

# 3

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## Concepts of Product Development

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### 3.1 Introduction

There is a certain coherence between Chapter 3 and Chapters 4, 5, and 6 which define the other concepts of network based high speed product development models and processes. My study of literature and the secondary cases form the basis of Chapters 3, 4, 5, and 6. Additionally, the said chapters should be seen as a continuation of the case studies carried out under the previously defined analysis framework described in the articles “Network Based Product Development – Analysis Framework for Case Studies” (Bohn and Lindgren, 2000) and “Network Product Development – Main Phenomena in Network Based High Speed Product Development” (Bohn & Lindgren, 2000) written for the sub-project on network based product development at the Centre of Industrial Production, Aalborg University.

The preliminary research objective on the concept “network based high speed product development” demanded that the researchers should carry out in-depth research on the concept of *Network Based High Speed Product Development*. During the work it became apparent that a series of concepts were related to network based high speed product development and needed to be accurately defined.

Consequently, the objective of such definitions is to clarify basic concepts of the research work and to put into perspective such concepts in relation to the role that they play in today’s and future network based product development. Such concepts will help to form the final framework of the research project.

Specifically, the framework for the definition and understanding of the research project includes the following definitions and answers to questions:

1. The product perspective – What is the product?
2. The product development perspective – related as well as new product development perspective – What is product development?
3. The product development model – What is a product development model?

4. The functions of the NB HS PD – Which functions are involved in the product development process?
5. The product development process – What is a product development process?

## **3.2 Development of Concepts**

### **3.2.1 Introduction**

For a long time up to 2003, concepts of product development had been very stable. Both researchers and industry used the same concepts about e.g. products and product development models and processes. However, as the pressure and focus on speed in product development intensified, some incremental changes came about concepts of product development in the last 5 to 10 years. Consequently, such gradual incremental changes resulted in radical new understandings and definitions of the concept and definition of product development.

Researchers realised that the existing concept of product development did not sufficiently explain the march of events in product development. Additionally, the industry realised that existing concepts of product development cannot match the new demands for product development on the global market.

Concepts of product development therefore changed, increased and were “mixed” in a way hardly ever seen before up to 2003. Concepts of product development were used in new and other ways and the boundaries of the concept of product development change, were developed, and used in ways we had never seen before.

In the following paragraph I will show how such changes in concepts developed both theoretically and in practice.

### **3.2.2 The Product Perspective**

#### **The Theoretical Approach**

Central to the course of a product development process is the creation of a product. If it is reasonable to claim that a product development process has an end or an output, it is the final creation of the product. Thus, we must address the issue of the concept of product and ask the following questions:

- What is a product?

and

- What does the concept of a product comprise?

Several authors have addressed this issue.

*“You may have noticed by now that the new products process essentially turns an opportunity into a profit flow. It begins with something that is not a product (the opportunity) and ends up with another thing that is not a product (the profit). The product comes form a situation and turns into and end.”* (Crawford, 1992)

Crawford’s point of view takes its point of departure in the marketing and customer perspective. In such a perspective the marketing point of view is the motivation of the business – “to create a profit” – whereas the customer point of view is to create maximum satisfaction of the customers’ needs.

However, Crawford’s dimension lacks three important points of view, viz. the design point of view and the technical point of view of the product. The technical and the design point of view are often closely related and will be dealt with collectively later in this chapter. Furthermore, Crawford’s point of view should be seen in the light of his anchorage in the business economic theory conception, where the technical and design point of view are quite different.

To decide the nature of a product, we must therefore take our point of departure in at least five points of view:

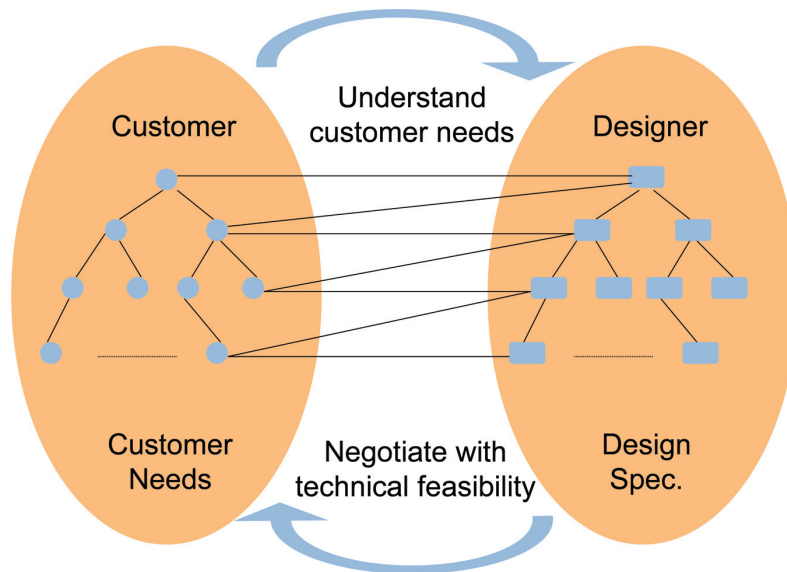
1. the marketing point of view (Philip Kotler, 2001) (Jiao and Tzeng, 1999)
2. the customer point of view (Philip Kotler, 2001)
3. the technical point of view (Eppinger, 2000)
4. the design point of view (Verganti, 2001)
5. the network point of view (Haakonson & Johanson, 1982) (Child and Faulkner, 1998)

To all appearances there is considerable difference between these five points of view and between their view of the nature of a product. We will come back to these different views later in this chapter. However, we will concentrate on the way in which a product is “born”, “dies” or leaves the market.

In the area between the these five points of view, the new product commences, is developed, and its future is decided upon. Many authors have dealt with the “birth” of a product.

*“In the course of a product development the product definition will often be prepared as a cooperation between marketing, customer and designers.”* (Jiao and Tseng 1999)

In their model outlined in Figure 3.1, Jiao and Tseng show the birth of a product as well as the continuous refining.



**Figure 3.1** The Elaboration/Refinement process and product definition.

*Source:* Copied from Jianxin Jiao and Mitchell M. Tseng “A requirement management database system for product definition”; *Integrated Manufacturing Systems* 10/3 [1999] 146–153.

The authors indicate that the product is continuously being formed and defined during the product development process in a close teamwork between customer, marketing, and designers. It is worth noticing that Jiao and Tseng do not operate with more than three partners; the technicians have been left out as single players but have been included in the design function.

Crawford says that a product has a beginning and an end. However, several examinations show that researchers and businesses do not exactly know when the product started – “the big bang” – or when the product is quite finished. Many cases have verified that it is also difficult in the course of a product development process to make the customer and often the technicians agree on a “final start of the product” and on a “final end and completion of a product”. This issue is often subject to major discussions and “fights” between customer and supplier. However, it can be stated that this might be a hopeless discussion. Several businesses and several researchers in 2003 considered therefore the concept of a product to have a propensity to be “floating”, and they believe that



a product is a process without a beginning or an end or with many beginnings and many ends (Corso, 2001).

### **The Practical Approach**

The case businesses used for the present research project mentioned that the decisive characteristic of the course of a product development process was the ability to “freeze” the product as late in the product development process as possible. Businesses like Glunz and Jensen (Case No. 30) and ScotIT (Case No. 55) confirmed this perception. The product is a process with many beginnings and many ends. The business can choose to encapsulate – “freeze” and start its beginning on the market. The product is by “nature” dynamic and offers the possibility of “developing” over a span of time *pari passu* with changes in market demands. Furthermore, the initiation of a product often offers the possibility of several product ends (Corso, 2001) and “encapsulation”.

Thus, the above scenario contradicts Crawford’s point of view with the product having a beginning and an end unless we consider the “frozen” product the end of “the product”. However, the “frozen product” only forms part of the total possibilities of the idea or concept of a product which the business chooses to “encapsulate” and market. By encapsulating or finishing the product, the business has given the product its final definition and have thereby applied a series of consequences and limitations which may at a later point in time turn out to have positive effects as e.g.:

1. Being first in the market
2. Forcing the competitors to improve their products
3. Changing the competitive conditions
4. Possibility of quickly making many variations

However, such effects may also turn out to be negative:

1. First mover disadvantage – the product had hidden, serious flaws which made the customers mistrust the product (GSI Lumonics)
2. Major consequential costs – repairs, upgrading etc. (MV)
3. The customers did not use the product in the expected way
4. The product architecture does not allow changes or the quick making of variations

By “freezing” the product, the developer or the product developing organisation has opted out of some possibilities once the decision has been made. Subsequently, the developer or the developing organisation will have to live with the characteristics of the product (Case No. 54 Grundfos) until a new

product has been developed. However, the “encapsulation” also offers new possibilities. Therefore, it is vital to make the product architecture right at the idea and concept phase so that a maximum of flexibility can be obtained at a later point in the product development process and on the market (Verganti, 2001).

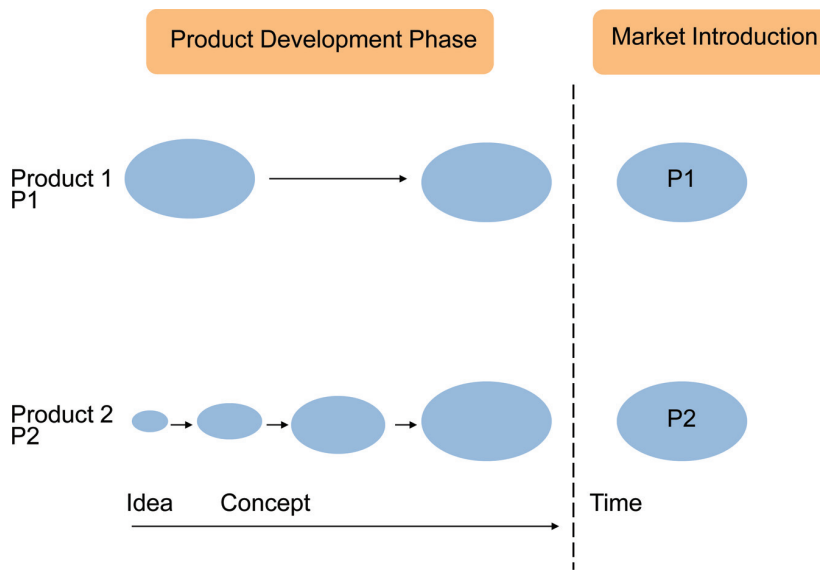
The above picture emphasizes the importance of addressing the two main areas of product definition:

- What is a product?
- When do we consider the product to begin and to be final or finished?

In the present research project, the latter question could easily be answered by defining the finished or the final product as:

*a product is considered finished at the exact time when it is introduced on the market*

A product could also be defined as shown in Figure 3.2 presenting the transition from the product development phase to the market introduction phase.

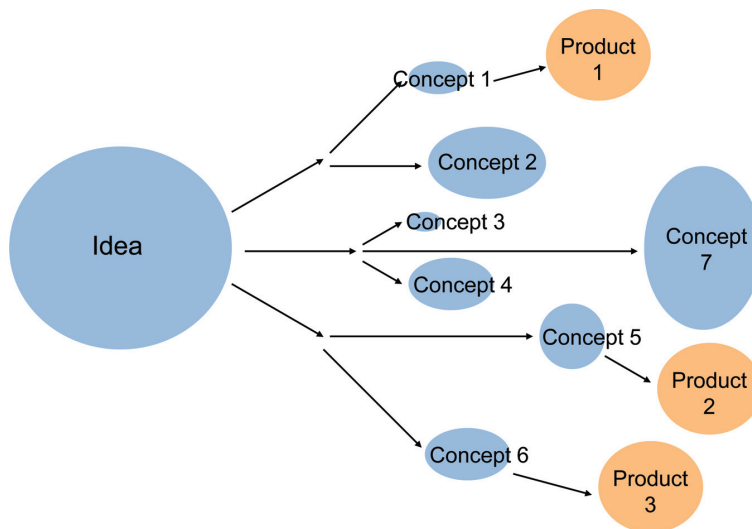


**Figure 3.2** Birth and maturity process of product.

Source: Peter Lindgren, 2001.

In such situations the product development group will generally hand over the developed product to the sales and production department for further market adaption and production (Hein and Myrup, 1985).

Thus, from idea to market implementation, the product undergoes a “birth”, a “maturity process”, and a “market introduction” – with many concepts and product prototypes before final product is decided upon as shown in Figure 3.3. In the terminology of the present product development theory the

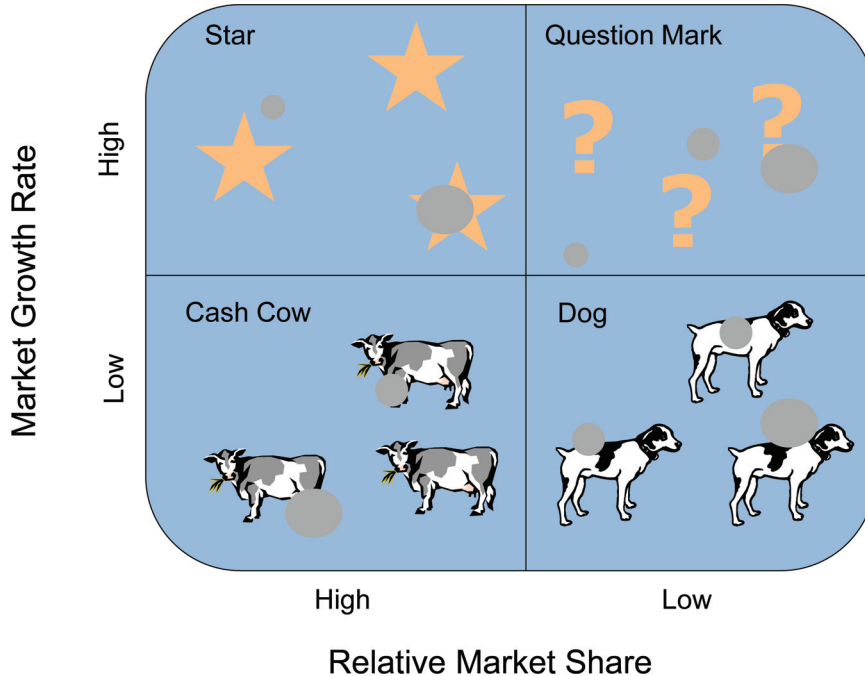


**Figure 3.3** One idea – many concepts, fewer products.

marketing phase designates the final finishing of the product or the completion of a specific product development process. However, we recognize the fact that specific product development processes pave the way for new product development processes and also pave the way for an adaption of the final product during its life cycle in the market – the adaption of parameter mix as shown in Figure 3.4.

The present research project will not focus on the market introduction phase as the project deals with the actual development of the product prior to market introduction, i.e. from idea to market introduction. In other words this project will not in particular address the problems or the product development adaptations related to products which have already been introduced to the market.

However, we therefore found ourselves between two possible definitions of a product:



**Figure 3.4** The Boston consulting group’s market share.

Source: Heldey. B., “Strategy and the Business Portfolio”, Long Range Planning.

- a product is only a product when it is introduced to the market
- a product is a product already when it is an idea or a concept offered to some customers but which has not yet been “produced” to the market

A lot of products in 2003 were sold to customers as the latter definition. The definition of a product therefore depended on:

- the viewer’s approach to the product – an “encapsulated” product or an idea or concept
- the viewer’s focus on before or after the market introduction

In the PhD project the main focus is on the idea and concept phase where the product has not yet been “encapsulated”.

### **The Practical Approach**

The case analysis (Case No. 11 Rossflex, Case No. 30 Glunz & Jensen, Case No. 1 Zara) showed very clearly that the businesses defined the product as

an “encapsulated” product introduced to the market. The businesses did not regard the product as a product before its introduction on the market. However, the customers regarded the product as existing once the idea and concept were “borne” and they did not see an end to the product because it was always there when needed. The technicians regarded the product as finished when the product is technically “encapsulated” and the network regarded the product as existent when the idea and concept were defined.

To finish the answer to the approach to the viewer on – What is a product? – we must therefore discuss the different approaches a viewer could have to a product up to 2003. I saw the following views on the product – the marketing, the customer, the technician, the design, and the network view.

To answer the question of defining a focus before or after the market introduction a discussion on the model and process of product development was central. This will be done in Section 3.4.

### 3.2.3 Marketing and Customer Perspective

#### The Theoretical Approach

The marketing and customer perspective are addressed collectively as these two issues are closely related in that they both take their point of departure in need and want satisfaction or which value the product can give the customer. Yet, the results of the two perspectives differ significant.

In relation to the marketing and customer perspective McCarthy and Perreault define product as follows:

*“the need satisfying offering of a firm or anything than can be offered to someone to satisfy a need or want.”* (McCarthy and Perreault, 1990)

McCarthy and Perreault take the need or want of the customer as the starting point; *need* being what the customer actually needs, whereas *want* is a manifestation of the customer’s desires and is thus a fickle and flighty need characterised by uncertainty and dynamics. As can be seen from the above, *need* can be accurately defined unlike *wants* which leave the product definition with a high degree of uncertainty. *Need* is often connected to existing products or to “incremental change” of existing products, whereas the satisfaction of *wants* can often be categorised as “radical change” where new demands are made on the product, new questions are asked of the shape of the product.

### **The Practical Approach**

The above explanation illustrates how difficult it was to define the concept of a product accurately. This was partly due to the experience that the desires of the customers during the initial phase of product development or even after the completion of the product development process often could not be fulfilled neither by the customer nor by the supplier. Needs and wants of the customer often changed during the product development process which means that the needs and wants of the customer often were significantly different at the beginning of the process compared to his needs and wants at the time of market introduction (Case No. 30 Glunz Jensen) (Case No. 56 Amanda project). Consequently, during a product development process customers often saw the product as a dynamic concept of the product, and the definition of a product could therefore often be characterised as a process towards an “encapsulation” of the final product which was subsequently introduced to the market or to the customer. However, this “encapsulated” product was the start of a process of new wants and needs. The product development process was therefore a driver of continuous innovation.

The above scenario may be the result of technological changes in the market or of changes in customer needs which arise while the product development is in process. The product may even be out of date or not answering the needs and wants already while the development is in process (Eppinger, 2000) (Hart, 2000). From a traditional business economic view this situation is not easy because it was practically impossible for a business in 2003 to earn money if the product never finishes or if the product is never “encapsulated”.

The case research showed that businesses selling goods would provide against such a situation by means of a system requirements specification or of a written agreement of what is the final product or the “encapsulated” product. As opposed to this, the customer would try to safeguard his interest by stipulating that the product was future-orientated or by including open standards in the agreement to make subsequent adaptations to the product (Case No. 57 TDC, Case No. 38 Lyngsø).

The above discussion left the buyer and the seller up to 2003 locked in a situation which required an answer to the question “Does the product have to have a beginning and an end?” If the product has an end, such an end must be the “freezing of small incremental bits the product” and the “market introduction” of “encapsulated bits” of the product.

The question is, however,

- Is it interesting to finish the product?

From a business relationship perspective it is better to have a continuous process “going on” with the customer. It is more interesting and better to regard the product as a process where there are several “encapsulations” going on.

If the product is finished, there is no need for the supplier and customer relationship any longer. In most secondary cases we studied and due to the radical and dynamic environment mentioned earlier, it showed that there is a continuous need for incremental and even radical improvements to what has been developed as “the final product” at a certain time. So the reality is that the product is a process or an ongoing process. Many researchers and many businesses were still “stucked” in 2003 in an old belief that the product was to be finished instead of finding out how they could do business on a product which was a process.

This stressed the necessity of viewing the product and the development of the product as a process in the future which may never reach its end. Such an argument was supported by several cases (Case No. 50 Microsoft, Case No. 30 Glunz Jensen) (Corso, 2001) (Verganti, 2002). In these cases the businesses had passed directly to prototyping perhaps realizing that the final product definition could not be made until the product had been introduced on the market and maybe not even until the customers had tested the product or had found new use for the product.

The present discussion also explained why some businesses in 2003 (Case No. 50 Microsoft) continuously market beta-versions or very early beta-versions of their products (Case No. 50 Microsoft) The business had realised that it will not be possible and it was not business economically advantageous to “finish” the product at a certain time. The business realised that product should not be finished because customers always wanted to change the product and always had a want for new product features (Case No. 55 Scooter IT, Case No. 50 Microsoft, Case No. 30 Glunz & Jensen).

The discussion also explicated the growing demand for and movement towards service, adventures and other not well defined products in 2003 – virtual products which were characterized exactly by having been created as an on-going process or ongoing product development in cooperation with the customer. Such products were generally produced in the “here and now” and “on the market” which meant that the final results were difficult to predict.

Additionally, it was often a matter of “trial and error” before the final product definition could be determined.

This of course accentuates the dynamics and the possibilities as well as the element of uncertainty of the product. It therefore seemed to be necessary to change the classical and traditional view of the product in 2003 and change our view of the product to a process view which defines the product as:

*“the product is regarded as a process in which the business creates a product – or a platform – with many solutions, many possibilities of extension and many starts and ends.”*

When this definition is the case then a discussion of tangible and intangible products is relevant.

### **3.2.4 Tangible and Intangible Products**

#### **Theoretical Approach**

In spite of the above mentioned discussion several authors put another dimension to classify the final product. Dibb defines it as follows:

*“everything, both favourable and unfavourable, that one receives in an exchange”* (Dibb et al., 1991:208).

Obviously, Dibb gives a very open and vague definition of the product. At the same time, he designates the consideration against which the seller will produce the product. Such consideration indicates one of the differences between the marketing and the customer perspective. It is obvious that there is a potential conflict of different views on this whether it is the marketing or the customer view that is to be used. The optimum of product development is of course to create a product which satisfies both views. Then it is possible to make the exchange and conduct the business.

Stanton makes a more specific definition of the concept of a product by indicating that the product consists of tangible as well as intangible attributes:

*“a product is defined as a set of tangible and intangible attributes, including packaging, colour, price, quality, brand, and the services and reputation of the seller. A product may be a tangible good, service, place, person or idea.”* (Stanton et al., 1991:168–9)

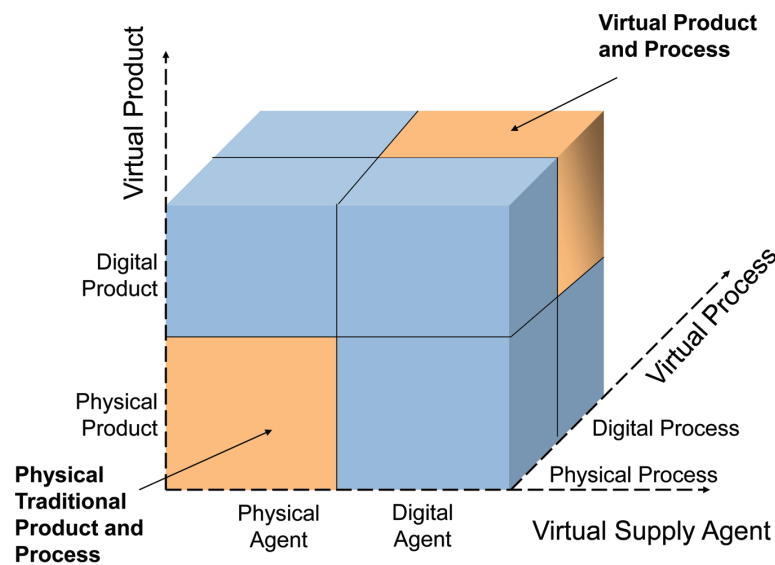


Thus, according to Stanton the concept of a product includes tangible and intangible attributes which are the features on which the global market is focusing today. There is a strong trend towards less tangible products and more intangible products.

### Practical Approach

Stanton's definition of a product corresponds to the developments which had taken place in industry up to 2003. Practically all products contain tangible and intangible attributes, and intangible attributes make up an increasing part of the products today. (Case No. 59 Nokia, Case No. 71 Nokia (perceived value)).

In Figure 3.5 the product dimensions are described and the above-mentioned development on the basis of the increasing influence of products changing from "encapsulated" final physical products to "encapsulate mixtures of physical, digital, and virtual processes.



**Figure 3.5** Product and process dimensions.

*Source:* Inspired by Turban 2001.

As can be seen from the Figure 3.5 my hypothesis was that there was a move in industry in 2003 from the physical product to a mix of physical, digital, and

virtual products. Moreover, the model indicated how the creation of a product moved from being a physical process to becoming a digital process and end up being a virtual process. Additionally, the product moves from physical supply agents to a mixture of physical, digital, and virtual supply agents. All combinations of the above will therefore be the possibilities and the potentials for the future global market. As can be seen there was a huge unused potential of new products and processes.

As a consequence, this research project had chosen to regard the concept of a product as a total mixture of total products or total processes consisting of both tangible and intangible attributes and processes (Kotler, 2000) (Verganti, 2000).

### **3.2.5 Needs and Wants of a Product**

#### **Theoretical Approach**

Our definition of a mix of a total product and process was to some extent similar to the marketing definition of a product. Philip Kotler (2002) describes the concept of a product as follows:

*“a product is anything that can be offered to a market for attention, acquisition, use or consumption, that might satisfy a want or need.”*  
(Kotler, 1994: 432)

Kotler emphasized *want* and *need* but at the same time he referred to the use of the product or the role that the product was meant to play for the customers. In other words, the function of a product was meant to satisfy specific wants and needs with the customers. As can be seen later in this book, the success rate of a product or of its performance was often proportional to the ability of the product to satisfy the customer’s needs – or the “voice of the customer” – or the value a product gave to the customer.

However, my definition of the product was different from Kotler’s definition because it stressed the mixture of product and processes, in particular the process element. Therefore, my definition of the product was:

*“a product is a mixture of anything physical, digital, or virtual that can be offered to a market for attention, acquisition, use or consumption, that might satisfy a want or need”*

This research project focused on the need, demand, and value which a product gave to the customer because it was in this area that businesses had the

possibility to make business. The wants of the customers were one of the important drivers to new products and processes. However, the business had to carefully analyse such wants to fulfil their purpose of making a profit.

Bradley emphasized Kotler's focus on the customer perspective in which the customer attempts to satisfy his needs with the product:

*“a product is therefore, anything that satisfies the customer and increasingly it is something which has embodied in it a high level of service. The consumption of products and services is the way in which users attempt to satisfy needs.”* (Bradley, 1995)

The needs and demands of a customer could be related to the value perceived by the customer. Such a value can be quite different from what the business, the technicians, or the network think are the needs and wants of the customer. The Nokia (Case No. 71) and Ford (Case No. 72) cases showed this very clearly.

The customer perspective was instead defined as the point of view of the customer where the customer's wants are fulfilled regardless of the customer's real needs and demands.

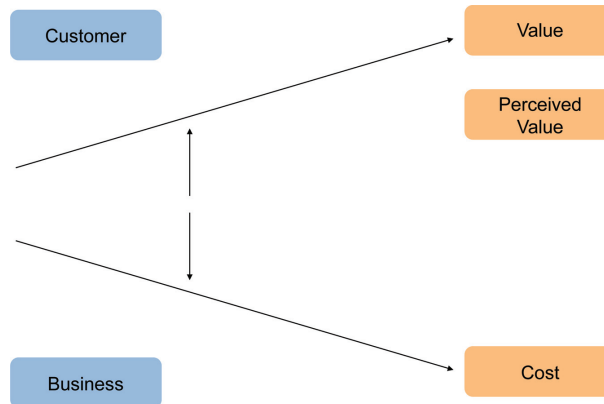
The new marketing view was defined as the point of the customer's perceived wants and needs fulfilled regardless of the customer's real needs and demands. This meant that the product can easily be “constructed” less complicated than the technicians, the network, and the customer think it should be as long as the product and the process fulfil the customer's perceived value. An example of this was verified in Nokia (Case No. 71), Ryan Air (Case No. 62), and Zara (Case No. 1).

The new marketing view and the customer view do not necessarily contradict each other. In the future, seen from a business economic outlook, the challenge in 2003 would be to maximize profit and/or reduce costs of production or product development with regard for the maximization of the customer's perceived value.

Consequently, the seller also has needs which he wishes to satisfy by participating in and entering into a product development process. Such needs are not necessarily merely of a short-term business economical character but can also be of a long-term strategic character.

Most often the customer perspective will take the side of the customer or will regard the product as a means to obtaining the highest degree of satisfaction for the customer without regard for the business economic interests of the seller. The marketing perspective on the other hand takes its starting

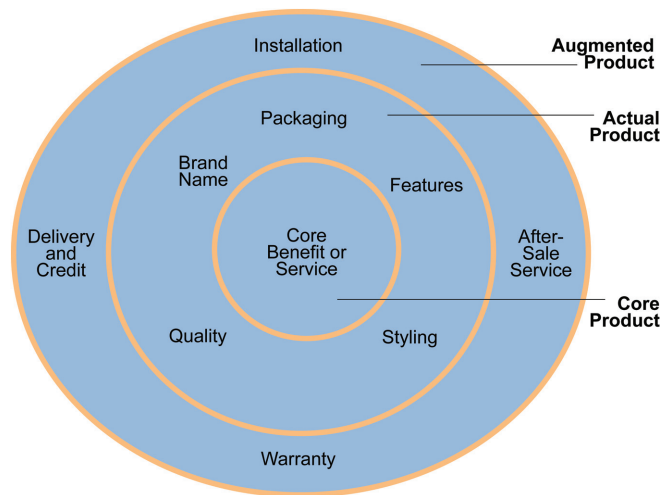
point in the needs, wants and perceived value of the customer and with a regard to business economics and profit maximization as shown in Figure 3.6.



**Figure 3.6** Cost value.

The field of tension on perceived value to the customer is decided between seller and buyer in the framework for product design from idea to market introduction.

Thus, the product related point of view of this research project took the new marketing outlook as its starting point. This outlook also formed the basis of the analysis framework of the product concept as illustrated in Figure 3.7.

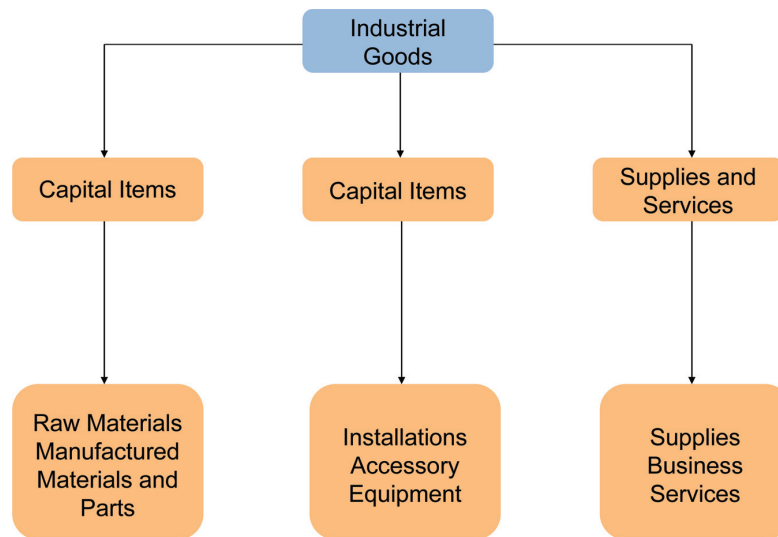


**Figure 3.7** Three levels of a product.

Source: Kotler, P., 2001.

The model takes its point of departure in the consumer perspective but the basic elements of this perspective were of central importance in the further analysis because B2B products contain the same basic elements, however, seen from a business to business point of view.

As the research project deals with business-to-business products, the products can be classified according to the model shown in Figure 3.8.



**Figure 3.8** Classification of products.

Source: Kotler, P., p. 436–438 Marketing Management 8th edition 1994.

To throw light on the problems of this research project, I choose to consider all classes of possible B2B products as relevant. As will appear later in this book, most of the cases and most of the empirical data were concentrate on products in the business-to-business market.

### 3.2.6 The Design Perspective

The design perspective had already been thoroughly described by Eppinger in his model reproduced in Figure 3.9.

The design perspective differs from the technician's perspective by not only focusing on functions but also and in many cases more on meaning (Verganti, 2000). Verganti went as far as to talk about design driven innovation. Thus, he put forward the idea that a product consists of three main components:

|  | Generic (Market Pull)  | Technology Push   | Platform Products   | Process Intensive  | Customized   |
|--|--|---|---|--|--|
| Description                                  | The firm begins with a market opportunity, then finds appropriate technologies to meet customer needs. | The firm begins with a new technology, then finds an appropriate market.                                | The firm assumes that the new product will be built around an established technological sub-system. | Characteristics of the product are highly constrained by the production process.   | New products are slight variations of existing configurations.             |
| Distinctions with respect to generic process |  | Planning phase involves matching technology and market. Concept development assumes a given technology. | Concept development assumes a technology platform.  | Both process and product must be developed together from the very beginning, or an existing production process must be specified from the beginning. | Similarity of projects allows for a highly structured development process. |
| Examples                                     | Most sporting goods, furniture, tools.   | Gore-Tex rainwear, Tyvek envelopes.   | Consumer electronics, computers, printers.  | Snack foods, cereal, chemicals, semiconductors.  | Switches, motors, batteries, containers.                                   |

**Figure 3.9** Summary of variants of generic development process.

Source: Eppinger, 2000.

- Language
- Message
- Meaning

The design perspective was very much related to the perceived value of the customer.

The design perspective was also closely related to the performance criteria or the design because the “soul” of the product is often related to and created by the designer. In terms of performance an excellent design can mean the difference between the life and death of a product. Additionally, an excellent design will make it exceedingly difficult – and in some cases impossible – for the competition to plagiarize or copy (Verganti, 2001).

Verganti makes a well-defined distinction between the design perspective and the technical perspective. Thus, Verganti maintains that the technician generally worries about functions which the designer sometimes does not necessarily do.

*Products with meanings but without function* (Philip Starke)

### **Practical Approach**

The B&O case (Case No. 2) reveals how design and protection of a good design could be extremely valuable to a business in 2003. B&O focus on design and perceived value at the customers'. This positions the business in an extremely attractive competitive advantage situation in 2003 where it was possible to gain a high price for their products.

Nokia (Case No. 71) was another example of how focus on design left the business in a competitive situation where Ericsson and other mobile telephone businesses found it very hard to compete up to 2003. Nokia focused on perceived value, and cost leadership production left the business with a significant net profit margin with which none of the competitors could compete at this point in time – 2003.

#### **3.2.7 The Technical Perspective**

The technical perspective is not in focus in this PhD project. However, I stress the importance of this perspective and its role as one of the main reasons for high speed and time pressure in “the field of product development”. Furthermore, the technical perspective made it possible to move businesses or products into new areas of digital and virtual products and processes.

Technically, everything the customers want seems possible either in a short-term or a long-term perspective. Most technical equipment became less and less expensive up to 2003. This meant that costs were no longer a limit to implementation of new technical features and products. However, there were still technical limits to new products as Richard Leifers (2002) described very well in his book about radical product development. Customers often did not adopt new technical products and processes in the way which the technicians had intended.

Therefore a close coordination between market, network, business competences, and the technical perspective of the product and the process were vital and important. The Amanda case (Case No. 56) and the Lumonics case (Case No. 37) show clearly the possible outcome when the technical perspective were forgotten and not well integrated in the product development project.

#### **3.2.8 The Network Perspective**

This perspective will be dealt with in Chapter 4.

### 3.2.9 The Total Product and Process Concept

On the basis of the above discussion, this project had chosen to define the product as follows:

*“a mixture of business to business product and process that can be offered to a market for attention, acquisition, use or consumption, that might satisfy a want or need both tangible and intangible”*

Accordingly, I choose to pay attention to business-to-business products and processes from idea/concept, to product development, to drivers to market introduction, and back to a new idea and concept development in a continuous product development process. This is illustrated in Figure 3.10.

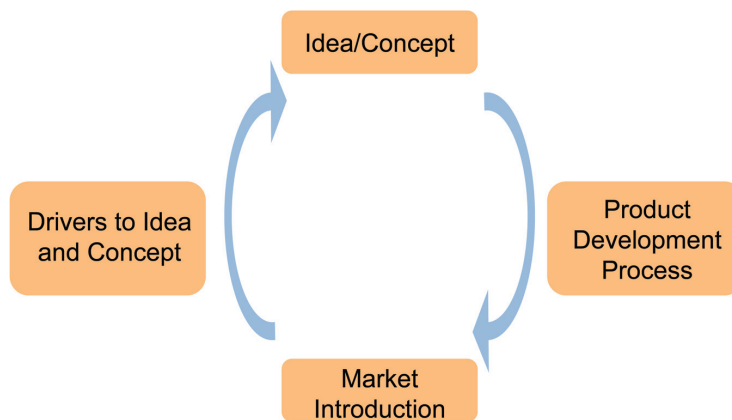


Figure 3.10 The total product concept.

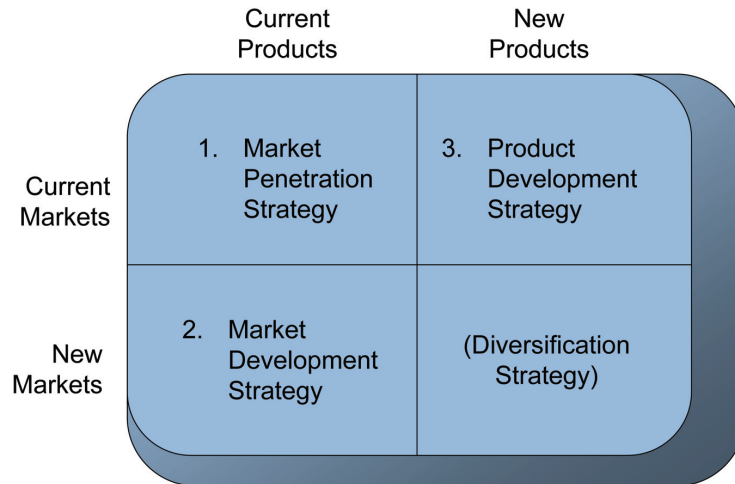
### 3.2.10 Other Product Perspectives

#### A Strategic Product Perspective

Some authors (Abell, 1980) saw product development in a much wider perspective than the ones outlined above. Thus, market development and market penetration were considered product development just as integrative growth was considered an extensive form of product development. Such an outlook is illustrated in Figure 3.11.

The above-mentioned PD strategy is relevant because the boundaries of product development strategy are integrated into and blended with the other three strategies. At the same time the PD strategy was under high





**Figure 3.11** Three intensive growth strategies.

Source: Ansoff; Product/Market Expansion Grid.

pressure for change. In this research project I choose to deal primarily with product development processes which were taking place in the shaded area in Figure 3.11. As a result of this, I decided not to include pure market development or integrative growth. Market penetration of existing products has been left out where such market penetration includes only promotion, price, or distribution adaptation.

### 3.3 The Strategic Product Development Perspective

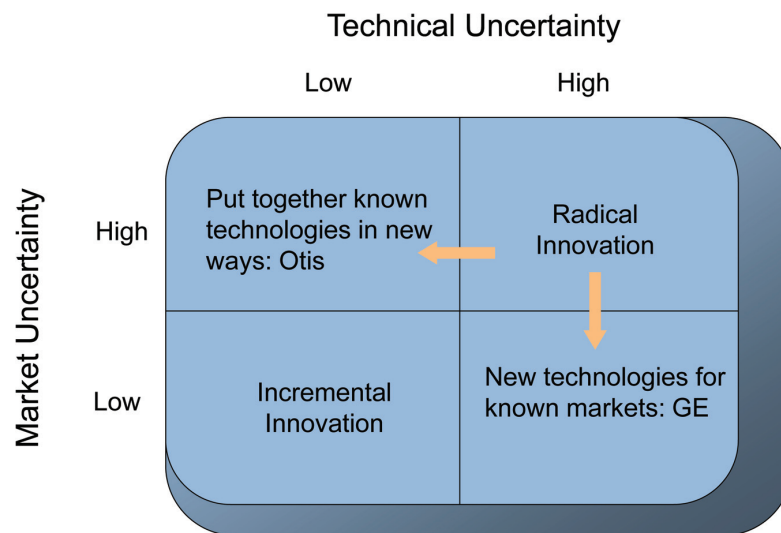
#### 3.3.1 Theoretical Approach

There can be a tremendous difference between the nature of a product development process and the product which is meant to be created through the process. Ansoff described the differences of the innovative elements or the degree of innovation in product development in his model reproduced in Figure 3.11.

Ansoff considered the product development assignment less complicated when the business was developing for existing customers or for existing markets because the customers and their characteristics were known to the selling business. Thus, Kotler 2002 maintains that the element of risk and the degree of uncertainty of the product development process and of the selling business had diminished when operating in this area.

Likewise, the degree of innovation in the product oscillates from variations on known or existing products, e.g. change of colour, change of size, new functions, to completely new and highly innovative products to the market, the customer and the business which they have not seen before. Other things being equal, the degree of uncertainty and the element of risk will increase concurrently with the degree of innovation which the product must achieve or perform. Such an increase in risk and uncertainty may increase because both the buyer and the seller lack knowledge and know-how of the product or of the manufacturing of the product. Consequently, the final product of the most innovative product development process – “The trouble shooting situation” (Håkanson and Johanson, 1982) – is so innovative and radical that neither the customer nor the seller know about the optimal product (Leifer, 2002).

Leiferd stated that there are four main types of uncertainties on radical innovation as shown in Figure 3.12:



**Figure 3.12** Nature of phenomenon.

Source: Ricard Leiferd.

- Market Uncertainties
- Technical Uncertainties
- Organisation Uncertainties
- Resource Uncertainties

Furthermore, he claimed that the uncertainty is high in all four areas in cases of radical innovation.

However, Lefierd (2002) claimed that businesses had to intensify their involvement in future radical product development to gain competitive advantage and continuous survival. Under such circumstances the parties will often agree on an experimental design of the product development process to reach a common goal or to achieve features that both parties want from the product (Verganti, 2001). The final product becomes flexible and dynamic right until the market introduction. The above of course influences the product development model.

The innovative element of product development can also include that the market and the customer are variables and unknown to the selling business. This area is named “the diversification area” and covers both product development as well as market development. Different degrees of diversification can be stressed

1. Concentric diversification
2. Horizontal diversification
3. Conglomeratic diversification.

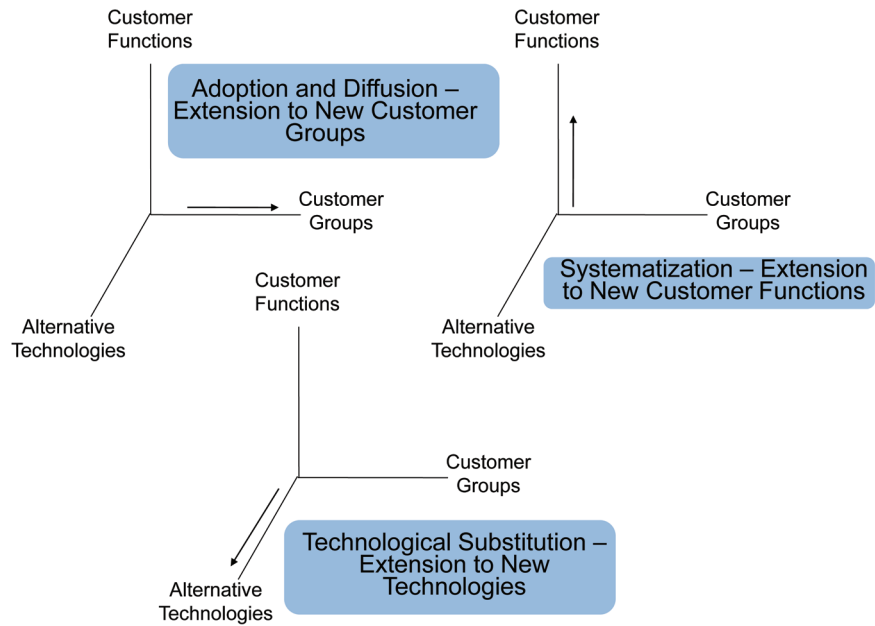
It is apparent that the element of risk and of uncertainty is increased according to the degree of diversification contained in the product development process. This had been proved in several surveys (Wind, 1973) (Abell, 1980) (Leifers, 2002).

Abell (1980) underlines and extends the assessment of the strategic risk by showing the consequences it will have when a business involve themselves in diversification and especially in conglomeratic diversification. When businesses force themselves into the area of diversification, they move outside their existing SBU with a change to customer needs, customer groups, and customer technology. This is shown in Abell’s Figure 3.13.

Balachandra takes it even further when repeating the above but at the same time seeing the product development task specifically in relation to the innovative element of a product development process.

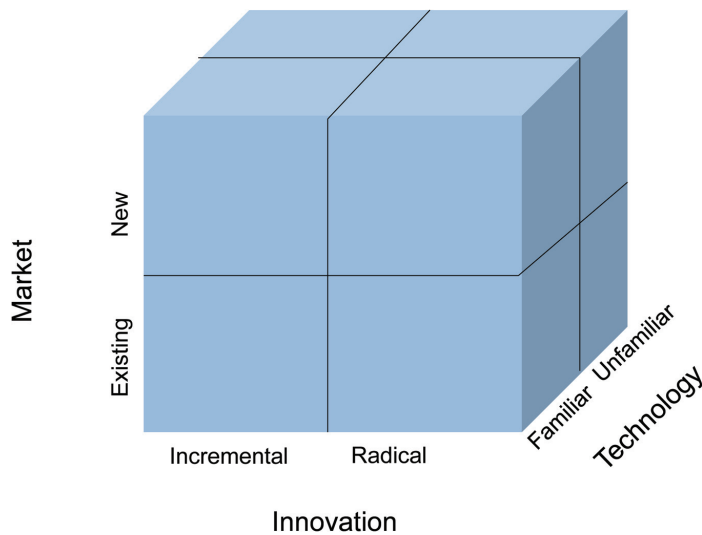
Thus, Balachandra suggested that the various product development processes can be described on the basis of three contextual variables as shown in Figure 3.14.

1. The nature of the innovation – incremental, radical
2. The nature of the market, existing, new
3. The nature of the technology – familiar, unfamiliar



**Figure 3.13** Defining the business – market evolution in three dimensions.

Source: D. F. Abell Defining the business The starting point of strategic planning.



**Figure 3.14** Elaboration/Refinement process and product definition.

Source: Balachandra, R. "An expert system for new product development projects" Industrial Management & Data Systems 100/7 [2000] 317–324.

Richard Leiferd (Leiferd 2002) supports Balachandra's definition by his definition on incremental and radical product development. Leiferd talks about radical product development as developing new to the market products.

Consequently, there were at least four strategic areas on which a product development process and a new product development project could be judged. These four areas are:

- The Customer Need Dimension – definition
- The Market Dimension
- The Technological Dimension
- The Innovation Dimension

Yet, the Market Dimension ought to be divided into two separate dimensions, the customer group dimension – the micro level (Abell, 1980) and the market dimension – the macro level (Albaum, 1994). Furthermore, the Technological Dimension should also be divided into two separate dimensions; the customer technological dimension (Abell, 1980) and the pure technological dimension. The former can be defined as the production technological method by which the manufacturer chooses to satisfy the wants and needs of his customers. The latter can be defined as the collection of technologies needed to meet the product development challenge.

Comparing the theories of Abell and Balachandra more closely, we realized that both of them characteristically emphasize the strategic dimension and the customer/market dimension. Furthermore, both authors underline the technological perspective, whereas the innovative perspective is considered differently by the two theorists. Balachandra considered the innovative perspective in the light of the product development perspective, whereas Abell considered it in the light of the strategic business perspective. However, both authors agreed that the element of uncertainty, risk and dynamics are radical when developing for the radical, new, and unfamiliar area. The handling of this area and the insight into the unfamiliar, the new, and the radical area became increasingly important during these years when the market life of a product was continuously diminished (Hamel and Prahalad, 1994) (Sanchez, 1996) (Leiferd, 2002). Such a move offered the possibility of radical competitive advantage. However, this research project and book will not put particular focus on the radical product development area.

In order to establish whether the theories outlined above would influence the speed of product development after 2003, I attempted to place and characterize each separate business case and each business joining the survey of this research project according to Abell's three dimensions, according to

Balachandra's innovative dimension, and according to Sanchez' classification of stable, evolving and dynamic product Market context. The characteristics are outlined in Table 3.1 below.

**Table 3.1** Characteristics of product development assignment

| Product Development Characteristics  | Variable 1  | Variable 2 |
|--|-------------|------------|
| Customer Needs (Abell, 1980) (Kotler, 2002)  | Old         | New        |
| Customer Group (Ansoff, 1980) (Balachandra 2000)<br>(Abell, 1980) (Kotler, 2002)     | Existing    | New        |
| Customer Technology (Abell, 1980) (Balachandra)<br>(Sanchez, 2000)                   | Existing    | New        |
| Production Technology (Abell, 1980) (Sanchez 2000)                                   | Familiar    | Unfamiliar |
| Market (Ansoff, 1980) (Balanca, 2000) (Abell, 1980)<br>(Kotler, 2002) (Leifers 2002) | Existing    | New        |
| Technology – One or Few (Balachandra, 2000) (Sanchez,<br>2000)                       | Few         | Many       |
| Innovation – Product Development Assignment (Ansoff,<br>1980) (Abell, 1980)          | Incremental | Radical    |
| Innovation – Strategic Area (Abell, 1980) (Ansoff, 1980)<br>(Balachandra, 2000)      | Existing    | New        |
| Process (Boer, 2001) please see later  | Old         | New        |
| Competition (Porter, 1980)   | Low         | High       |
| Network (Coldmann & Price, 1995) (Child and Faulkner,<br>2001) please see later      | Old         | New        |

Table 3.1 primarily summarizes the characteristics of the product development assignment and presents the structural framework characteristics to the task of the product development project. This will be commented on later in Chapters 7 and 8. Such a summary, however, does not deal with the choice of product development model or of the product development process. It is therefore necessary to discuss the product development model in detail.

### 3.4 The Product Development Model

In a previously published article (Bohn & Lindgren, 2000) as well as in Chapter 1 of this research project various product development models were mentioned. We described the development in product development models since the 1960s in order to understand and describe the research in product development processes and models. On the basis of this work, the following analytical framework for NB HS PD emerged.

At an early point in the process it became apparent that the framework had to contain four basic elements:

1. The types of product development models.
2. The functions involved in the NB HS PD – i.e. the departments/ functional areas involved in product development.
3. The core of the NB HS PD – i.e. the mission, the objectives, the strategies, and the resources controlling the product development project.
4. The phases in the product development process.

In the following I will discuss items 1 and 2 together.

### 3.4.1 PD Models and Functions in NB HS PD

Apart from the contributors mentioned in the article, initial inspiration to the above model had been Sarens (1984) and Hart et al. (1999). The latter two classify the product development models into five categories.

1. Department Stage Models
2. Activity Stage Models
3. Decision Stage Models
4. Conversion Process Models
5. Response Models

#### Department Stage Models

*“These describe the NPD process by focusing on the departments or functions that hold responsibility for various tasks carried out” . . .*

*“The ideas are often assumed to arise in the R&D department; the engineering function will then “make” the prototype, after which production will become involved to plan and carry out the launch.”*  
(Hart, 1999)

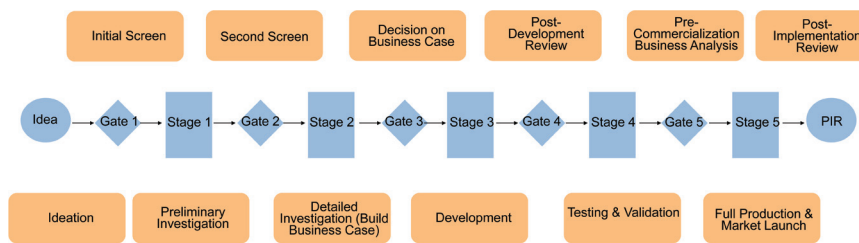
Hart presented the following criticism:

*“These representations are rather outmoded as it is now accepted that the “pass the parcel” and “relay” approach to NPD from one department to the next is too time-consuming and does foster ownership of and strategic responsibility for the new product and there is no market feedback since marketing is presented with the product to market.” . . . “These models have been abandoned by the literature which examines NPD and by major businesses as more NPD cases show that everything happens mostly simultaneously.”*  
(Hart, 1999)

### Activity Stage Models

*“This type of model improves on the department model-stage models through its focus on actual activities carried out, which include various iterations of product development and market testing.”* (Sarens, 1984) (Hart, 1999)

An example of this model is shown in Figure 3.15.



**Figure 3.15** Activity stage model.

Source: Cooper, 1993.

Hart presented the following criticism:

*“These models have been criticized for still promoting a pass the parcel approach to NPD since the activities are still seen to be the responsibility of separate departments or functions.”* (Takeuchi and Nonaka, 1986)

### Decision Stage Models

*“The model describes processes consisting of stages of activity, followed by review points, or gates, where the decision to continued (or not) with the development is made. These NPD models are known under a number of different names, depending on their origin: (Hart, 2000).”*

Such models include i.a.:

- Phase Review Process model
- Stage-Gate Process model
- Pace model
- And others model

An example of these types of models are shown in Figures 3.16 and 3.17.



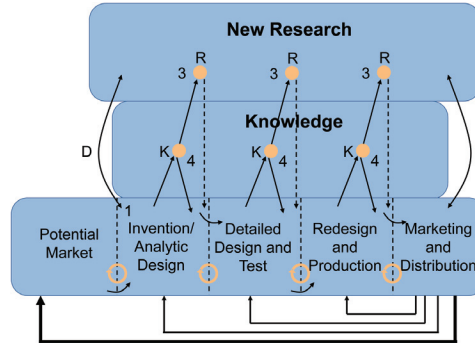


Figure 3.16 Chain model.

Source: Christensen, Jens Frøsløv; Produktinnovation – proces og strategi.

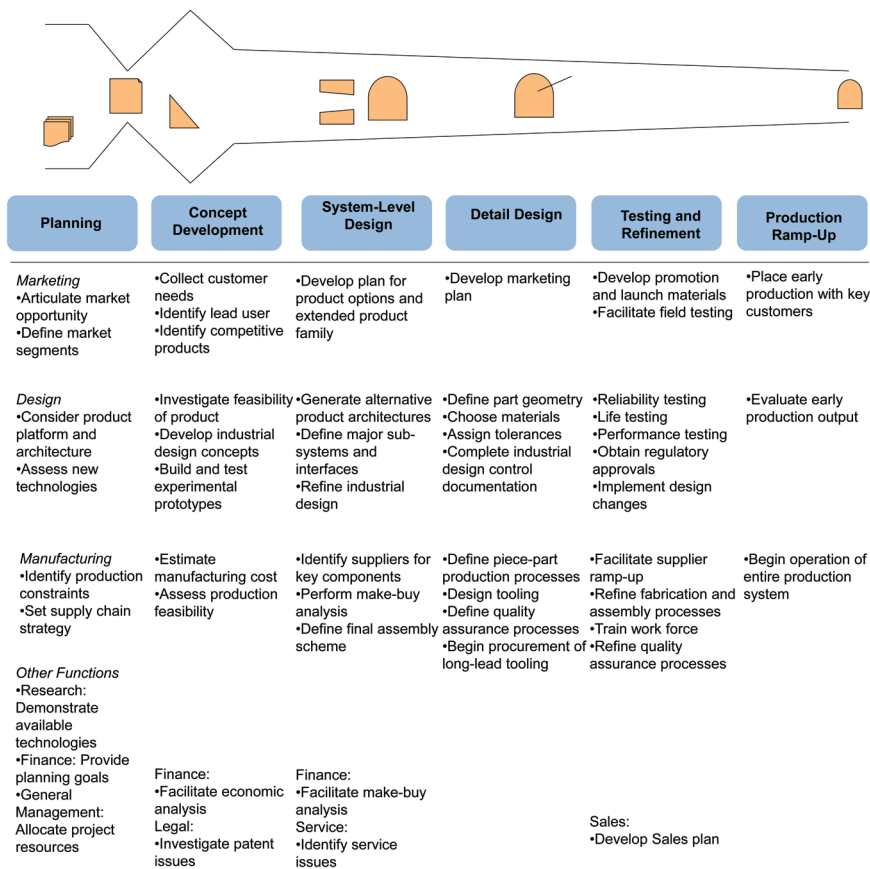


Figure 3.17 Generic product development process.

Source: Eppinger, Steven D.; p. 16.

Hart gave the following criticism:

*“This approach clarifies the reality and importance of feedback loops, which although not impossible within the framework of the simpler activity-stage models, are usually not highlighted either. With the decision-stage models, each stage is viewed in terms of its potential output.”* (Sarens, 1984) (Hart et al., 1999)

### **Conversion Process Model**

*“These NPD models provide little insight into the NPD process, since they view it as a “black box” in an attempt to get away from the imposed rationality of departmental, activity, and decision based models. The alternative conversion process is a collection of the unspecified tasks which may or may not be carried out, depending on the nature of the innovation.”* (Hart, 1999)

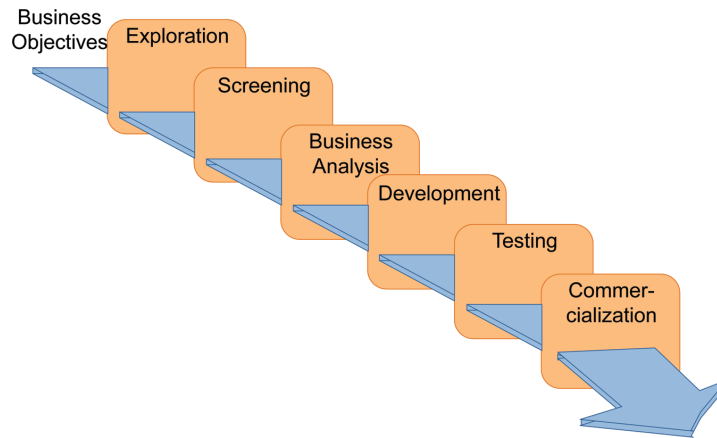
Hart (2000) gave the following criticism:

*“Essentially, a series of inputs are envisaged, which may be composed of information on customer needs, a design drawing or an alternative manufacturing procedure. Over time, depending on a multiplicity of factors, including human, organizational and resource related, this input is converted into an output.”* (Sarens, 1984) (Hart, 1999)

### **Response Models**

These models take their starting point in changes taking place at the beginning of the NPD (Becker and Whistler, 1967). These models focus on the individual's or on the organisation's response to changes such as new product ideas, or R&D project proposals in terms of acceptance or rejection of the idea or project. A number of factors influencing the decision to accept or reject the proposal are helpful to the extent that they provided a new angle on what might otherwise be called the screening stage of the NPD process.

The two models that had been most widely used in and validated by research until 2003 were the decision- and activity-stage models. An example of the activity-stage model is shown in Figure 3.18.



**Figure 3.18** The Booz, Allen and Hamilton activity- and stage model of new product development.

Hart gave the following criticism to the model:

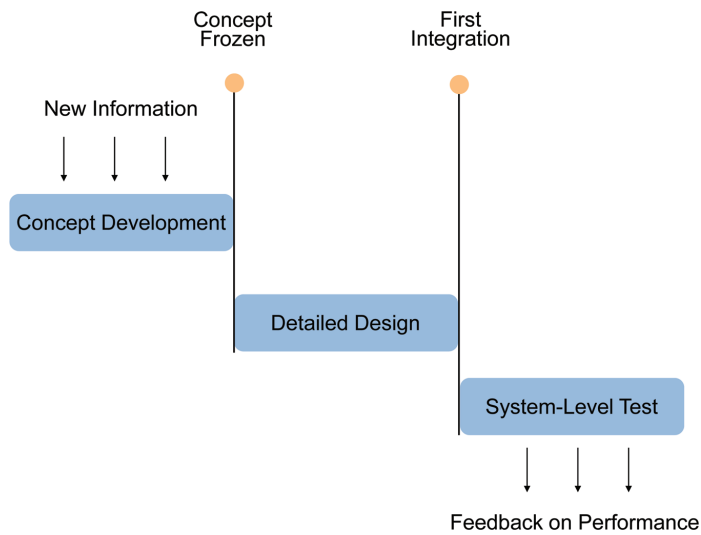
The NPD process is idiosyncratic to each individual firm and to the new product project in question. Further if a new product concept fails the concept test, then there is no guidance as to what might happen next. Another crucial issue related to the activity- and decision-stage models is that the models do not adequately communicate the horizontal dimensions of the NPD process. For example if, at the product development stage, production people have a problem which pushes production cost up, this could affect market potential. The marketing and technical assumptions need to be reworked in the light of this new information.

These shortcomings of the activity-stage models resulted in the advancement of the idea of parallel processing, which acknowledges the iterations between and within stages, categorizing them along functional configurations (Baker and Hart 1999).

### Flexible Models

Roberto Verganti stressed the importance of developing the existing product development models e.g. the stage gate models because of their lack of flexibility in relation to strong, dynamic, and rapid changes on the global markets. Stage gate models seem to be too inflexible when businesses entered a market of rapid change and major dynamics. Stage-gate models turn out to be too expensive for businesses focusing on the dynamic and unstable “field of product development”.

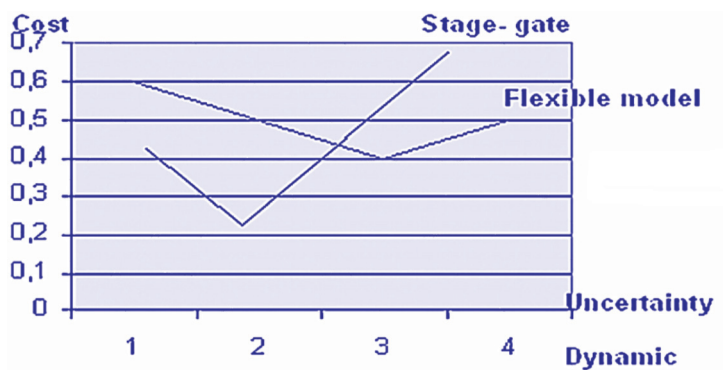
Verganti's suggestion of a more flexible product development model is shown in Figure 3.19 below.



**Figure 3.19** Flexible model of product development.

Source: Verganti, R., *Developing Product on "Internet Time"*, 2001.

Verganti argued that flexible models would have some cost advantages when moving into uncertain and dynamic markets and technical areas as shown in Figure 3.20 below.



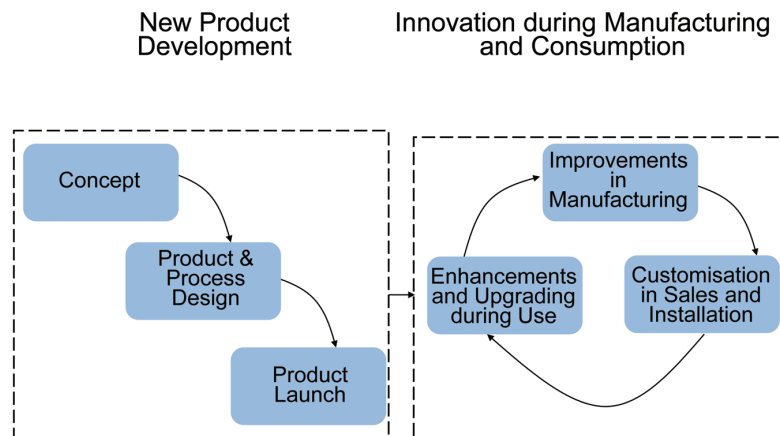
**Figure 3.20** Costs of flexible and stage-gate product development models related to uncertainty and dynamics. Inspired by Roberto Verganti.

At the same time Verganti stressed the important issue of creating a product architecture at the very beginning of the product development process. Otherwise, he argues, the product development project would end up in chaos which is not the intention of the flexible models. A case to show the use of flexible models is the Microsoft case (Case No. 50).

The criticism of the flexible product development models maintains that if the models are not chosen and treated in the right way, they will create chaos in the product development project and the businesses will suffer a major loss of money. Flexible models were argued to be best used in flexible and dynamic product development environments.

### “On the Market” – Product Development Models

A large Italian research carried out by Mariano Corso and others at Polytecnico de Milano on the Italian SME industry showed new perspectives of product development models in 2002. Case research (Case No. 55 SCOIT) showed that the major part of product development was carried out as an “on the market” product development process between customer and suppliers. The product development was mainly focused on incremental “on the market” product development activities. The best result of these product development activities and ideas were carried back to the businesses afterwards to be built into new products or more radical product development projects. An example of such a product development model is seen in Figure 3.21.



**Figure 3.21** Process of continuous product innovation at single product level.

Source: Inspired by Corso, M., 2001.

The “on the market” product development model was one of the first attempts to integrate network partners in the product development model. I will elaborate on this type of model in Chapter 8.

The research project tried to verify the product development models of the case businesses. In this way I hoped to be able to analyze the businesses product development model and product development process and to verify which NPD model was actually being applied.

The criticism of the “on the market” product development model was that there had to be a very tight leadership on which product development can be attended “on the market”. Otherwise, – as I have discussed earlier – the product development activity can turn out to be too highly based on the customer view. This may result in businesses not earning money.

### **Practical Approach**

The secondary cases showed that it was the decision and activity stage models that were the most frequently used models and the best documented of the known NPD models. Hart (1999) and Biemans (1992) verify this result and my hypothesis was that this will also be the result of the empirical data on businesses joining the primary research. Hart (1999) and Biemans (1992) also maintain that the decision stage model was really an extension of the activity stage model and can be adapted to incorporate input from third parties. This makes it potentially useful as a means of integrating other players in the NPD process such as network partners, suppliers, customers, and others. Such an integration is the next important focus of this research project in regard to the network perspective.

#### **3.4.2 The Core of the NB HS PD**

The decision on a strategic core to the product development activities are critical activities prior to the beginning of the product development process (Wind, 1973) (Cooper, 1993) (Clark & Wheelwright, 1993) (Hart, 2000) (Verganti 2002). The product development project and the activity can “stick” to the core and know about the mission, goals, strategy, organisation, and boundaries to network partners.

#### **3.4.3 Informal and Formal Product Development Models**

##### **Theoretical Approach**

Most literature on product development maintained that businesses had a formal product development model in accordance with which they carried out their product development (Bohn & Lindgren, 2002).

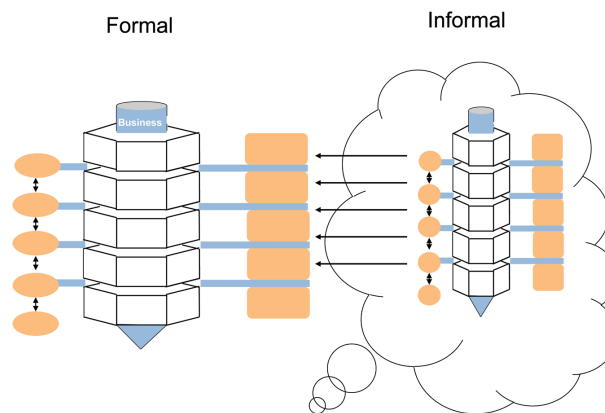
An increasing number of cases in product development literature including my own explorative case research verified and stressed the existence of another model – the “informal product development model or the informal product development process” which runs parallel with the official product development model and process. This hypothesis was indicated both in theory and in practical product development especially when radical product development projects were carried out (Leifers, 2002). The research project wanted to verify this and its impact on high speed product development.

### Practical Approach

The secondary cases showed that the case businesses would often display their “official” product development model (Case No 73 Lego; Cases No. 38 Lyngsø) but when looking into the case it was strongly indicated that an informal product development model and process was taking place in the business.

My hypothesis was that the classic stage-gate models and official models could not explain the entire course of the product development. It was maintained that when it comes to “gaining time”, increasing the speed of the product development process, and developing such products as the customers want, such informal product development models were often more decisive than the formal product development models.

At the same time my hypothesis was that the “informal” product development model and process influenced the very early phases of the product development process to a large extent and maybe even decisively. See Figure 3.22.



**Figure 3.22** Informal product development model.

Source: Lindgren, P., 2001.

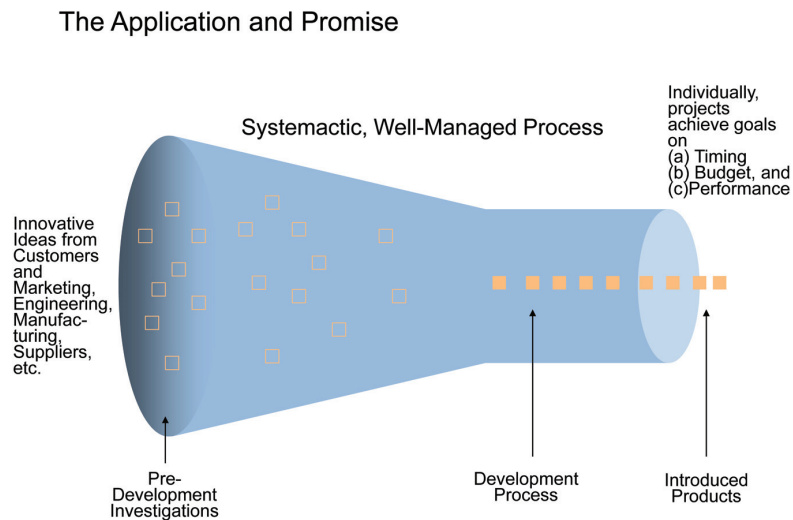
It was therefore important to this research project to analyse thoroughly whether informal models and processes such as the above existed or and if they had impact to high speed product development.

At this point in time in 2003 we did not know how such informal product development models looked or how they influenced and interact with the formal product development model. However, I put forward the hypothesis that such informal models *do* exist, and one of the objectives of this project was to confirm or disprove their existence.

The hypothesis of this research project was that such informal product development models and processes were important to the achievement of high speed product development. Part of the explanation of high speed might be found in the fact that informal product development models as well as informal processes exist in the businesses. However, my hypothesis was that this was not officially accepted by product development managers in the businesses as such a state of affairs would collide with the ISO9000 guidelines.

### 3.5 Product Development Drivers and Funnel

In most product development back in 2003 businesses saw the aim of any product or process development project to take an idea from concept to reality – or through the product development funnel Figure 3.23 – at as high speed as possible.



**Figure 3.23** The NPD funnel.

Source: Wheelwright & Clark, 1993.



The converging NPD funnel is graphically illustrated in Figure 3.23 in its simplest form. The illustration is inspired by (Wheelwright & Clark 1993) but – as previously mentioned – it is also initially verified in the secondary case businesses.

The funnel is determined by the following dimensions of choice:

1. Sources of ideas
  - a) Entry Points
  - b) Direction
  - c) Breath
2. Selection Process
  - a) Purpose
  - b) Criteria
  - c) Structure
  - d) People

There are many sources from which ideas may spring. In their model Clark and Wheelwright suggest some sources from which the ideas may come.

Table 3.2 shows clearly that ideas can be attributed to many sources and that as early as in the 1990s Clark & Wheelwright drew attention to the network of a business as a significant source from which to generate ideas.

**Table 3.2** Sources of ideas

|                  |
|------------------|
| Innovative Ideas |
| Customers        |
| Marketing        |
| Engineering      |
| Manufacturing    |
| Suppliers        |

*Source:* Clark & Wheelwright, 1992.

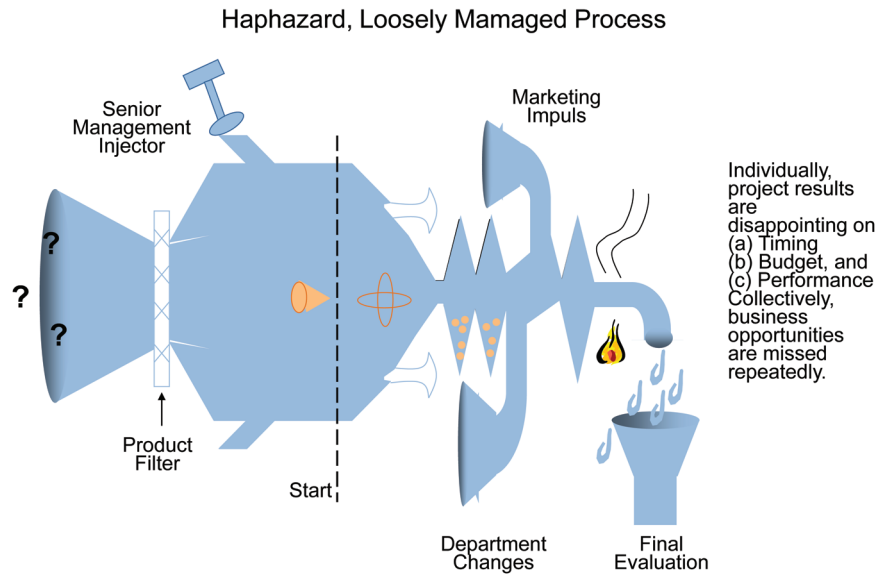
The research project wanted to verify where the ideas came in at that time and verify the impact on speed in product development.

Clark & Wheelwright suggested another model according to which the management “forces” an idea through the development funnel. See Figure 3.24.

As can be indicated, the management is also a source of ideas but they are also decisive of the speed at which the product development progresses (Clark & Wheelwright, 1993).

It has also become apparent that ideas arise via various so-called drivers. Such drivers are described and examined in Section 3.6.

### The More Common Reality



**Figure 3.24** Actual development funnel.

Source: Clark & Wheelwright.

### Practical Approach

The secondary cases showed different sources to ideas for product development as indicated in Table 3.3. Mainly such sources were registered as follows:

**Table 3.3** Sources to product development ideas in general

| Sources to Product Development Ideas in General | In Percent |
|---|------------|
| Customers                                       |            |
| Suppliers                                       |            |
| Marketing                                       |            |
| Sales   |            |
| Leadership/Management                           |            |
| Production                                      |            |
| Product Development                             |            |
| Competition                                     |            |
| Others  |            |

This research project wanted to verify the sources of product development.

### **3.6 Generic Product Development Process**

The generic product development process or the generic product development processes and their background had been repeatedly described by several different researchers and authors, i.a. Abel, 1986; Eppinger, 1995; Hart, 1999, Conti & Spina, 1999.

When discussing the generic product development process, much of the discussion had been about the factor that initiates the product development process, the factor that “drives” and maintains the process, and the factor that completes the process.

#### **3.6.1 Drivers of NB HS PD**

##### **Theoretical Approach**

The driver or the feature which starts off the product development process has many aspects. My hypothesis was that the process is often characterised by a market-pull, a technical pull or a network pull situation. This means that “the field of product development” initiates the product development process when an opportunity arises in the market – when a strategic window opens (Abell, D.F., 1980). Subsequently, the business will employ all possible markets. The technological and network options required to satisfy the needs of the market (Eppinger, 1995). Thus, the market “pulls” the decision of development along (See Figure 3.10).

In addition to such a pull process on the market, there are another four variants or drivers according to Eppinger (1995):

- The Market Pull Process
- Technology – Push Products
- Platform Products
- Process Intensive Products
- Customized Products

These five generic product development processes are outlined in Figure 3.25.

However, the research showed a lack of one important dimension in Eppinger’s model as it seems that the design perspective (Verganti, 2001) as an initiator of new products had been left out. This has been elaborated on in Figure 3.25.

|   | Generic (Market Pull)  | Technology Push   | Platform Products   | Process Intensive  | Customized   | Design Driven                 |
|---|--|---|---|--|--|-------------------------------|
| <b>Description</b>                                  | The business begins with a market opportunity, then finds appropriate technologies to meet customer needs. | The business begins with a new technology, then finds an appropriate market.                            | The business assumes that the new product will be built around an established technological sub-system. | Characteristics of the product are highly constrained by the production process.   | New products are slight variations of existing configurations .            |                               |
| <b>Distinctions with respect to generic process</b> |  | Planning phase involves matching technology and market. Concept development assumes a given technology. | Concept development assumes a technology platform.  | Both process and product must be developed together from the very beginning, or an existing production process must be specified from the beginning. | Similarity of projects allows for a highly structured development process. | Language, Message, Meaning    |
| <b>Examples</b>                                     | Most sporting goods, furniture, tools.   | Gore-Tex rainwear, Tyvek envelopes.   | Consumer electronics, computers, printers.  | Snack foods, cereal, chemicals, semiconductors.  | Switches, motors, batteries, containers.                                   | Philip Starch, Marie Bergmann |

**Figure 3.25** Generic product development processes – design driven (adapted from Eppinger and Verganti).

Source: Verganti, 2002.

Verganti referred to the design driver stating that this driver differs from the technical and market driven drivers in that designers are driven by a wish to design existing product better or design product with out functions but with meanings (Phillipe Starck, 1999).

This research project did not wish to exclude any of the six types of product development drivers from our field of research as they were expected all to be relevant to the research project. However, our primary focus was on identifying drivers but primarily the market pull and customized product drivers. All our cases were in accordance with Table 3.4.

**Table 3.4** Drivers for the PD process

| Drivers for PD Process     | Idea Stage |
|----------------------------|------------|
| Market Pull                |            |
| Technological Push         |            |
| Platform Products          |            |
| Process Intensive Products |            |
| Customized Products        |            |
| Design Driven Pull/Push    |            |

The drivers listed above describe the origin of the ideas at the entrance of the funnel. It was the hypo these that what happens in terms of process in the product development model at this stage had influence to the speed in the product development process.

### Practical Approach

The secondary cases showed examples of different drivers to the product development process. However it seemed very clear that the market pull and the technological push drivers were the main drivers to product development.

#### 3.6.2 Overall Processes in NB HS PD

When considering the generic processes in a PD project from a general point of view, such processes could initially be described as outlined in Cooper's (1993) model below in Table 3.5.

**Table 3.5** Frequency of activities in new product process development project

| Activity/Processes                           | Frequency (%) | Proficiency<br>Quality Index<br>Scores (0–10) | Need for<br>Improvement<br>Scores (0–10) |
|--|---------------|---|--|
| Initial Screening                            | 92,3          | 5,27  | 5,48                                     |
| Preliminary Market<br>Assessment             | 76,8          | 5,47  | 5,37                                     |
| Preliminary Technical<br>Assessment          | 84,9          | 6,69  | 4,60                                     |
| Detail Marketing<br>Study/Marketing Research | 25,4          | 5,74  | 5,83                                     |
| Business & Financial<br>Analysis             | 62,9          | 6,49  | 4,27                                     |
| Product Development                          | 89,1          | 6,55  | 4,47                                     |
| In-House Product Testing                     | 88,9          | 6,96  | 3,87                                     |
| Customer Test of Product                     | 66,3          | 6,69  | 3,99                                     |
| Test Market/Trial Sell                       | 22,5          | 6,86  | 4,59                                     |
| Trial Production                             | 48,9          | 6,79  | 3,66                                     |
| Pre-Commercialization<br>Business Analysis   | 34,5          | 6,26  | 3,95                                     |
| Production Start-Up                          | 56,0          | 6,31  | 4,37                                     |
| Market Launch                                | 68,1          | 6,36  | 4,44                                     |

Source: Cooper, 1993.

The process could also be described as Eppinger (2000) did in his model. The generic processes from 1–5 were the focus of this research project. It is also among these five processes that according to Cooper we found the greatest need not only for improvement but for continuous improvement and learning (Cooper, 1993) (Sanchez, 1996) (Bessant, 1999) (Eppinger, 2000).

Relevant literature also described the entire product development course as an overall process (Booz, Allen, Hamilton 1982) (Cooper, 1993) containing certain generic activity stages. As previously mentioned the literature also focused on the first activity stages in the entire product development process, i.e. mainly the idea and concept phase.

R. Cooper (1993) and others did not, however, deal with the processes pertaining to these stages in order to obtain their PD objectives. Until this point in time, this area had not been thoroughly dealt with.

Cooper also described the process as being visionary and claimed that ideas and concepts did not appear from the PD process. My hypothesis was that new ideas and concepts indeed appeared from product development.

Furthermore, continuous improvement and learning in PD posed an increasing problem to businesses and was consequently the subject of ever growing research efforts (Boer, 2000) (Corso, 2001). Such efforts were the result of an overall wish to improve each separate product development process. However, it will be much more interesting to improve the subsequent product development processes. This could only be achieved by edifying learning about and from the preceding and on-going product development projects and from other product development processes known within the network of the business (Gieske, 2001).

In other words, CI and learning should not only be sought and achieved by internal PD processes but also across PD processes and also across the network.

My hypothesis was that this would result in learning and double loop learning in NB NPD.

Until now research had not focused on NB HS PD and continuous improvement and learning. The case examinations showed that the businesses were primarily concerned with CI within the individual PD processes or PD projects. However, there were some underlying processes going on as Wheelwright & Clark verify in their process model.

The above mentioned Figures 3.22 and 3.25 signify a need for thoroughly examining the understanding of the processes and the partial processes of product development.

Hart et al. (1999) attempted such an examination by extending the discussion of generic processes by breaking the overall processes into small tasks. She also spoke of generic processes within the separate activity stages of the entire product development process; see Table 3.6 and also Figure 3.26.

**Table 3.6** Processes within stages and gates

| Stage of Development   | Information Needed for Stage; Nature of Information  | Sources of Information  | Likely Output of Stage in Light of Information  |
|--|--|---|---|
| Explicit statement of new product strategy, budget allocation  | Preliminary market and technical analysis; business objectives   | Generated as part of continuous MIS and corporate planning  | Identification of <i>market</i> (NB. Not product) opportunities to be exploited by new products                                   |
| Idea generation (for gathering)  | Customer needs and technical developments in <i>previously</i> identified markets  | Inside business: sales people, technical functions. Outside business: customers, competitors, inventors, etc.   | Body of initially acceptable ideas  |
| Screening ideas: finding those with most potential   | Assessment of whether there is a <i>market</i> for this type of product, and whether the business can make it. Assessment of financial implications: market potential and costs. Knowledge of business goals and assessment of fit | Main internal functions: <ul style="list-style-type: none"> <li>• R&amp;D</li> <li>• Sales</li> <li>• Marketing</li> <li>• Finance</li> <li>• Production</li> </ul> | Ideas which are acceptable for further development  |
| Concept development: turning an idea into a recognizable product concept, with attributed and market position identified | <i>Explicit</i> assessment of customer needs to appraise market potential. <i>Explicit</i> assessment of technical requirements  | Initial research with customer(s). Input from marketing and technical functions   | Identification of key attributed that need to be incorporated in the product, major technical costs, target markets and potential |

(Continued)

**Table 3.6** Continued

| Stage of Development  | Information Needed for Stage; Nature of Information   | Sources of Information  | Likely Output of Stage in Light of Information   |
|---|---|---|--|
| Business analysis: full analysis of the proposal in terms of its business potential | Fullest information thus far: <ul style="list-style-type: none"> <li>• Detailed market analysis</li> <li>• Explicit technical feasibility and costs</li> <li>• Production implications</li> <li>• Corporate objectives</li> </ul> | Main internal functions Customers                               | Major go-no go decision: business needs to be sure the venture is worthwhile as expenditure dramatically increases after this stage. Initial marketing plan. Development plan and budget specification |
| Product development: crystallizing the product into semi-finalized shape            | Customer research with product. Production information to check "makeability"   | Customers Production  | Explicit marketing plans   |
| Test marketing: small-scale tests with customers                                    | Profile of new product performance in light of competition, promotion and marketing mix variables   | Market research: production, sales, marketing, technical people | Final go-no go for launch  |
| Commercialization   | Test market results and report  | As for test market  | Incremental changes to test launch<br>Full-scale launch  |

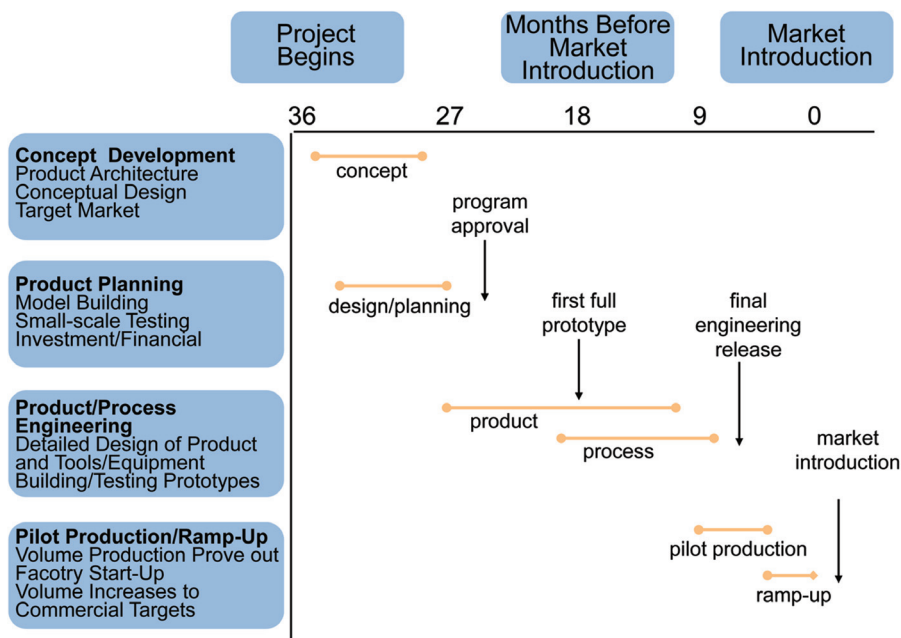
Source: Hart, 1999.

Hart stated that the process models had been the object of considerable criticism.

*"The NPD process is idiosyncratic to each individual firm and to the new product project in question. Its shape and sequence depend on the type of new product being developed and its relationship with the firm's current activities."* (Cooper, 1988, Johnne and Snelson, 1988)

*In addition to the need to adapt the process to individual instances, it should be stated that in real situations there is no clear beginning, middle and to the NPD process* (Hart, 1999).





**Figure 3.26** Underlying processes.

Source: Wheelwright & Clark, 1992.

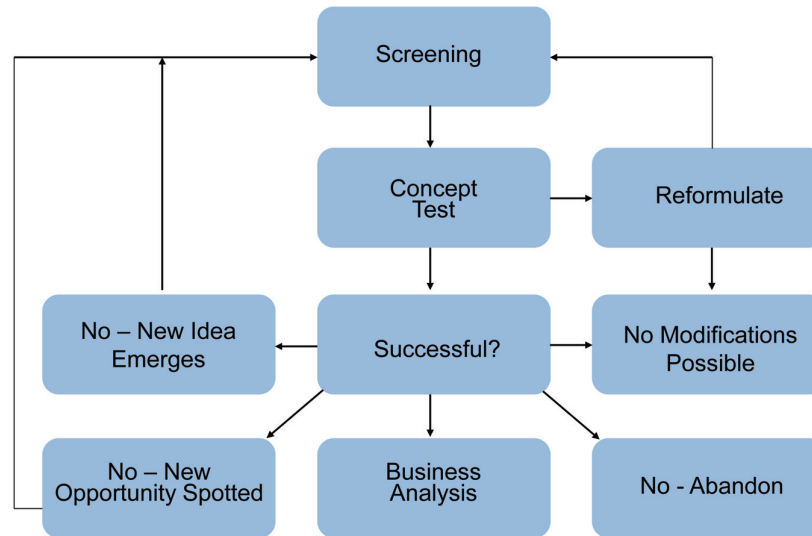
At an earlier point in this research project, I asked when a product is final or when a product development course is final. As can be seen from the above, Hart (1999) confirms that it is extraordinarily difficult to determine the beginning and the end of a process as a product development process. Furthermore, each separate stage and gate in a product development process can have infinitely many beginnings, processes and sub-processes, and results as indicated in Figure 3.27.

Therefore it is imperative to put the question

- is it important to determine a beginning and an end of a product?

My hypothesis was that it is not important because businesses do not gain any value by defining the beginning and the end of a product.

A growing number of researchers and authors claimed at that time that with the development of a product development process, other challenges and opportunities in other functional areas or departments involved in product development come into existence (Hart, 1999). Consequently,



**Figure 3.27** Related strands of development.

Source: Lindgren, P., 2002.

the argumentation that NPD must necessarily be based on interplays between the various departments and networks involved in product development arises. Additionally, it follows that product development is an iterative process, not only between stages but also within stages. The criticism directed at the activity and decision stage models claimed that such models:

*“do not adequately communicate the horizontal dimensions of the NPD process”* (Hart, 1999).

As a consequence, the idea of “Parallel processing” had come into existence as indicated in Figure 3.28. This idea acknowledged the iterations between and within stages, categorizing them along functional configurations.

The idea of parallel processing was highly prescriptive: it advised that major functions should be involved from the early stages of the NPD process to its conclusion. This, it was claimed, allowed problems to be detected and solved much earlier and the entire process was much speedier (Hart, 1999). This phenomenon was one of the main phenomena of high speed NPD which was also the focus of this research project. This aspect is illustrated in Figure 3.29.

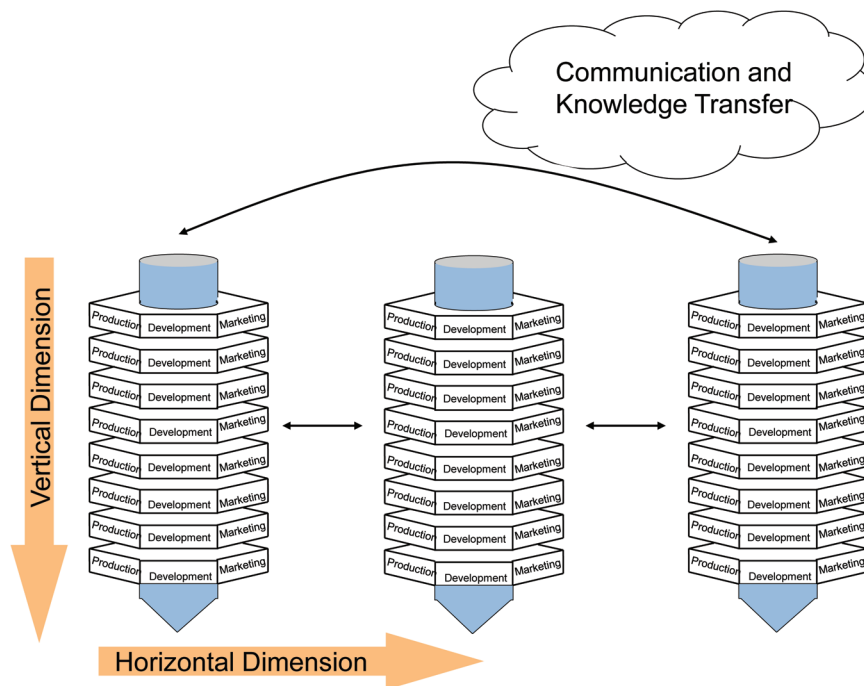


Figure 3.28 Vertical and horizontal processes.

Source: Lindgren, P., 2002.

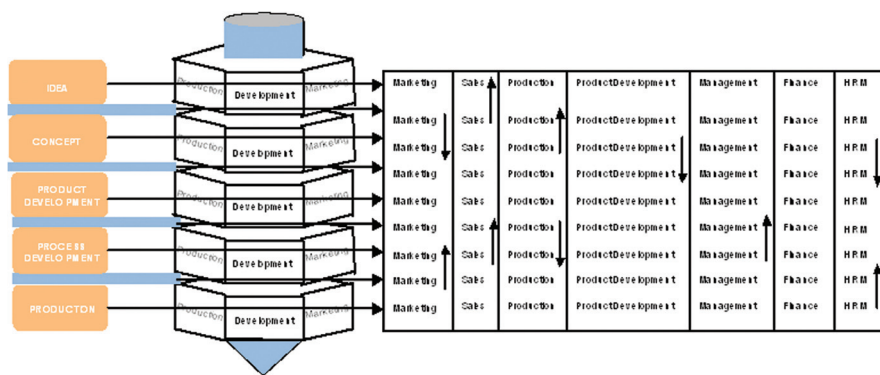


Figure 3.29 Stage gate functions which move up into the model.

Source: Lindgren, P., 2002.

As can be seen there are processes going on

1. Between functions
2. Between phases
3. Between functions and phases
4. Between networks

I will elaborate further on this framework model later in Chapter 8.

### 3.7 Summary

Concepts of product development had changed up to 2003 as we have seen above. Both researchers and the industry realised in the years up to 2003 how the concepts of the products and product development models and processes were changing even more as indicated in Table 3.7.

**Table 3.7** Change in the concept of product and product development

| Change in the Concept of Product and Product Development | Now  | Future   |
|--|--|--|
| Product characteristics                                  | Physical products and immaterial products                      | From physical products to more immaterial products                       |
|  | A product  | A total product  |
|  | One final product delivered to the market                      | Multi products (Both physical, digital, immaterial and virtual products) |
|  |  | Sequential encapsulation of a product – “never ending story”             |
|  |  | From product to process  |
|  |  | The product change to a process  |
|  | Stable products  | Dynamic products   |
|  | Focus on function and value                                    | Focus on perceived value and meaning                                     |
|  | The business finish the product                                | The customer change the product together with the business continuously  |
|  | The customer and the business does not accept trials and error | The customer and the business accepts trial and error                    |
|  | Physical and digital process                                   | Physical, digital and virtual process                                    |
|  | Physical service and to some extent physical processes         | Physical, digital and virtual process                                    |

**Table 3.7** Continued

| Change in the Concept of Product and Product Development | Now  | Future   |
|--|--|--|
| The core of the product                                  | Mostly stable and well defined core of the product<br>Not interactive into all areas | Rarely stable or always under construction and dynamic<br>Interactive in all areas |
| The core of the product development project              | Mostly static  | Rarely static – high degree of dynamic   |
| The product development model                            | Mostly stage-gate model  | All types of product development models  |
| The Product development process                          | One process with one start and one beginning.  | Continuous process with many starts and many ends.                                 |

The changes, the pressure, and the focus on product development was expected to intensify in future but it was also expected to turn out to be more complex and challenging when product development intensifies with more product development carried out in networks under even higher pressure on speed.

Product development in networks will be the issue of the next chapter.

