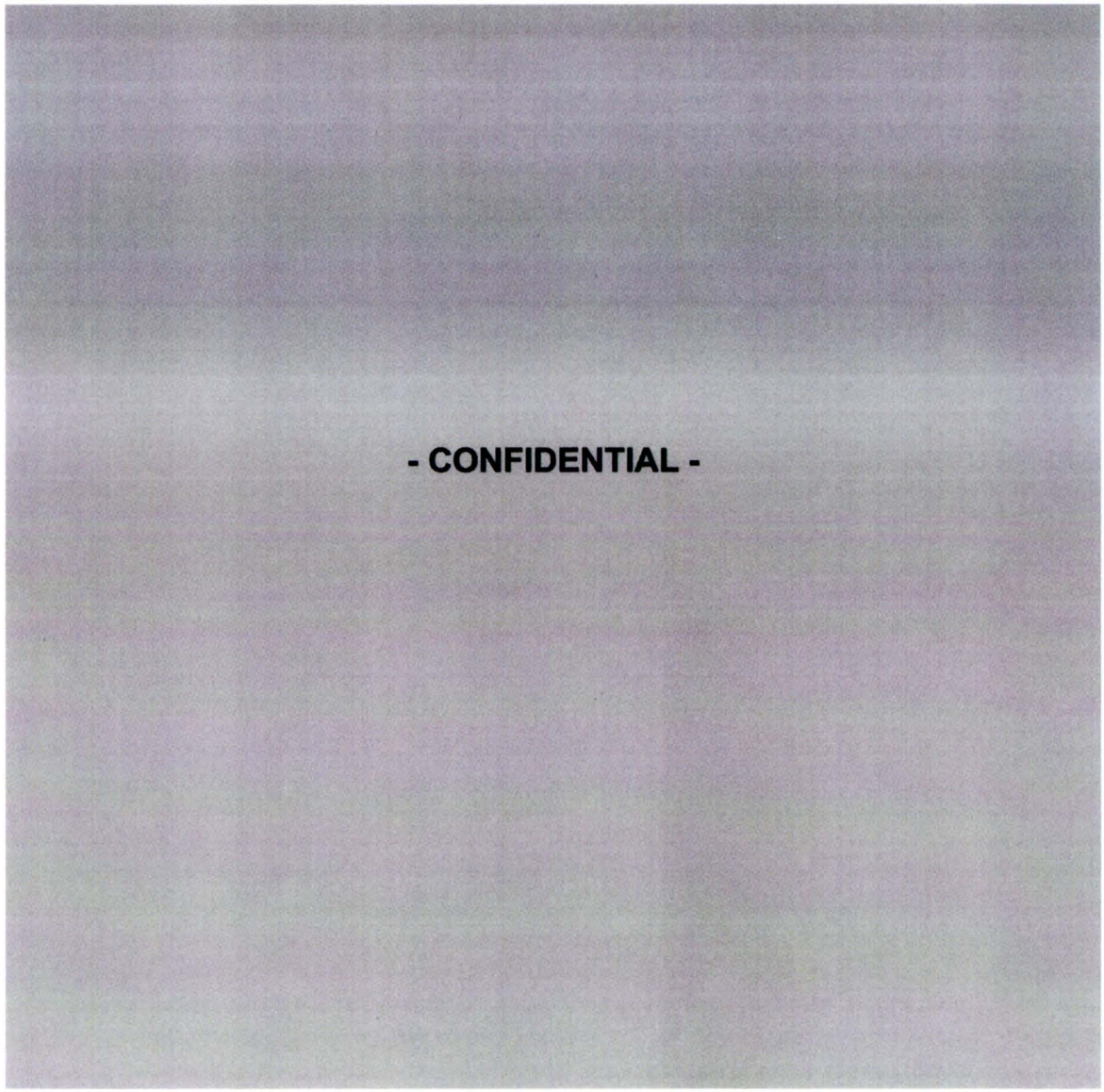
- ***Step Thirteen**: Commercialisation*
The final step is the commercialisation of the innovation. Early innovators or adopters need to be found who want to adopt the technology innovation. When a partnership is established in the development, this step will be easier since a buyer has already been identified at an earlier stage.

As can be seen in Figure 6.4, this innovation pentathlon leads to valuable TPD features which could distinguish the Siemens VDO navigation systems from the competition based on the scenario of product leadership.

6.5. Adopting the change
This section forms a guide to accomplishing the required change. It describes the intentional path along which the change can be achieved. Several steps need to be taken in order to adopt the

change:

Step I: Necessity for change



Step II: Capacity to change

After a scenario is selected, the whole Siemens VDO organisation must be made aware of the knowledge of TPD, and the functionalities that can be developed. Management and engineers must be aware of the change in order to enable a successful adoption of the process of change.

The first step is to create awareness within the TPD teams. It must be made clear what TPD is, what the TPD functionalities are, and what the value proposition is.

The second step is to create awareness among all of the parties involved in the development of TPD, e.g. product managers and project leaders. By bringing a clear, common view of TPD and its possibilities to their attention, the role of TPD in the development of navigational systems will become more important.

The third and final step is to extend this awareness into the rest of the organisation. This can be done by giving presentations or distributing folders, through several layers of the organisation. This will increase the consciousness of Siemens VDO regarding TPD.

Step III: Approach to change
The selection for a scenario must be made by the management involved with TPD. The lead in the process of change will also be in the hands of the management. In this situation, a directive approach is preferred. The change must be controlled from the top-down.

For a strategic change it is hard to formulate clear, measurable targets. The preferred scenario must lead Siemens VDO to being the market leader for TPD on the navigational market. Nevertheless, it is important to set targets. TPD managers could, for example, set a deadline on the development of a single roadmap for TPD, or on the number of innovative projects that are initiated. It is important that these targets are communicated to the TPD workforce.

Step IV: Direction of change
In this fourth step, the approach to change is translated into tasks and roles or responsibilities. It is important to indicate who is in charge and responsible for each step in the process. Table 6.4 provides this information.

As can be concluded from Table 6.4, the centre of gravity regarding the responsibility of the change lies with the TPD managers. This does not mean it has to cost them much time. When a scenario is selected, it is more a change in setting priorities between projects. The scenario and the roadmap are tools to help the responsible managers in doing this. Only the last element of implementation and steps 10 to 12 affect the daily routine of the team members. The other elements are necessary to deliver input and to create the right environment for the development of the features, and can therefore be seen as a management responsibility.

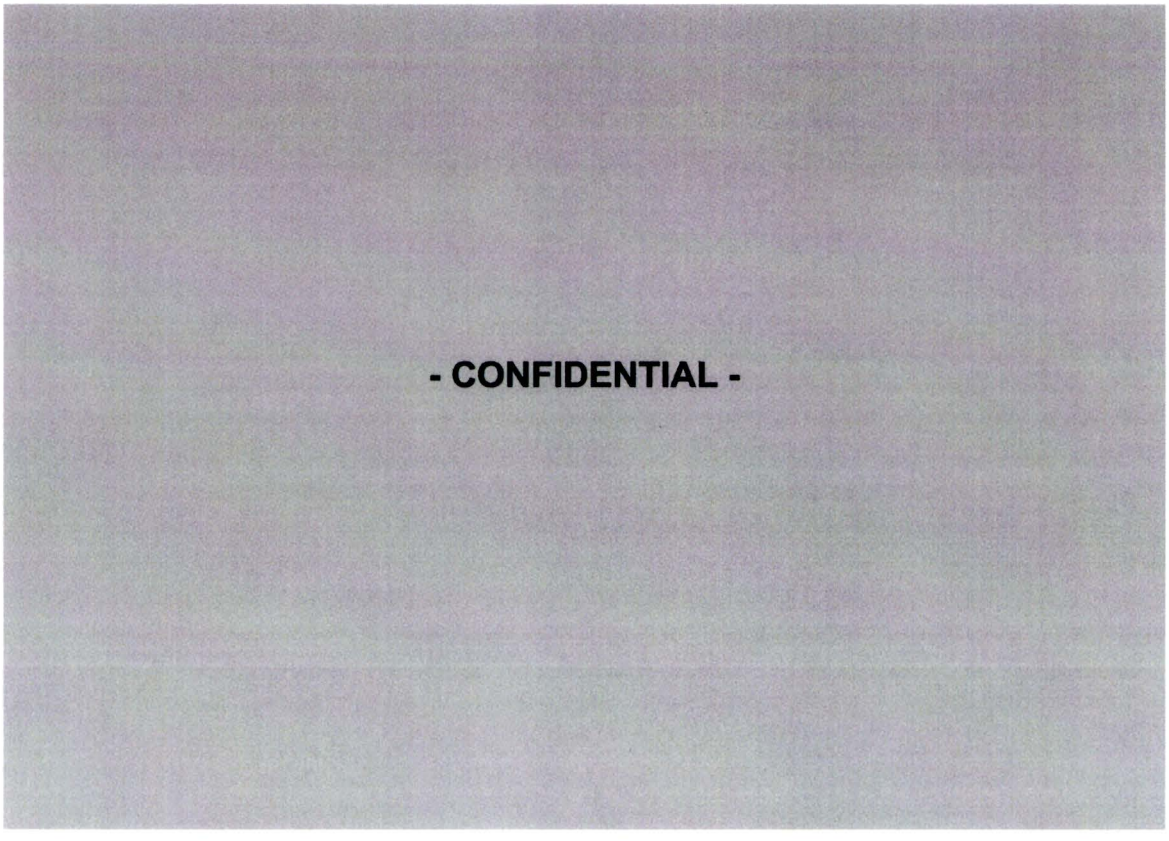
Step	Task	Role
1. Determine CV TPD	Getting insight in the CV and the Kano classification of the TPD features	Marketing
2. Select scenario	Make the scenario selection	(TPD) managers
3. Create awareness of TPD	Promote TPD and its features trough the Siemens VDO organisation	TPD managers
4. Creative session with both TPD teams	Creating a list of innovative TPD features	TPD team
5. Screening the ideas	Evaluating the ideas	TPD managers
6. Protecting ideas	Check for possible patents	TPD managers
7. Valuating the ideas	Analysing future cash flows per idea	TPD managers
8. Balancing the ideas	Creating one roadmap for TPD	TPD managers
9. Setting up development teams	Creating a multi-disciplinary, heavy weight project team	TPD managers
10. Create prototype	Developing a working model of the innovation	TPD team
11. Test prototype	Conduct a HCCT	TPD team
12. Improve prototype	Adjust the prototype based on the results of the HCCT	TPD team
13. Commercialisation	Putting the new TPD feature on the market	TPD managers, Project managers, Product managers

Table 6.4: Roles and responsibilities

Step V: Guarantee for change
For the change to become a long term improvement, it is important to guarantee a lasting effect in the organisation. The internal processes must be in line with the selected scenario. For product leadership it is important that advanced development is rewarded at least as equally as the normal projects. Therefore, it is important that the project leader of a technology innovation project is a heavy weight manager. Furthermore, it is important that in the evaluation of the performance of individual workers, the innovative projects are weighted at least equally to the other projects.

It is also important that individual workers are trained as on a regular basis the idea generating phase is repeated and they must be familiar with creativity sessions. They must also be made aware of the consequences of working in multi-disciplinary groups. The most important change for the individual workers is the introduction of the HCCT. The input for development is different to what they are used to. They must be made familiar with this tool, and how to translate the test results into improvement characteristics.

6.6. The process of change



This chapter provided answers to the deliverables two, five and six. The next chapter summarises the conclusions and recommendations based on the contents of this chapter, also indicated in Figure 6.5.

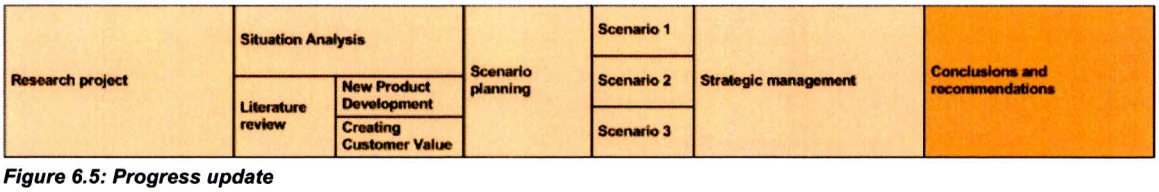


Figure 6.5: Progress update

Chapter 7. Conclusions and recommendations

This chapter completes the report. In Section 7.1, it is evaluated whether or not the deliverables are actually delivered and if the goal set in Chapter 1 is reached. Section 7.2 provides the limitations of the performed research and Section 7.3 gives recommendations based on these findings.

7.1. Evaluation deliverables

This section evaluates the deliverables formulated in Chapter 1.

Insight and better understanding of the concept of Customer Value

This report clarifies the concept of CV, and how it can be created. The use of the scenarios and the connection to the identified value criteria makes it clear that CV is a highly individual concept. This makes it important for a company to act consistently according to a specific scenario in creating value for its target customer. Furthermore, an important insight is that offered features can be classified according to Kano's feature analysis to give the development team more insight in the features requested by its target customer. A company should be aware of the classification of the features it offers, and how they match with the preferred scenario of the company. It can be concluded that this deliverable is fulfilled.

Insight into the Customer Value of the TPD products

One of the most important conclusions of this research is that there is a lack of common understanding of what the TPD products and their value propositions are. This is particularly between the two TPD departments of IIS and SSO, where there is no clear view of what exactly the TPD-teams add to the Siemens VDO navigation systems. As a result, an unambiguous answer to the question 'What are the TPD products?' is difficult to provide as this is not clear within the Siemens VDO organisation. Moreover, it is unclear what the role and responsibility of both teams in the development of (new) TPD products is. In consultation with both TPD teams this report (Appendix U) provides an overview of the current functionalities TPD can offer. In the scope of this project the establishment of a single view of TPD was attempted, but the lack of cooperation inhibited this initiative.

The concept of creating CV is not present in the current organisation. As stated in Chapter 4, it is always the customer who determines what creates value. In contrast to this, it can be concluded that it is impossible for pure technology push innovations to determine what the CV of new features is since these features are unknown to the customer and respond to unknown or hidden needs. Furthermore it can be concluded that Siemens VDO has no insight into the CV of its TPD features. The concept of CV is not integrated in its current NPD approach.

This report makes a start to creating awareness of what TPD is, but this partly depends on the selected scenario. Therefore, this report has not been able to provide insight into the CV of the TPD products. However, the report does establish the importance of the concept of CV and investigates the fact that there is no common view of TPD and the role of TPD in the Siemens VDO navigation system. It can be concluded that this deliverable is fulfilled.

Insight and better understanding in the concept of New Product Development

The concept of NPD has been clarified throughout this report by the pentathlon framework. This framework describes five connected elements, and provides an environment for the development of new products. It is made clear that the focus in the pentathlon differs for each scenario: Different strategies require different process inputs and outputs. It is therefore vital that every organisation determines what their strategy is (i.e. which scenario they are aiming at) in order to set up a suitable NPD approach. It can be concluded that this deliverable is fulfilled.

Insight into the cash flows in the supply chain
The role of Siemens VDO in the supply chain differs from customer to customer and from project to project. In some projects they are first tier, in others second tier. TPD can be both a customer and a supplier for the several parties in the supply chain. This has its consequences for the role and responsibilities of Siemens VDO in the supply chain. Therefore in the Siemens VDO case it is not a matter of *the* supply chain as there are several possible chains, including several internal and external parties. As a consequence there are several cash flows, also both internal and external.

TPD is always a component of the complete navigation system. In the scope of this research, TPD is regarded as a possible key selling point for the Siemens VDO systems, depending on the selected scenario. TPD can be used to sell more navigation systems, which should justify the development costs of the functionalities. It can be concluded that this deliverable is not fulfilled.

An appropriate New Product Development approach based on the Customer Value of the TPD products and services
Currently, there are two individual roadmaps for TPD, neglecting the CV of TPD. Both TPD teams have their own view of the future and which features are to be developed. The shortcomings of this situation were identified as the main problems in Chapter 1 and the design parameters in Chapter 2. This can be improved by selecting a scenario which would guide the development of new TPD functionalities and enable both teams to create a common roadmap, as discussed in Chapter 6. It can be concluded that this deliverable is fulfilled.

Implementation plan for the New Product Development approach
Section 6.5 describes several steps to implementing the developed NPD approach. The main roadblocks for the implementation are that the organisation is unable to make the scenario selection and that the two departments are unable to set common priorities for the development of a single roadmap. It can be concluded that this deliverable is fulfilled.

Table 7.1 gives a summary of the deliverables.

The main goal of the assignment was to gain insight into the Customer Value of the TPD products and the way New Service Development is and could be done, and to enable the organisation to offer the market maximum Customer Value regarding TPD products, so that satisfactory revenues are generated for Siemens VDO. Based on this, it can be concluded that this goal is reached.

7.2. Limitations of the research

The most prominent limitation of the research is that it does not make use of any market information. Although it would have led to important insights of the CV of the TPD features, it fell beyond the scope of this project to conduct market research. Now all the conclusions are based primarily upon

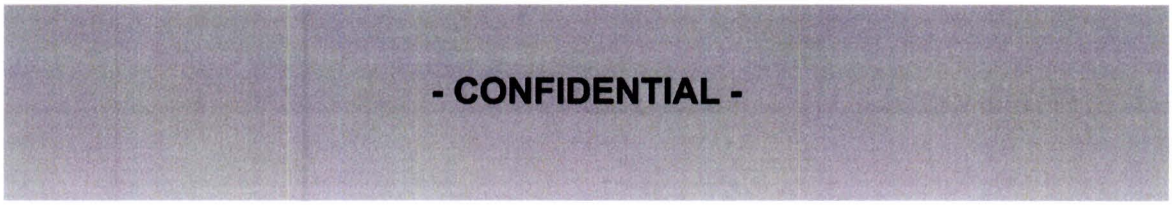
Deliverable	Fulfilled?
1. Insight and better understanding of the concept of Customer Value	✓
2. Insight into the Customer Value of the TPD products	✓
3. Insight and better understanding in the concept of New Product Development	✓
4. Insight into the cash flows in the supply chain	✗
5. An appropriate New Product Development approach based on the Customer Value of the TPD products and services	✓
6. Implementation plan for the New Product Development approach	✓

Table 7.1: Overview deliverables

insights from an engineering point of view, and as stated in Chapter 4, engineers are weak predictors of CV. Regardless of this limitation, it can be stated that a scenario selection is absolutely necessary for Siemens VDO TPD. The outcomes of market research would only deliver input to the selection process for a suitable scenario for TPD.

The preferred scenario is selected based on two hypotheses which should be tested in further research:

***Hypothesis 1**: TPD is able to offer a wide range of excitement features.*



***Hypothesis 2**: The organisation is willing to position TPD as a diversifier.*
This assignment was performed at the DCE. This site in Eindhoven is responsible for the development of the TPD features. The entrepreneurial attitude of the TPD team formed the main reason for this assignment, but it was never investigated whether or not the rest of the Siemens VDO organisation is willing to position TPD as a diversifier for its navigational systems.

Assignments have been formulated for testing these hypotheses in further research.

7.3. Recommendations

Based on the conclusions and limitation the following recommendations are made:

1. Make a scenario selection
The main point this report produces is that it is essential for Siemens VDO to make a strategic decision for TPD. The corporate strategy does not match with the current organisation. Continuing with the current processes will not lead to the future Siemens VDO wants or expects. This analysis enforces that making a scenario selection, regardless of the outcome, will solve the problems the current organisation is experiencing.
Based on the SWOT-analysis and the resulting confrontation matrix, this research recommends the scenario of product leadership for TPD.

2. Conduct market research to obtain insight into the Customer Value of TPD
The second recommendation is that it is highly important to get insight into the CV of the TPD products. This will enable the organisation to develop valuable functionalities that create Customer Value matching with the selected scenario. This could be the subject of further research.

3. Develop a single roadmap for TPD
An important finding from the plan of change is that creating a common roadmap for TPD is essential. For features to be developed, the requirements of both TPD teams must be analysed. As stated in Chapter 6, new features can require new software, new data, or both. This must be taken into account when developing a single TPD roadmap so as to allow for adjustment between the two departments.

4. Create awareness of TPD in the Siemens VDO organisation
It is important that both teams have the same view of what TPD is. Common understanding and direction are essential in solving the problems of the current organisation. A next step is to make the rest of the organisation aware of TPD. The knowledge of TPD and its functionalities are relatively

unknown in the organisation: TPD must create awareness and propagate their presence. This could be a subject for further research.

With the conclusions and recommendations the report is brought to a close, as can be seen in Figure 7.1.

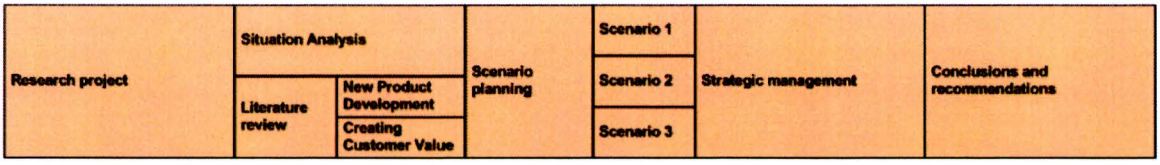


Figure 7.1: Progress update

Discussion

This discussion contains the afterthoughts on the assignment that was performed over the past nine months at Siemens VDO Trading B.V. Firstly the assignment and the feasibility of the conclusions and recommendations are discussed, followed by the impact of this research on scientific literature. The discussion is concluded with process and personal reflections.

Reflection of the assignment

Creating Customer Value must be the cornerstone of conducting business for every organisation. One of the most important reasons for creating Customer Value is that the whole organisation is aware of it. The assignment started with a very broad scope of 'how to make money in TPD?'. During the first phases of the assignment, it became clear that TPD is a part of the total navigation system and that it can therefore be used as a unique selling point of the Siemens VDO systems. Prior to this, a strategic choice for TPD must be made, reflected by the three scenarios. It can be concluded that a common choice for both TPD teams is necessary in order for successful development of a New Product Development approach according to the preferred scenario. In my opinion, the scenario-based exploration of the options to create Customer Value forms the main strength of this assignment. It clearly indicates the options and consequences for the development of new products.

Feasibility

The feasibility of the conclusions and recommendations depends heavily on the willingness of the organisation to change. It is not enough when a majority supports the ideas; all involved managers must support the required strategic choice before effect will take place. At the moment of writing, the organisation is not ready for implementation of the recommended strategic change due to resistance in the decision making unit. The report provides an extensive analysis of the current situation, and offers three scenarios for the future. It highlights why the strategic choice is necessary, and what the different options are. The feasibility depends on the willingness of the managers who do see the need to change to further diffuse the ideas developed in this report.

The main limitation of the conclusion is that no market figures were used to support the conclusions. It is unknown if the customers are willing to buy a navigation system that distinguishes itself from the competition, based on TPD. Gaining market insight must therefore be the main focus for TPD in the future, particularly about what users' value in TPD.

Based on the analysis performed, an implementation plan is written in Chapter 6 for my personal preferred scenario; product leadership. As a scenario has yet to be selected by Siemens VDO, it is unknown if this will be the scenario for TPD. Since the described pentathlon is only useful for the specific scenario of product leadership, a different pentathlon is required if preference is given to another scenario. This will also influence the steps for adopting the change.

Scientific contribution

In this research, I tried to combine several fields of research (e.g. marketing, behavioural science, organisational development, innovation management) into a scenario based exploration for creating Customer Value in the development of new products and services. I think I succeeded in this intention and that this final report gives a good understanding of the relations between these fields. The success of my research lies in the translation of the adoption of technology innovation and Customer Value into the scenarios, which clearly points out the problems, the need to change, and the options for the future.

One of the questions posed by Siemens VDO in the orientation phase was that they wanted to know

how the current problems they face can be explained with recent literature. In my opinion this report answers this.

Process reflection

The first phases of the process were necessary for setting the right focus for the assignment. After the identification of the need for a clear TPD, a clear focus for the process was established, which provided me with a clear structure for the further implementation.

In this process, I had the opportunity to make use of four interested and involved tutors, from university and Siemens VDO, all with individual backgrounds and knowledge. This diverse knowledge proved to be a motivational mix for this assignment; experts from the field of Innovation Management and Technology Adoption in combination with enthusiastic tutors from both sides of the TPD organisation. Although this was an autonomous and individual assignment, they always provided me with advice or guidance when necessary. I can therefore state that the composition of the team of tutors made an important contribution to the result of this assignment.

Personal reflection

The last months have been an excellent acquaintance with the real business world: It gave me the opportunity to bring the studied theory into practice in a highly dynamic environment. From the outset, the assignment had a broad scope which made the focusing an intensive period of the project.

Personally, I think that I managed to control the process well. The phases identified in the beginning and the accompanying milestones formed the basics of my planning, and I managed to perform in accordance with this planning.

The main learning point for me is that in the development of ideas it is important to work together with the decision makers for these ideas. This will slow down the design process, but it will hasten the decision making as support has already been created during the design phases. Support is essential for successful implementation.

I consider this report as gratifying closure to my study of Industrial Engineering and Management Science at the Eindhoven University of Technology. For me, it has been a period which gave me the opportunity to develop myself on both professional and personal levels, and which I will look back on proudly in the future.

References

Abernathy, W.J., Utterback, J.M., (1978) *Patterns of Industrial Innovation*. Technology Review, Cambridge, June/July 1978, Vol. 80, Iss. 7, pg 40, 8 pgs.

Akao, Y., Mazur, G.H., (2003) *The leading edge in QFD: Past, present and future.* The International Journal of Quality & Reliability Management, Bradford: 2003. Vol. 20, Iss. 1, pg. 20, 16 pgs.

Albrecht, K., (1994) *Customer Value*. Executive Excellence Provo, Vol. 11, Iss. 9, pg. 14, 2 pgs.

Boersma, J. Loke, G., Loh, H.T., Lu, Y., Brombacher, A.C., (2003) *Reducing product rejection via a High Contrast Consumer Test.* In T. Bedford, P.H.A.J.M. van Gelder, Proceeding of ESREL 2003, European safety and reliability conference 2003, 15-18 June 2003, Maastricht, The Netherlands, Lisse: Swets & Zeitlinger, pg. 191, 4 pgs.

Bratton, J.A., Gold, J., (2003) *Human Resource Management: Theory and Practice*, Basingstoke Palgrave, 3rd edition.

Burgelman, R.A., Christensen, C.M., Wheelwright, S.C., (2004) *Strategic management of technology and innovation.* New York: McGraw-Hill, 4th ed (1st ed 1988), ISBN 007-123230-3.

Courtney, H., (2003) *Decision-driven scenarios for assessing four levels of uncertainty*. Strategy & Leadership, Chicago, 2003, Vol. 31, Iss. 1, pg 14, 9 pgs.

Davis, F.D., (1986) *A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results.* Doctoral dissertation, Sloan School of Management, Massachusetts Institute of Technology.

Davis, F.D., Bagozzi, R.P. Warshaw, P.R., (1989) *User Acceptance of Computer Technology: A Comparison of two theoretical models*. Management Science, Aug 1989, 35, 8, pg. 982, 22 pgs.

Dodgson, M., Gann, D., Salter, A.J., (2005) *Think, Play, Do: technology, innovation, and organization*, Oxford University Press, ISBN 0-19-926809-6.

Foster, R.N., (1986) *Innovation: the attackers' advantage*. London, Pan, 1986, 316 pgs, ISBN 0-330-29925-5.

Goffin, K., Mitchell, R., (2005) *Innovation management: strategy and implementation using the pentathlon framework*, Basingstroke: Palgrave Macmillan, ISBN 1-4039-1260-2.

Heene, A., (2001) *Praktijkboek strategie, bruggen bouwen naar de toekomst.* Scriptum, 2001, ISBN 9020944177, 332 pgs

Johnson, G., Scoles, K., (1999) *Exploring Corporate Strategy*, Pearson Education Limited, 5th edition, ISBN 0-13-263856-8.

Johnson, W.C., Weinstein, A., (2004) *Superior customer value in the new economy: concepts and cases*. Boca Raton, CRC Press, 2nd edition, ISBN 1-57333-356-9.

Keizer, J.A., Halman, J.I.M. and Song, M., (2002) *From experience: applying the risk diagnosing methodology*, Journal of Product Innovation Management, vol. 19, pp. 213-32.

Kempen P.M., Keizer J.A, (2000) *Advieskunde voor praktijkstages: organisatieverandering als leerproces*, Wolters-Noordhoff (Groningen, The Netherlands), 2nd edition, ISBN 90-01-46822-5.

Kerssens-van Drongelen I., Pearson, A.,Nixon, B.,(2003) *Organisation and management of research and development facilities - From cost to profit focus*. International Journal of Technology Management, Geneva, 2003. Vol. 25, Iss. 8, pg. 746, 20 pgs.

Kotler, P., Keller, K.L., (2006) *Marketing management*. Upper Saddle River, Prentice Hall 2006, 12th ed. (1st ed 1967), ISBN 0-13-145757-8

Kuylman, S., (2005) *New service development in order to increase customer loyalty and to differentiate from competitors: combining platform-based development with sequential new service development models*. Eindhoven University of Technology, Master thesis.

Lomme, T., (2005) *Measuring perceived product quality in Siemens VDO car navigation systems: user survey for route quality*, Eindhoven University of Technology, Master Thesis.

Meyer, M.H., DeTore, A., (1999) *Product Development for services*. The Academy of Management Executive, Aug 1999, Vol. 13, Iss. 3, pg. 64, 13 pgs.

Mom, G.P.A., (2006) *Diffusion and technological change, Culture, technology and the emergence of a "European car"*. Eindhoven University of Technology, internal report.

Mom, G.P.A. (2006) *Function and Experience: Technology, User Culture and the Emergence of the Family Car for Long-Range Tourism in the United States, 1917-1940*. Eindhoven University of Technology, internal report.

Moore, G.A., (2002) *Crossing the Chasm: marketing and selling high-tech products to mainstream customers*. New York, Harper Collins Publishers, 2002, ISBN 0060517123.

Nijssen, E.J., Ligthart, P.E.M. (1999) *SWOT-analyse: vloek of zegen?* Bedrijfskunde, 71, nr 1, pg15, 5pgs.

Orndoff, K., (2002) *Strategic Tools for RIM professionals*. Information Management Journal, Nov/Dec 2002, Vol. 36, Iss. 6, pg 65, 6 pgs.

Porter, M. E., (1980) *Competitive strategy: Techniques for analyzing industries and competitors*. New York, Free Press, 1980, 396 p, ISBN 0-01-925360-8.

Prajogo, D.I., Sohal, A.S., (2006) *The relationship between organization strategy, total quality management (TQM), and organization performance - the mediating role of TQM*. European Journal of Operational Research, Amsterdam, Jan 1, 2006, Vol. 168, Iss. 1, pg. 35.

Robertson, S., Robertson, J., (1999) *Mastering the requirements process*, Addison-Wesley ACM Press (Amsterdam, the Netherlands), ISBN 0-201-36046-2.

Rogers, E.M., (2003) *Diffusion of innovations*. London Free Press, 5th ed. (1st ed 1962), ISBN 0-7432-2209-1.

Ruiter, C.E. de, (2005) *Quantification study into analyzing HCCT survey data : 'analyzing high contrast consumer test survey data; finding associations between people characteristics and questionnaire responses': high contrast consumer test in LCD television sets*. Eindhoven University of Technology, Master Thesis.

Schiffer, M.B., (2005) *The Electric Lighthouse in the Nineteenth Century: Aid to Navigation and Political Technology.* The Johns Hopkins University Press, Technology and Culture, Volume 46, Number 2, April 2005, pg. 275, 31 pgs.

Schilling, M.A., Hill, C.W.L., (1998). *Managing the new product development process: Strategic imperatives.* The Academy of Management Executive, Vol 12, Iss 3, pg. 67.

Schoemaker, P.J.H., (1995) *Scenario Planning: A Tool for Strategic Thinking*. Sloan Management Review, Winter 1995, Vol. 36, Iss. 2, pg 25, 16 pgs.

Seligman, L., (2006) *Sensemaking throughout adoption and the innovation-decision process.* European Journal of Innovation Management, Bradford 2006, Vol. 9, Iss. 1, pg. 108, 13 pgs.

Squire, B., Readman, J., Brown, S., Bessant, J., (2004) *Mass Customization: The Key To Customer Value?* Production Planning & Control. London: Jun 2004. Vol. 15, Iss. 4; pg 459.

Storey, C., Easingwood, C.J., (1999) *Types of new product performance: Evidence from the consumer financial services sector.* Journal of Business Research, New York, Oct 1999, Vol. 46, Iss. 2, pg. 193, 11 pgs.

Tatikonda, M.V., Montoya-Weiss, M.M., (2001) *Integrating operations and marketing perspectives of product innovation: The influence of organizational process factors and capabilities on development performance.* Management Science, Linthicum, Jan 2001, Vol. 47, Iss. 1, pg. 151.

Treacy, M., Wiersema, F., (1993) *Customer Intimacy and Other Value Disciplines, three paths to market leadership*. Harvard Business Review, Boston: Jan/Feb 1993. Vol. 71, Iss. 1, pg. 84, 10 pgs.

Treacy, M., Wiersema, F., (1995) *The discipline of market leaders: choose your customers, narrow your focus, dominate your market*. Addison-Wesley Publishing Company (Amsterdam, The Netherlands), ISBN 0-201-40648-9.

Venkatesh, V.,Morris, M.G., Davis, G.B., Davis, F.D., (2003) *User Acceptance of Information Technology: Toward a unified view*. MIS Quarterly, Sep 2003, Vol. 27, Iss. 3, pg. 425.

Verschuren P.J.M., Doorewaard H., (2000) *Het ontwerpen van een onderzoek*, Lemma (Utrecht, The Netherlands), 3th edition, ISBN 90-5189-886-X.

Walters, D., Lancaster, G., (1999) *Value-based marketing and its usefulness to customers.* Management Decision, London, 1999. Vol. 37, Iss. 9, pg 697.

Wright, A.D., (2000) *Scenario planning: a continuous improvement approach to strategy.* Total Quality Management, Abingdon, Jul 2000, Vol. 11, Iss. 4-6, pg. S433, 6 pgs.

Woodruff, R.B., Gardial, S.F., (1996) *Know Your Customer: New Approaches to Understanding Customer Value and Satisfaction*. Cambridge, Blackwell Publishers, 338 pgs., ISBN 1557865531.

Wheelwright, S.C., Clark, K., (1992) *Revolutionizing Product Development: Quantum Leaps in Speed, Efficiency and Quality.* New York, The Free Press, ISBN 0-02-905515-6.

Abbreviations

C-IQ	=	Intelligent Content on Demand (C= Content IQ= Intelligent)
CV	=	Customer Value
HCCT	=	High Contrast Consumer Testing
HoQ	=	House of Quality
IIS	=	Interior and Infotainment Solutions
JIT	=	Just in Time
MMI	=	Man Machine Interface
NPD	=	New Product Development
NSD	=	New Service Development
OEM	=	Original Equipment Manufacturer
PC	=	Performance Characteristic
POI	=	Point of Interest
QFD	=	Quality Function Development
R&D	=	Research and Development
RDM	=	Risk Diagnosing Methodology
SSO	=	Service and Special Solutions
TMC	=	Traffic Message Control
TPD	=	Third Party Data
TQM	=	Total Quality Management
TTM	=	Time To Market

Figures and Tables

Appendix A: Interviews

- Interview structure

All interviews held in the orientation phase were structured as follows:

Part I: Introduction
- Personal introduction
- Introduction of the assignment

Part II: Personal background
- Educational background
- Work experience
- Current function

Part III: Current situation
- TPD
- New Service Development
- Customer Value

Part IV: Shortcoming problems of the current situation
- TPD
- New Service Development
- Customer Value

Part V: Preferred situation

Part VI: Follow up

- List of the interviewees

A list of the interviewees can be found in Table A.1

Name	Function
Stefan de Hoog	Company supervisor, supervisor TPD team IIS
Harald Hagenaars	Company tutor, TPD delegated SSO
Willem den Braven	Project leader Group Program Management, IIS
Henk Eemers	Head of the Maps department, SSO
Ben Laauwen	Discipline Leader TPD, IIS
Peter Goedegebure	Software architect, member TPD team IIS
Vijayaraghavan Thakshinamoorthy	Software developer, member TPD team IIS
Rob Vriens	Requirements manager, Project Manager +++-group
Walter Slegers	System architect
Leo Beuk	Member Advanced Development team
Hans Schulte	Benchmark Navigation
Judith Swinkels	Benchmark Navigation
Peter van Nunen	Senior Manager Purchasing
Carsten Mertens	Market Research IIS (via email)
Paul Hesen	Software Quality Engineer
Eric van Rooij	Software Engineer TPD, SSO
Bart Meulenbroeks	Member of the TPD team, IIS

Table A.1: List of the interviewees

Appendix B: Cause and effect diagram

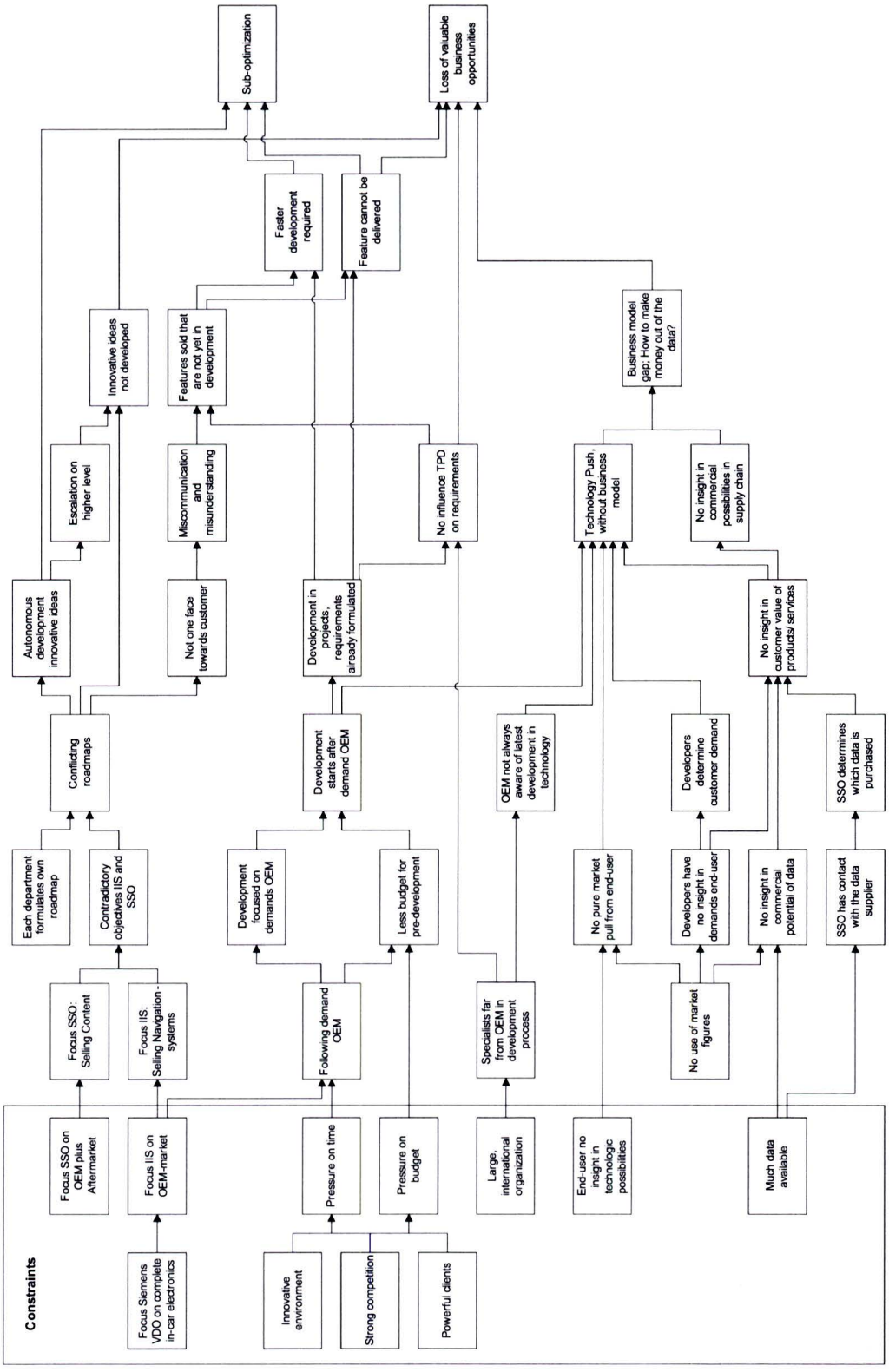


Figure B.1: Cause and effect diagram

Appendix C: Siemens VDO navigation systems

Monitor Navigation
MS 5700
MS 5700 XL
MS 5700 SD
MS 5700
MS 5700 RD
MS 5600
MS 5600 XL
MS 5600 SD
MS 5600
MS 5600 RD
MS 3200
MS 3200

Navigation Radio
MS 4400
MS 4200 RS
MS 4150 RS MP3

Portable Navigation
MS 2000

Mobile Navigation
MN 2200
MN 2100

Appendix D: Components of modern navigation systems

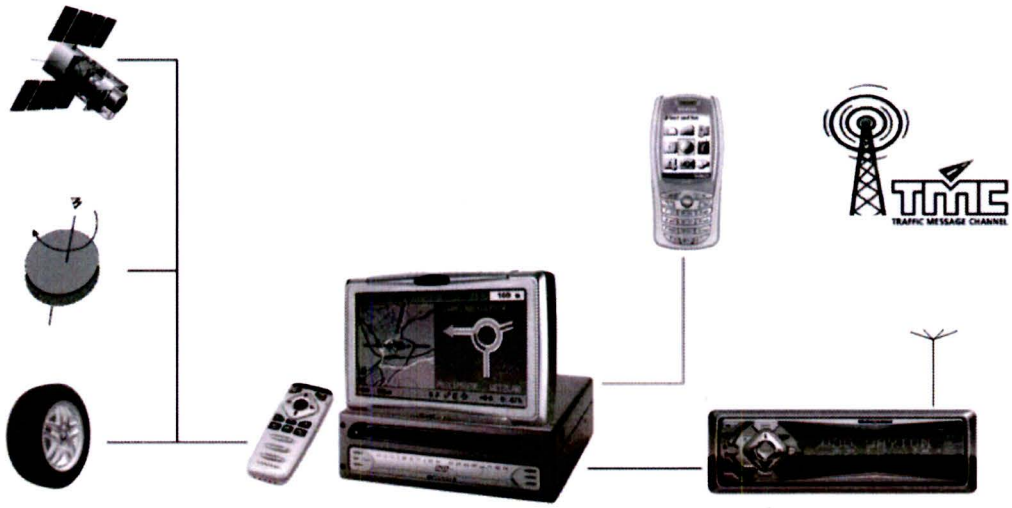


Figure D.1: Components of modern navigation systems

On the left side of the picture in Figure D.1 the satellite and the sensors are displayed which make the system aware of the position of the car, its traveling direction and speed. In the center of the picture the CD or DVD based computer with a separate display is shown. On the right side the GSM connection, and TMC - RDS broadcasts for receiving traffic information are shown. Navigation systems nowadays are able to plan dynamic routes and give advice on possibly desirable detours. These detours can be useful for instance when a traffic jam due to a car accident has occurred. The system calculates whether it is wise to take an alternative route. Another desirable detour can for instance be planning a via-route to the nearest restaurant while you are on your way towards your destination. The system searches for the nearest restaurant, plans a via-route towards this new destination and after the meal you can go on with your trip towards your destination.
It seems that the only task the driver nowadays has, with the luxury of an in vehicle navigation system, is just to follow the instructions given by the system. The driver will then be navigated to the desired destination without any problems and via the (according to the route planner) most optimal route. In reality however the user may not always blindly follow the system and may deviate from the planned route, even when there is no concrete indication for a deviation. In that case the system is able to update the route, based on the choices of the user and its current position.

Source Lomme (2005)

Appendix E: C-IQ

Navigate your way into the Future with C-IQ.

By purchasing your navigation system you have taken the first step into a new dimension of smart, flexible navigation. Now discover one of the most innovative software concepts currently available for your navigation system with VDO Dayton and C-IQ.

C-IQ offers you maximum travel freedom and flexibility on every journey – you always have access to precisely the services you want and only pay for the period you have booked. You automatically receive regular, up-to-date CD/DVD-ROMs containing the latest software, free of charge*. This is all part of our commitment to outstanding service, allowing you to get the most out of your personal navigation data package.

The following pages contain the most important information about the scope and content of this flexible next-generation navigation concept.

C-IQ gives you access to the Future of navigation today.

A navigation system is only as good as its software.

C-IQ is more than map software. C-IQ is a flexible, innovative software concept for your navigation system. It enables you to make your own selection and use of the latest navigation data such as street-level maps, travel guides and traffic information for the whole of Europe. The advantage is that you only pay for the services you have selected.

What C-IQ means for you:

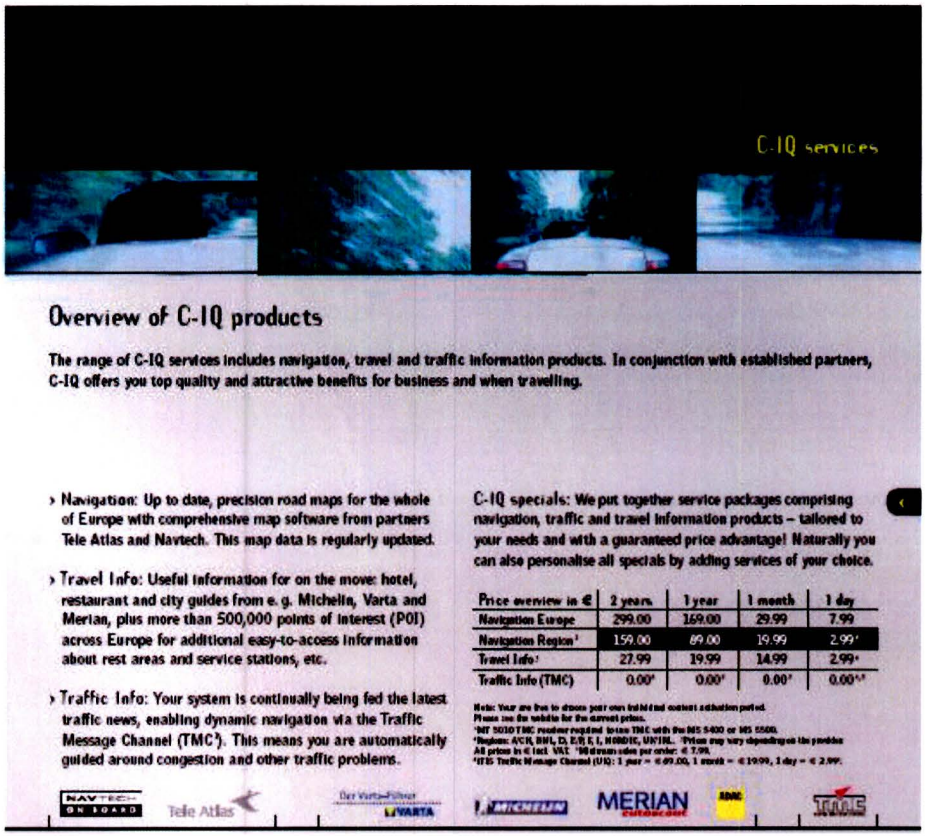
› Freedom to choose content and scope
Travelling in Europe? As a C-IQ customer the choice is yours: whether for a holiday, short journey or business trip you can activate the latest maps, travel guides and traffic information for the respective country, avoiding the need to buy new map software or travel guides.

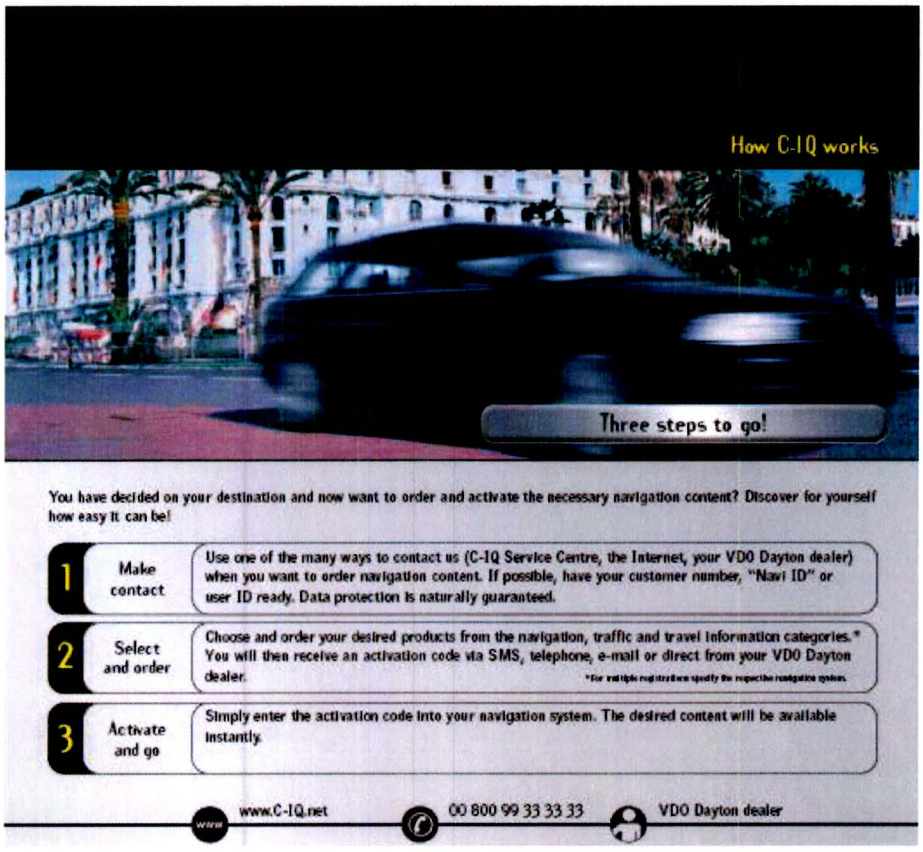
› Time period freely selectable
Planning a short journey or a longer trip? You can determine the time and duration of activation to benefit from fair and flexible pricing: You only pay for the service(s) you need within the time period you have selected.

› Free software update service
Did you know that every year around 15 % of road data changes? As a C-IQ customer you will receive regular DVD/CD-ROM updates containing the latest road maps and travel guides, free of charge.*

Test C-IQ services free of charge!

The preview function gives you free use of 2 country maps and 2 travel information products for 2 days. You can access the preview function under "C-IQ/preview" on your system's menu.


C-IQ services
Overview of C-IQ products
The range of C-IQ services includes navigation, travel and traffic information products. In conjunction with established partners, C-IQ offers you top quality and attractive benefits for business and when travelling.
› Navigation: Up to date, precision road maps for the whole of Europe with comprehensive map software from partners Tele Atlas and Navtech. This map data is regularly updated.
› Travel Info: Useful information for on the move: hotel, restaurant and city guides from e. g. Michelin, Varta and Merian, plus more than 500,000 points of interest (POI) across Europe for additional easy-to-access information about rest areas and service stations, etc.
› Traffic Info: Your system is continually being fed the latest traffic news, enabling dynamic navigation via the Traffic Message Channel (TMC¹). This means you are automatically guided around congestion and other traffic problems.
C-IQ specials: We put together service packages comprising navigation, traffic and travel information products – tailored to your needs and with a guaranteed price advantage! Naturally you can also personalise all specials by adding services of your choice.
Price overview in €
2 years
1 year
1 month
1 day
Navigation Europe
299.00
169.00
29.99
7.99
Navigation Region²
159.00
89.00
19.99
2.99²
Travel Info²
27.99
19.99
14.99
2.99²
Traffic Info (TMC)
0.00²
0.00²
0.00²
0.00²,³
NAVTECH ON BOARD
Tele Atlas
LIVARTA
MERIAN
TMC


How C-IQ works
Three steps to go!
You have decided on your destination and now want to order and activate the necessary navigation content? Discover for yourself how easy it can be!
1
Make contact
Use one of the many ways to contact us (C-IQ Service Centre, the Internet, your VDO Dayton dealer) when you want to order navigation content. If possible, have your customer number, "Navi ID" or user ID ready. Data protection is naturally guaranteed.
2
Select and order
Choose and order your desired products from the navigation, traffic and travel information categories.* You will then receive an activation code via SMS, telephone, e-mail or direct from your VDO Dayton dealer.
3
Activate and go
Simply enter the activation code into your navigation system. The desired content will be available instantly.
www.C-IQ.net
00 800 99 33 33 33
VDO Dayton dealer

Appendix F: Third Party Data

The TPD-team was originally initiated to create openness in the Siemens VDO navigation systems. With this solution, third-party suppliers would be able to supply additional information on POIs. The first version, TPD Phase 1, allowed third-parties to add an information page for POIs that were already marked on the map (such POIs are called Facilities or Facility POIs). TPD Phase 2 decoupled the TPD from the map database. This allows TPD suppliers to add new POIs to the system. Over time, several implementations of TPD for the various platforms and applications have come into existence.

The current developments in TPD are aimed at providing a more seamless integration of the TPD with the navigation functionality. Examples of this are '*alert point functionality*', '*POI along the route*', and '*scenic routes*'.

Generic TPD is a collective term covering the functionality currently available in TPD, as well as new functionalities planned for products in development. Figure F.1 shows a (highly simplified) sketch of a Generic TPD. It will be implemented on the navigation computer and it discloses the TPD data in the navigation system to its clients; all access to TPD data runs through Generic TPD. Additionally, Generic TPD can interact with other components to offer functionality that is tightly integrated with core navigation functionality.

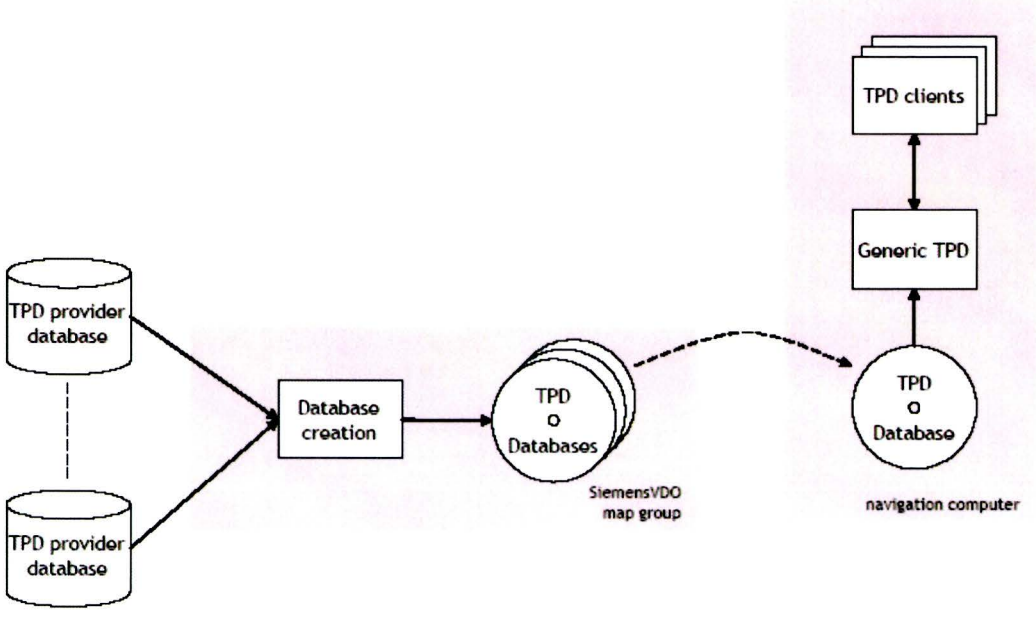
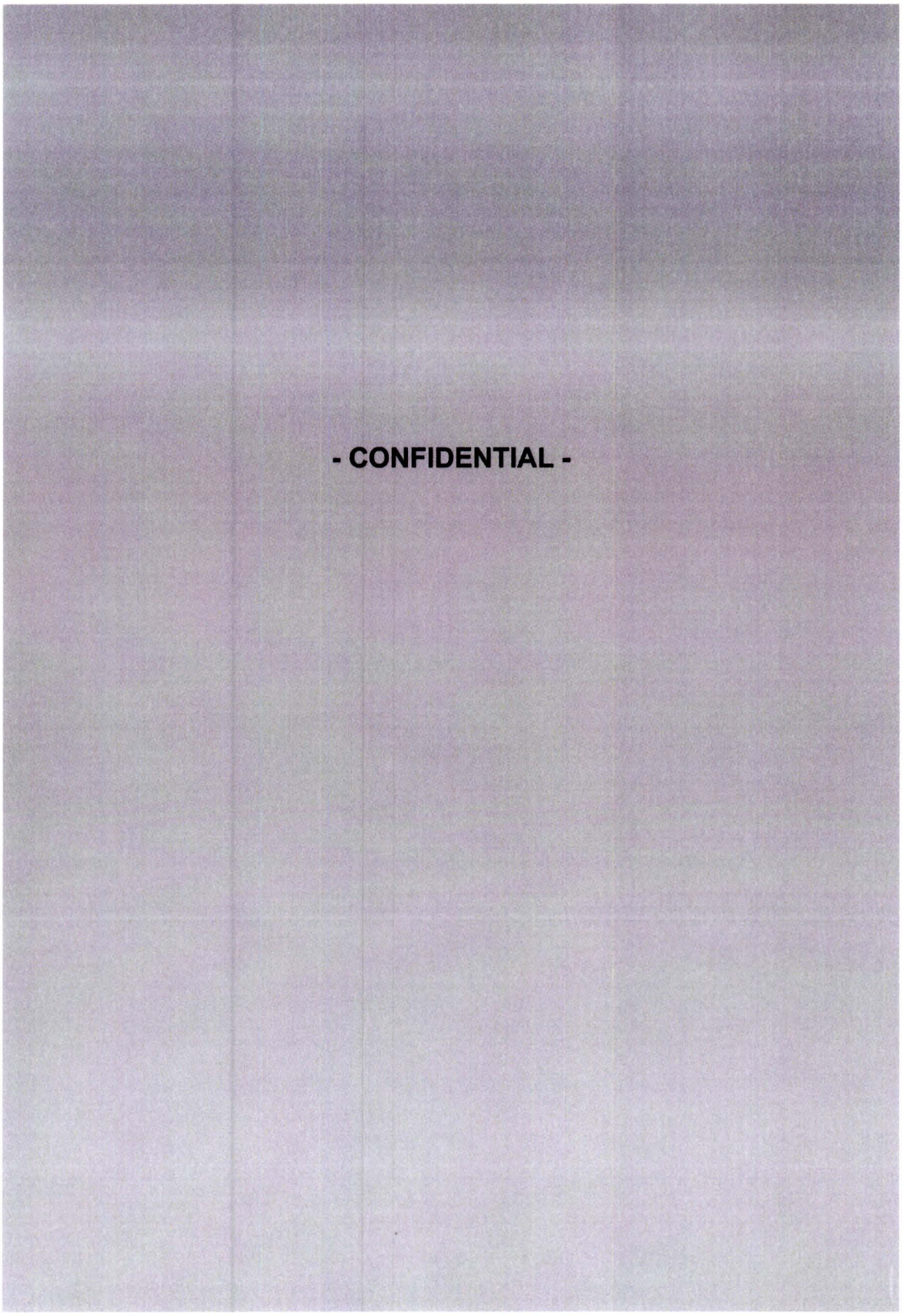


Figure F.1: Generic TPD

Appendix G: Market share Siemens VDO



Appendix H: Service characteristics

Service researches have identified distinctive characteristic of services that have been used to contrast services with products. These characteristics are (Kuylman, 2005):

- *Customer participation, co-production*; Services can be viewed as processes rather than objects, requiring the new service developer to consider far more than just the design of the service per se. The ethos of services is interactivity and services, by their very nature, are developed and consumed as a process with a multiplicity of actors. Interactions are difficult to anticipate or plan, standardise and control. Such characteristics point to the value of harnessing and managing interactivity through inter-personal and inter-organisational relationships throughout the service development process.

- *Intangibility*; compared with a service a product is tangible; you can see, touch, taste, hear, or smell a product prior to purchase. Intangibility often causes customers to evaluate the service. To overcome this, a company can consider making the service more tangible for the customer by using concrete physical evidence like documents.

- *Inseparatibility*; a service is produced and consumed simultaneously. This means that mostly, both the desk personnel and the consumer need to be present in order to produce the service. In contrast to services, products are produced and consumed separately; the product is often produced without the presence of the customer. Only after production the customer can use the product. Inseparability makes it difficult to standardise a service. A service is likely to vary each and every time because of the influence of the customer. Another difficulty that arises from inseparability is the management of quality control; a service firm can not control quality before consumption.

- *Heterogeneity*; this characteristic refers to the variability between the service experiences of the customer, while they have bought the same service. The service experience of consumers can vary over time, across contact personnel, or within contact personnel and can vary as experienced by different customers. Compared to services, products are more robust to variability, because they are usually made according to certain requirements and standards.

- *Perishability*; a service cannot be stored and has to be produced on demand. This means that capacity planning is critical to service suppliers. Demand may vary greatly, yet needs to be met promptly or stand to be lost. In contrast to a service, a product can be stored in a warehouse, which enables the company to deliver the products immediately and if necessary in large numbers.

Appendix I: Market trends

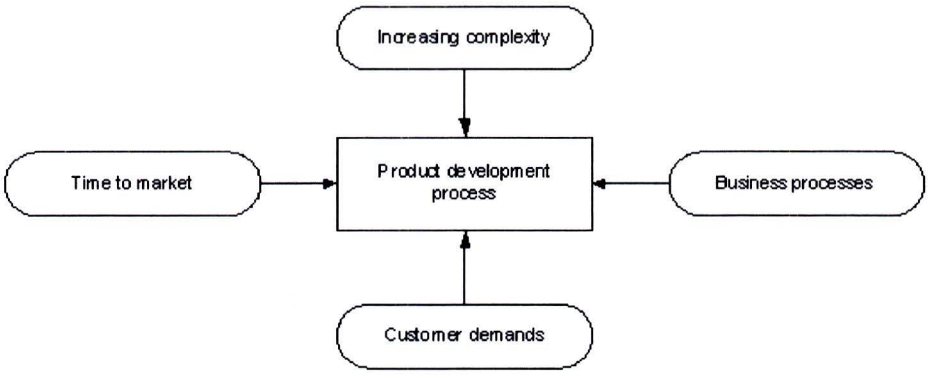


Figure I.1: Market trends influencing the product development process, source De Ruiter (2005)

Shorter Time to Market (TTM)

Fierce competition and shorter product life cycles increase the pressure on Time to Market (TTM). Being just a few days ahead in launching a new product can be essential for a company and disastrous for the competition. Over the last few years the major impact involving this theory has proven its validity, and pressure on a company 'not missing the train' has build-up. Continuous research into development of products and services is being carried out, resulting in new products, services and processes coming out all the time and therefore being outdated faster. Companies try to shorten the time-to-market by speeding up their development and production process, or by introducing the just-in-time concept (JIT). The emphasis is on shortening the TTM, with the risk of reserving less time for (extensive) product testing.

Increasing product complexity

Analysing the whole range of new products and services reaching the market over the last few years, they seem to become more complex in terms of number and variety of parts, used technology and functional aspects. As a direct result of increased product complexity, the manufacturing process becomes more complex as well, increasing the complexity for the NPD process. Especially in innovative high tech consumer products, there is an increased risk on product – customer mismatches. While product complexity increases and product life cycles become shorter, there is a need for more detailed and timely information on product – customer interaction.

Globalisation of business process

The whole business world is extending; small town companies developed into national stores and globally operating multinationals. Forming alliances, outsourcing and networking is on the order of the day, making the business processes part of a bigger concept. The objective of the business process is to get the right product to the right people at the right moment, which is essential to stay competitive. Underlining this notion the business process has to be flexible and adaptable to market change, hence information deployment becomes the backbone of the organisation. Globalisation of the business process requires open communication lines that provide fast, accurate and timely feedback.

Increasing customer demands on product quality and reliability

Without having a product, brand or service comparison, customers could not make a choice on the market. The increase of factors like competition, social status, product variability offered, etc., is of influence on the customer behavior towards a product. In accordance to these factors customers are becoming more aware of product quality. In the past, companies decided product quality and product features the customer could chose from, nowadays, customers are demanding and expecting more of the consumer products regarding to product quality and reliability.

Appendix J: Research and Development expenditures

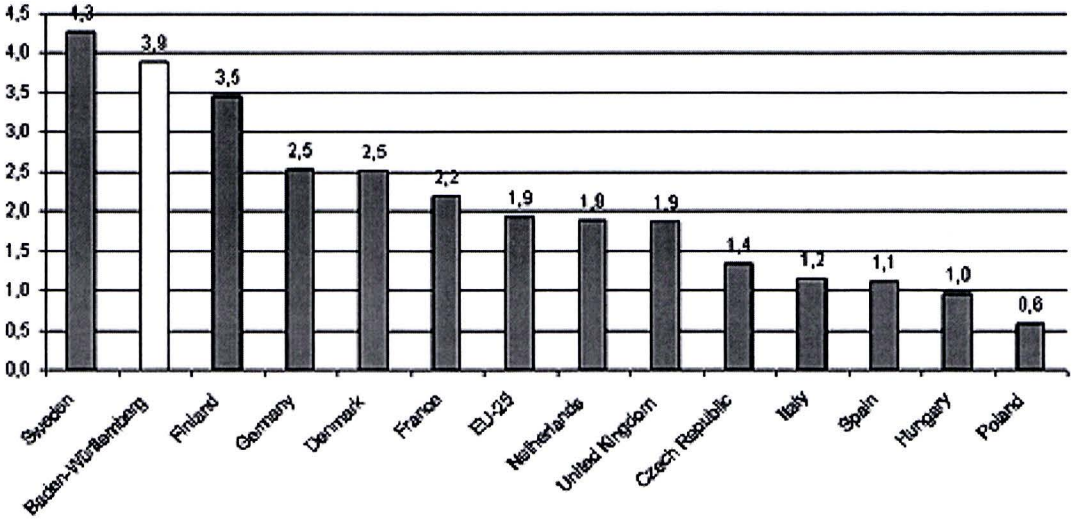
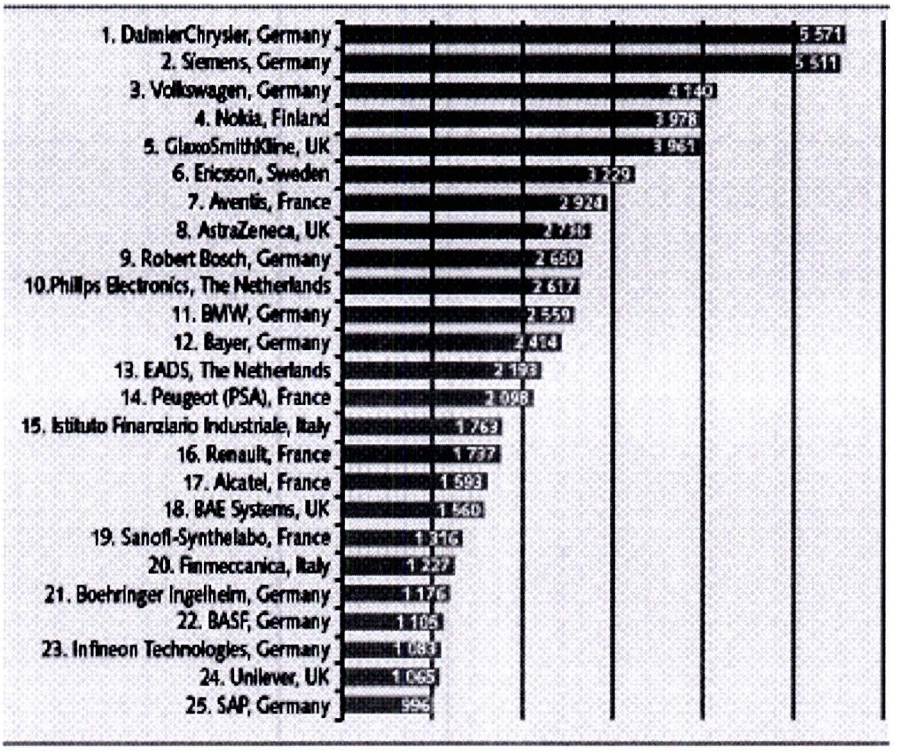


Figure J.1: R&D Intensity in the EU (expenditures on R&D as % of GDP in 2003)

	EU Top 500		Non-EU Top 500	
FTSE Sector	Sector R&D investment as % of all sectors	R&D/ Sales ratio (%)	Sector R&D investment as % of all sectors	R&D/ Sales ratio (%)
Automobiles & Parts	23.8	4.6	15.7	4.1
Pharmaceuticals & Biotechnology	17.0	15.2	18.5	15.1
IT Hardware	12.4	15.6	22.9	8.6
Electronic & Electrical Equipment	10.3	6.5	10.9	5.7
Chemicals	7.2	4.2	4.2	3.8
Aerospace & Defence	6.8	8.0	2.1	2.7
Engineering & Machinery	4.6	2.5	2.5	2.8
Telecommunication Services	2.8	1.0	2.0	2.5
Software & Computer Services	2.6	12.8	7.8	10.0
Oil & Gas	1.9	0.3	1.2	0.5
Others (21 sectors)	10.6	1.5	12.2	2.1
Total (21 sectors)	100	3.4	100	4.6

Figure J.2: EU and non-EU R&D investments by sector



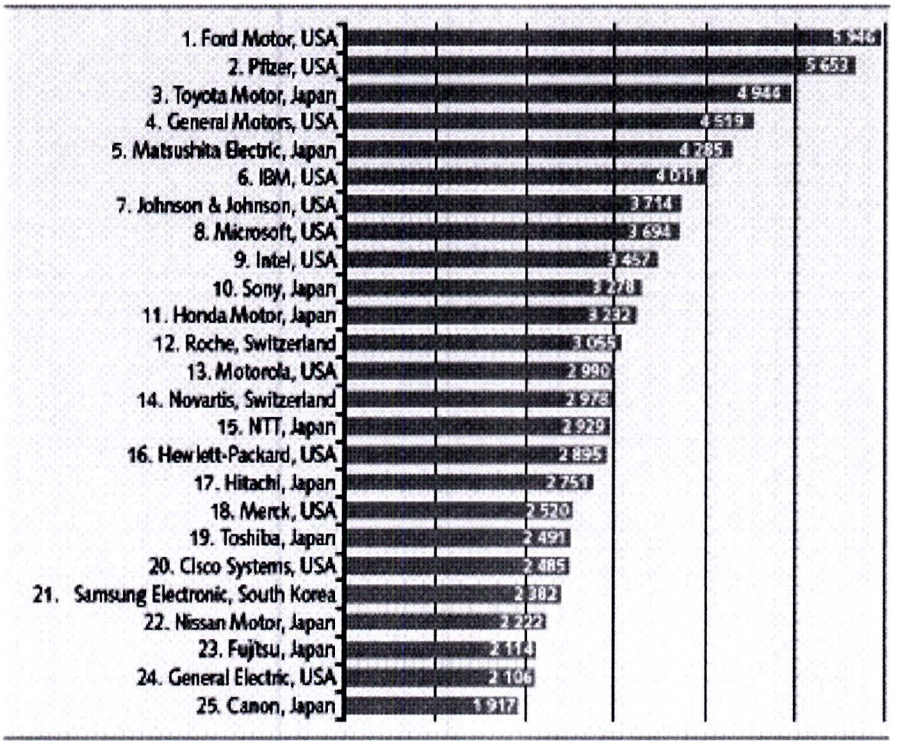


Figure J.3: Ranking of top EU and non-EU 25 companies and their location, by worldwide R&D investment (million euro) in 2003

Appendix K: Risk Diagnosing Methodology

A company cannot be innovative without taking risks. Managing risk is therefore an important factor in all phases of the development of new products and services. According to Keizer et al. (2002) a project activity should be labelled 'risky' if:

- The likelihood of a bad result is great,
- The ability to influence it within the time and resource limits of the project is small,
- Its potential consequences are severe.

The success of product innovation is determined by external influences and internal circumstances in which technological, organisational, market of financial factors interact. To be effective, a risk assessment method can help identify potential risks in the following domains (Keizer et al., 2002)

- *Technology*: Product design and platform development, manufacturing technology and intellectual property,
- *Market*: Consumer and trade acceptance, public acceptance and the potential actions of competitors,
- *Finance*: Commercial viability,
- *Operations*: Internal organisation, project team, co-development with external parties and supply and distribution.

For all these domains the basic question is: What is new or different in the knowledge and skills this project requires of the company in general and the project team in particular? A method to diagnose and manage risk in innovative projects is the Risk Diagnosing Methodology (RDM). It allows a firm to thoroughly and systematically diagnose the technological, organisational and business risks a project faces, and formulate and implement suitable risk management strategies. The outline of the RDM method can be found in Figure K.1.

The purpose of RDM is to provide strategies that will improve the chance of a project's success by identifying and managing it's potential risks. The aims of RDM are to:

- Evaluate each potential risk on it's likelihood, controllability, and relative importance to project performance,
- Take a cross-functional perspective by identifying and evaluating technological, market, financial, and operational risks,
- Conduct the risk assessment at the end of the idea phase and periodically reassess the project for unforeseen risks and deviations from the risk management plan,
- Identify and evaluate the product innovation risks individually, and generate, evaluate and select alternative solutions in subgroups and plenary sessions.

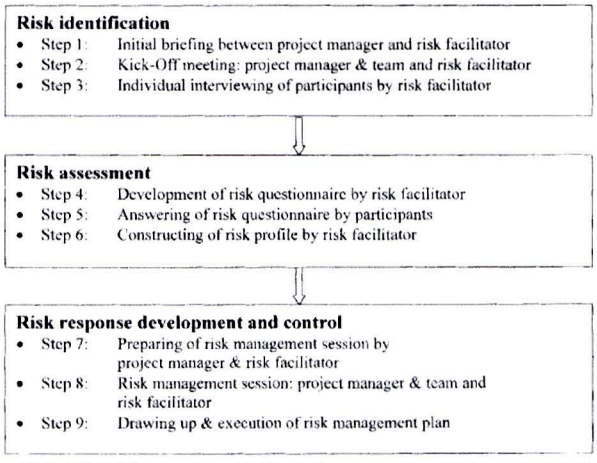


Figure K.1: Risk Diagnosing Methodology, source Keizer et al. (2002)

Appendix L: House of Quality

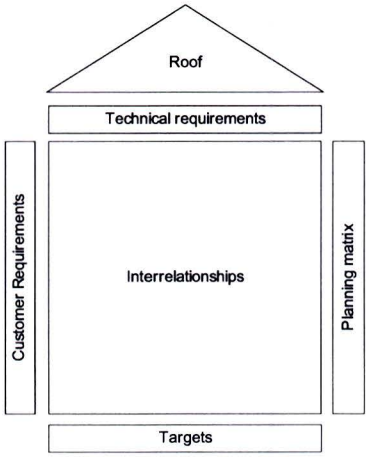


Figure L.1: The House of Quality

1. Customer requirements

This is generally the first portion of the House of Quality matrix to be completed and also the most important. It documents a structured list of a product's customer requirements described in the words of the customer (the Voice of the Customer).

2. The planning matrix

The planning matrix serves several purposed. Firstly, it quantifies the customers' requirement priorities and their perceptions of the performance of existing products. Secondly it allows these priorities to be adjusted based on the issues that concern the product development team. The measures used here are gathered from the customers. The most important measure is the requirement importance weighting, which quantifies the relative importance of each of the customer requirements.

3. Technical requirements

This part of the House of Quality is also referred to as the engineering characteristics or the Voice of the Company; it describes the product in the terms of the company.

4. Interrelationships

The interrelationships form the main body of the House of Quality. Its purpose is to translate the requirements as expressed by the customer into the technical characteristics of the product.

5. Roof

The triangular roof of the House of Quality is used to identify where the technical requirements that characterise the product, support or impede one another. For each cell the question is asked: 'Does improving one requirement cause a deterioration or improvement in the other technical area?'. It highlights where a focused product development could lead to a (range of) benefit(s) to the product. It also focuses attention on the negative relationships in the design.

6. Targets

This final section summarises the conclusions drawn from the data contained in the entire matrix. It leads to technical priorities by providing the relative importance of each technical requirement of the product in meeting the customer's specified needs.

Appendix M: High Contrast Consumer Testing

Customers expect to get products with an extensive functionality and a high reliability for a reasonable price. Therefore, in general the goal of NPD is transforming customer requirements into a product that satisfies the customer needs (Seligman, 2006). QFD makes it is possible to connect customer requirements with technical requirements, and to set requirements in the development of new product (features). In a market pull environment, it is usually the case that the requirements of the customers are known. For technology push, this lies different. The new product or service is unknown to the user, and therefore the users' requirements are unknown to the engineers. Therefore, QFD in its pure form is not useful for technology push innovations.

According to Boersma et al. (2003) engineers are bad predictors of user's requirements. Therefore, it is very worthwhile to test a technology innovation on a user as soon as possible in the product development process. High Contrast Consumer Testing (HCCT) tries to deal with unexpected consumer behavior. It is a method using consumer tests to find possible product rejections by observing critical and extreme customers using a product in realistic operating conditions. The setup of a HCCT involves the following steps (Boersma et al., 2003):

1. Identify all new innovative product features to be tested,
2. Identify extreme customers of the product and of these new features by brainstorming,
3. Initiating a test session which allows observation of these extreme customers utilizing the test product under near-realistic operating conditions,
4. Prompting the customers' though-process,
5. Feeding- back information to the product development team.

The purpose is to accelerate failures and expose product-usage issues as soon as possible in the NPD process to minimize the risk of consumer rejection because they do not know how to operate the product or that the product does not meet the consumer's expectations. The main benefit is an improved understanding of how the product would be used by customers. Therefore the HCCT concept showed excellent potential for product development processes with innovative products and services (Boersma et al., 2003).

Appendix N: Team structures

Functional team structures

People are grouped primarily by discipline, each working under the direction of a specialized sub-function manager and a senior functional manager. The functional project organisation brings specialised expertise to bear on the key technical issues. The different (sub-) functions coordinate ideas through detailed specifications that all parties agree to at the outset and through occasional meetings at which issues that cut across groups are discussed. Primary responsibility for a development effort passes sequentially from one function to the next, a transfer often referred to as 'throwing it over the wall'.

A function team structure is useful when a product's architecture is modular. When there are unpredictable interdependencies in the work to be done by two functional organisations, functional teams impede success.

Lightweight cross functional teams

As in the functional development structure, those assigned in cross-functional teams reside physically in their functional areas, but each functional organisation designates a liaison person to represent it on the project coordination committee. This approach usually occurs as on add-on to a traditional functional organisation, with a functional liaison having that role added to his or her duties. The project managers in cross-functional teams are generally lightweight, with little status or influence in the organisation. And although they are responsible for informing and coordination the activities of the functional organisation, the key resources remain under the control of their respective functional managers.

The primary strengths and weaknesses of the cross functional are those of the functional project team structure, but now at least one person over the course of the project looks across functions.

Heavyweight cross functional teams

The heavyweight project manager has direct access to, and responsibility for, the vast majority of those involved in the project. The project leader is a senior manager within the organisation and may even outrank the functional managers. Moreover, heavyweight leaders have primary influence over the people working on the development effort. Often the core group of people is dedicated and physically co-located with the project leader. The challenge for the organisation is to achieve a balance between the needs of the individual heavy weight project and of the broader organisation.

Autonomous team structures

With the autonomous team structures individuals from the different functional areas are formally assigned, dedicated and co-located to the project team. The project leader, a heavyweight in the organisation, is given full control over the resources contributed by the different functional groups. Furthermore, the project leader becomes the sole evaluator of the contribution made by individual team members. In essence, the autonomous team is given a clean sheet of paper; it can create its own organisational practices and procedures. However, the team will be held fully accountable for the final results of the project.

Virtual teams

A group of individuals, who work together across time, space, and organizational boundaries on a product development, are working in a virtual team. Virtual teams allow organisations to hire and retain the best people required for a project, regardless of the location.

Appendix O: Focus in different technology phases

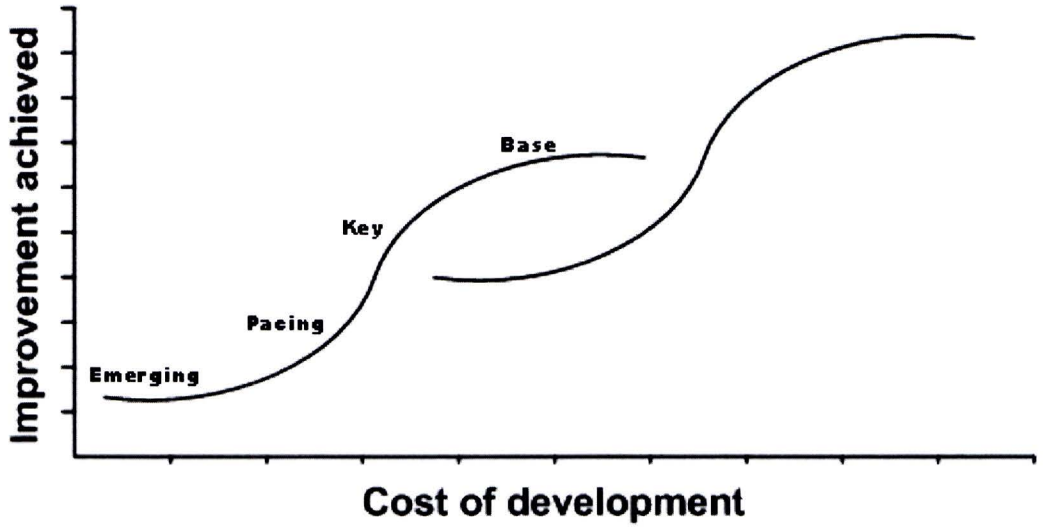


Figure O.1: The S-curve of technological progress, source Foster (1986)

Technology phase	Typical R&D focus	Typical company focus
Emerging	Technical understanding Patents and IPR	Find early adopters Gain practical experience Publicize capability
Pacing	Demonstrate capability Establish standards Explore variations Understand limits	Respond to early market feedback Speed of response Flexibility Readiness to learn
Key	Performance improvements Customer focused features Technical mastery Design for manufacturing	Product performance improvement Market share Exploit new niches and applications
Base	Reliability Cost Ergonomics Scan for new technologies	Reliable and respected supplier Brand image Quality Value Complementary products and services Business process improvement

Table O.1: Shifting focuses during the different Technology phases, source Goffin and Mitchell (2005)

Appendix P: The scenarios

Scenario 1: Operational Excellence

'The lowest total cost'. This can mean the lowest price, but not necessarily. It means offering the best deal. So, it might be focused on product reliability, in order to lower the customers' future cost of ownership. Another element of cost stressed is convenience, the absence of tangible or intangible costs stemming from annoyance and irritation. The strength of this first scenario is offering a swift, dependable service (easy and low total costs), focused on efficiency, offering as less variety as possible.

Operational excellent companies create an unmatched value proposition of best total costs. The goal of this is growth. Other market leaders might raise prices to exploit their product advantage, but such a tactic runs counter to the operational excellence strategy. They obtain growth in 3 different ways:

1. Work to assure a constant, steady volume of business to keep their assets continually working,
2. Find new ways to use their existing assets,
3. Replicate their formula in other markets.

What distinguishes operational excellence from operational competence is:

- Willingness to make hard choices.
- Offering as less product variety as possible,
- Having the courage not to please every customer,
- Forging the whole company, not just manufacturing and distribution into a single focused instrument.

The secret of this value discipline is *'formula'*. Formula is the foundation for an aggressive and highly successful enterprise.

Scenario 2: Product Leadership

Product leaders display their ability and determination to make products that customers recognize as superior, products that deliver real benefits and performance improvements. Customers are not impressed by one-time inventions followed by countless improvements, so a certain continuous rate of innovation is required for a product leader. They have powerful brand images. Product leaders launch their offerings with a big bang.

Business is not driven by procedure, but by the extraordinary talent of key individuals who develop breakthrough after breakthrough. Product Leaders crave a mix of tangible and experiential benefits; they expect the performance of breakthrough products to move their rational and their emotional selves. They are focused on turning ideas into targets; the goal is to create new conveniences, methods and benefits.

Once an enterprise comes up with a breakthrough, the product rarely sells itself, due to a lack of personnel who understand both technology and business opportunities. They often create products for which there is little initial demand. Therefore, the cultivation of markets must go hand in glove with breakthrough product development. Product leaders have to prepare markets and educate potential customers to accept products that never before existed.

As stated in previous chapters, every breakthrough product develops sales demand at a natural rate; the rate of diffusion of innovation. The challenge of product leaders is to push the rate of diffusion beyond what is natural and common, to get demand to climb faster and earlier.

Product leaders hold onto their position by managing their portfolio of development activities; they employ structure and process; and they learn how to manage their people. Product leaders create flexible organizational structures and robust processes. They allow resources to move toward the most promising opportunities during the development. 'Make hay while the sun shines', is the motto in the prioritization phase of the innovation pentathlon.

Product leaders run their organisation according to three main principles:

Principle one: Keep people on track by organising the work in a series of well-paced challenges, each with a clearly defined outcome and a tight deadline,
Principle two: Create business structures that do not oppress,
Principle three: Stress procedure where it pays the biggest dividend.

Scenario 3: Customer Intimacy

Customer intimate companies deliver unmatched value in an extraordinary level of service, guidance, expertise, and hand-holding it offers clients. They offer the best total solution, by providing the best overall result for their clients by attending to a much broader range of their clients' needs. Customer-intimate companies personalise basic service and even customize products to meet unique customer needs, they are willing to take on responsibility for achieving results.

Successful customer-intimate companies are those that have become expert at their customers' business and at creating solutions. Deep customer knowledge and breakthrough insights about the client's underlying processes are the backbone of every customer-intimate organisation today.

Customer-intimate companies take the long view. A steady client is a lasting asset; a one-time client is a poor investment. They avoid clients that do not have a deep relationship potential. They steer clear of pure transactions. It hurts their business to serve clients that already know what to buy and are shopping only for price or product features; extra service in advice and expertise is what they deliver.

Customer-intimate companies create for their clients an unmatched value proposition of best total solution. They offer expertise that drives client performance; a willingness to share in client's risks, and real, meaningful tailoring and customisation of products and services, not useless "value added" service.

Appendix Q: Questionnaire 1 - Core Competences TPD

The main question to be answered by this questionnaire is: Based on which value criteria does Siemens VDO offer value to its customers? The respondents were asked to fill in the four most important value criteria according to indicate on which criteria Siemens VDO TPD wants to diversify itself from its competitors. Table Q.1 represents the list of Value Criteria, including a short description, which was filled in by 75% of the requested respondents. These four criteria were given the score of 5 ('essential'), the others received the score of 1 ('not important'). On average the criteria received the score as presented in Table Q.2.

Value criteria	What customers value	Score
1. Price	We (*) value low price	
2. Delivery	We value on time delivery We value fast delivery We value flexible delivery tim	
3. Quality	We value high quality	
4. Technical attributes	We value optional extras We value durable/ reliable products	
5. Product variety	We value an extensive product range	
6. Flexible volume	We value the ability to order any quantity of a product	
7. Customisation	We value input before product purchase	
8. Services	We value after-sales technical support We value product training	
9. Design	We value a low-cost designed product We value fast designs We value an innovative design	
10. New products	We value new products	
11. Brand name	We value the brand name associated with the product	
12.		
13.		

*** 'We' refers to the Siemens VDO customer**

Table Q.1: Questionnaire value criteria

Value criteria	Average score SSO	Average score IIS	Average score overall
1. Price	1	3	2,33
2. Delivery	1	3	2,33
3. Quality	5	5	5,00
4. Technical attributes	1	5	3,67
5. Product variety	5	1	2,33
6. Flexible volume	1	1	1,00
7. Customisation	1	1	1,00
8. Services	1	1	1,00
9. Design	1	3	2,33
10. New products	5	3	3,67
11. Brand name	5	1	2,33
12.	0	0	0
13.	0	0	0

Table Q.2: Average score value criteria, based on questionnaire

Appendix R: Questionnaire 2 - Classification TPD features

The main question to be answered by this questionnaire is: To which category of the Kano-classification do the TPD features belong from the engineering point of view? To determine the class a feature belongs to, a pair of questions needs to be asked for each TPD feature. Each pair of questions includes the functional question, which asks the user how he or she would feel if a feature were present, and the dysfunctional question that asks the user how he or she would feel if the feature was not present.
Two examples:

How would you feel if the **Levelled POIs** were fully integrated available on your navigation system?	- I like it that way - I expect it to be that way - I am neutral - I can live with it that way - I dislike it that way	
How would you feel if your navigationsystem did not include fully integrated **Levelled POIs**?	- I like it that way - I expect it to be that way - I am neutral - I can live with it that way - I dislike it that way	

How would you feel if the **Travel Guides (C-IQ products)** were fully integrated available on your navigation system?	- I like it that way - I expect it to be that way - I am neutral - I can live with it that way - I dislike it that way	
How would you feel if your navigationsystem did not include fully integrated **Travel Guides (C-IQ products)**?	- I like it that way - I expect it to be that way - I am neutral - I can live with it that way - I dislike it that way	

The questions where analysed according to the scheme provided in Figure R.1. The result for all current TPD features is presented in Table R.1.

Customer Requirements → / Functional Question ↓		Dysfunctional Question: Like	Expect	Neutral	Live with	Dislike
Functional Question	Like	Q	E	E	E	L
	Expect	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live with	R	I	I	I	M
	Dislike	R	R	R	R	Q

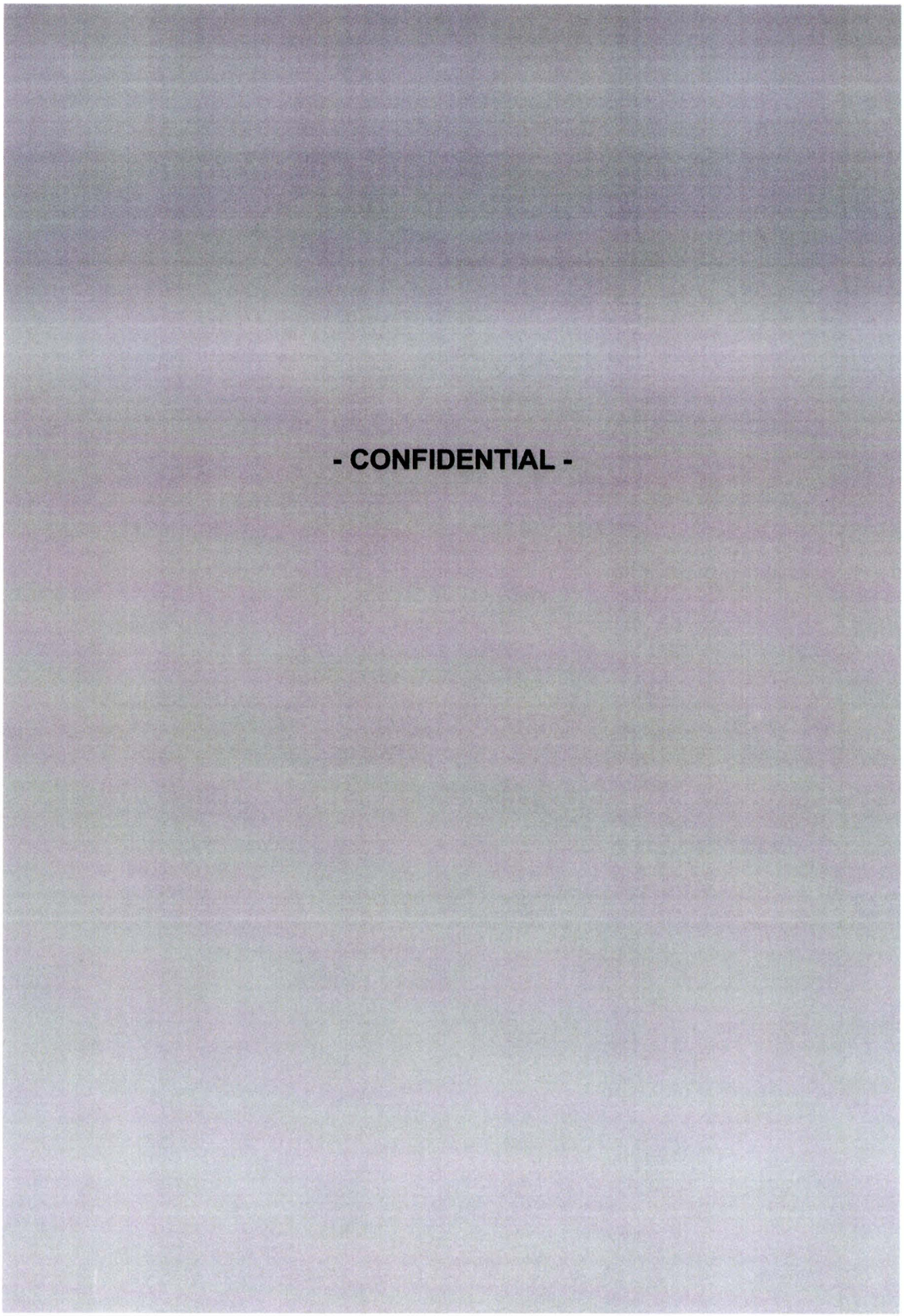
M Mandatory
L Linear
E Exciter
R Reverse
Q Questionable
I Indifferent

Figure R.1: Classifying features, source Goffin and Mitchell (2005)

TPD functionalities	IIS	SSO
1. TPD products	Performance	Indifferent
2. Levelled POIs	Performance	Indifferent
3. Travel Guides	Indifferent	Indifferent
4. Search for POIs in an area	Basic	Performance
5. Pre-defined routes	Excitement	Indifferent
6. Alert points	Excitement	Indifferent
7. Searchable attributes	Excitement	Indifferent
8. Facility pages	Excitement	Indifferent
9. Information attributes	Excitement	Indifferent
10. Category selection	Basic	Indifferent
11. Product selection	Basic	Indifferent
12. Language selection	Indifferent	Performance
13. Corridor functionality	Performance	Indifferent
14. Eject DVD and still search	Performance	Excitement
15. Intelligent typewriter	Indifferent	Excitement
16. Search along the route	Performance	Performance
17. Add, remove or update POIs	Excitement	Performance

Table R.1: Categorisation of TPD features

Appendix S: SWOT Analysis



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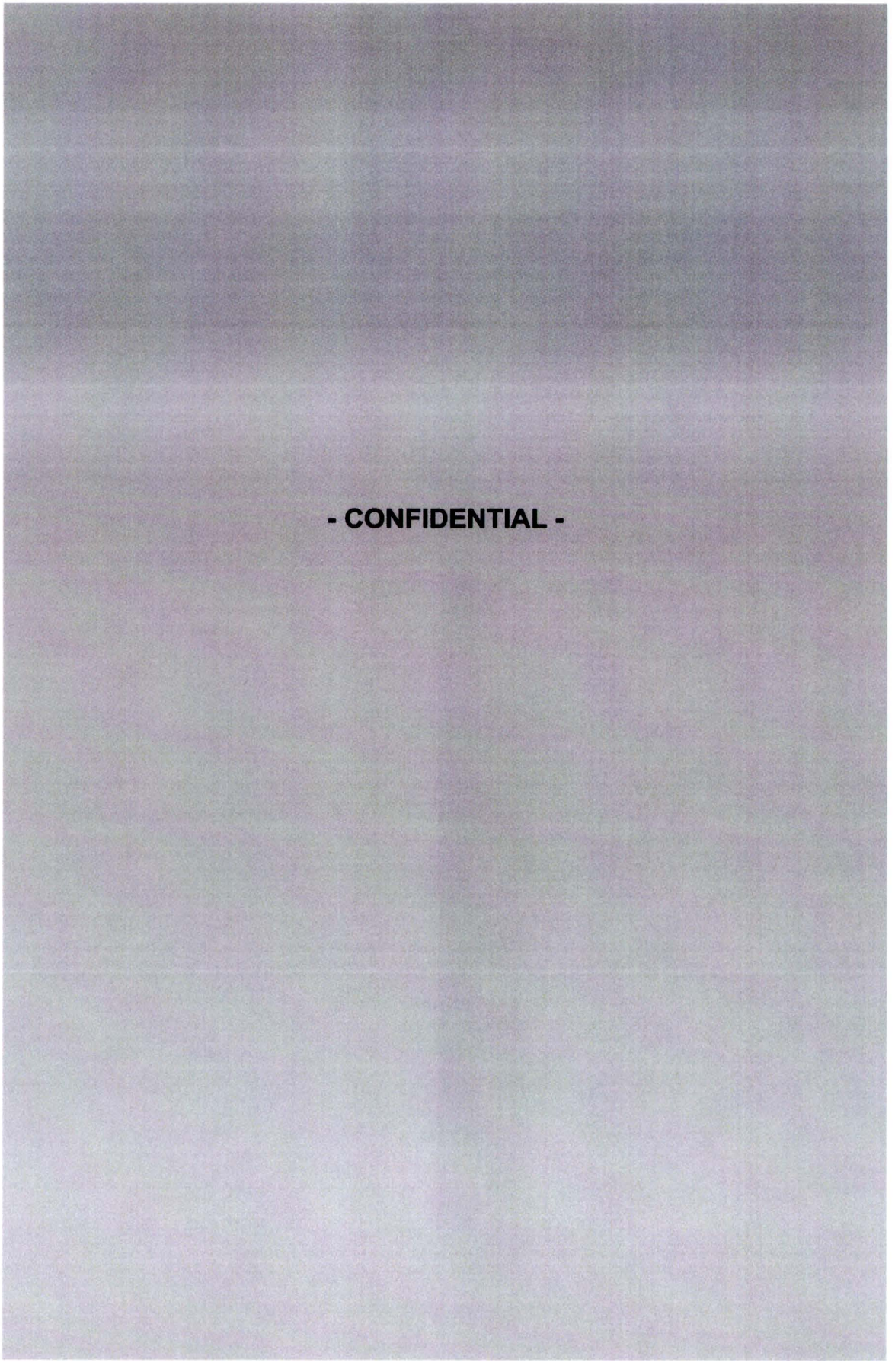
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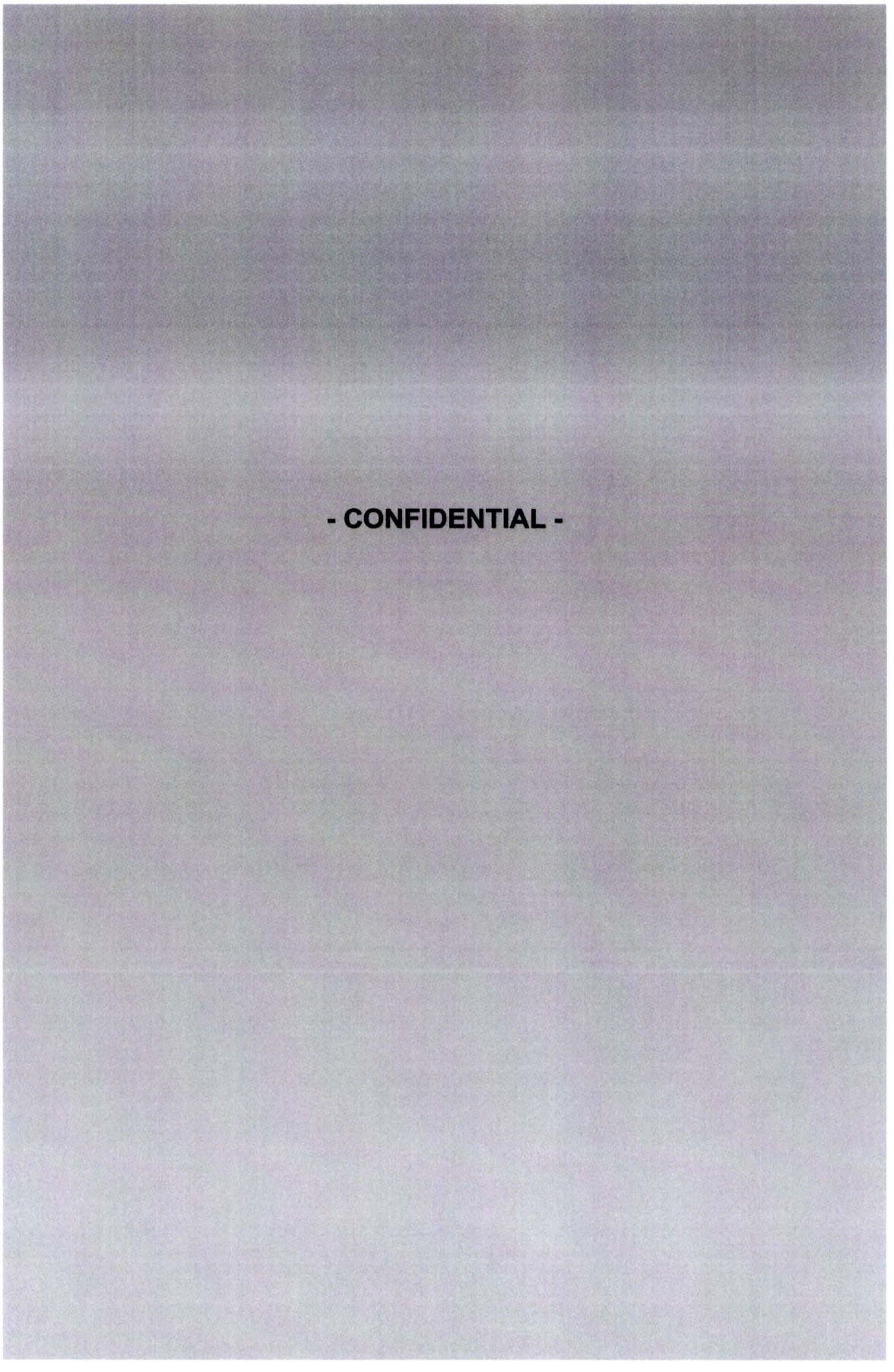
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Appendix T: The cultural web

First the elements of the cultural web are discussed (Figure T.1, and Table T.1), followed by the cultural web for product leadership (Table T.2)

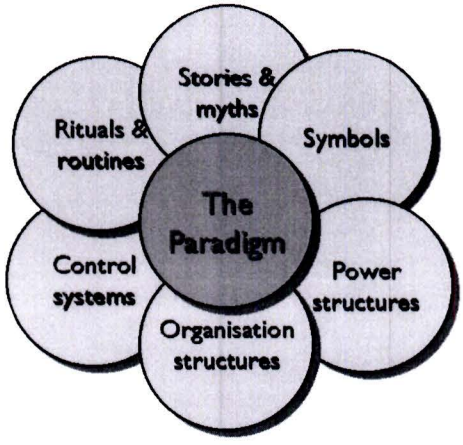

Figure T.1: The cultural web (Source: Johnson and Scoles, 1999)

Aspect	Explanation	Reflected by
Organisational Structures	The term 'Organisational Structures' refers to the formal arrangements made by the organisation to describe its working arrangements. Increasingly, these are flat structures with delayered hierarchies. In effective organisations they are open and organic, and reflect the rapidly changing emphasis of operations and priorities.	Formal way of working, organisation charts
Power Structures	Power structures describe the functional work of the organisation reflecting the effort and drive required to carry out the work; the power hierarchy of the organisation. The explicit structures reflect the formal arrangements as described; but within those structures are the informal power arrangements through representative and networking arrangements	Informal way of working, not easily recognizable from organisation charts
Symbols	These are the significant elements, 'signs' and 'emblems' that the members of the organisation recognise as standing for them. They can include the leaders of the organisation and often include symbolic acts of particular significance and include physical features	Logos, uniforms, standardised design, architecture, language and terminology used.
Myths and Stories	These are the stories told amongst members of the organisation about themselves as individuals and about the organisation as a whole. They describe the kernel of truth about the organisation; they reflect the values that prevail and which are perceived as dominant.	Heroes and bad guy stories, symbolising what the organisation is about
Routines and Rituals	Routines and Rituals are often not described formally but are of day-to-day significance and reflect important relationships and activities. They reflect what an organisation celebrates and rewards in small but significant ways.	'the way we do thingsaround here' Training, promotion and reviews
Control sytems	The Control Systems of any organisation monitor the distribution of resources; they often constitute hard plans for the future work, defining priorities and key indicators of performance. They also contain soft systems such as induction programmes for staff joining the organisation and the appraisal system that connects individual commitment to the work of the organisation.	Measurement and reward systems
Paradigm	The central paradigm is expressed as a statement summarizing the main points about how an organisation thinks and acts. It is the distillation of the points fro the six surrounding circles.	Core beliefs, assumptions, values

Table T.1: Explanation of the cultural web

Aspect	Current situation	Desired situation	Change required?
Organisational Structures	The organisational structure does not allow any adjustment between the 2 departments. Everything is top-down organised, which does not support pure technology push.	In effective organisations, required for product leaders, the organisation is characterised by its flat structures and delayered hierarchies. The organisation must be open and organic, to be able to respond to developments in both the market and the technology.	YES
Power Structures	In practice, the organisation is less layered as expected from the organisation chart, the way of working is informal. However, when it comes to responsibilities and allocations of resources everything is very formally structured, due to the functional structure.	Being innovative requires an informal way of working, and high levels of responsibility low in the organisation.	YES
Symbols	The Siemens name is an innovative brand name. The first thing noticed when entering the building is a sign that states 'our innovations shape the future'.	Product leaders must breathe innovation through its symbols, including a strong brand name.	NO
Myths and Stories	The current organisation is partly forthcoming from the old Philips organisation, which results in several stories about the Carin-platform.	Heroic stories about exciting new product develoments, that represent the innovative nature of the company.	NO
Routines and Rituals	Typical for the functional organisation is that transferring developments to functions is regarded as 'throwing it over the wall'. This is a good description of the relationship between IIS and SSO regarding TPD.	Innovation needs adjustment between the functions. Therefore the 'walls' need to disappear.	YES
Control sytems	Resources are allocated to projects, initiated on customer demand. As all development is done in projects, measurement and reward systems are focused on the performance in customer oriented projects.	As pure technology push is not initiated by customers, projects must be initiated based on innovation. Resources must be allocated, and this effort must be measured and rewarded.	YES
Paradigm	No clear unambiguous view, strategy does not match with organisation.	Being a product leader for TPD.	YES

Table T.2: The cultural web for product leaders

Appendix U: What is TPD?