

## **PART IV**

### **Empirical Results**

This part presents the empirical results of the PhD project. The presentation will be divided into four chapters. Chapter 9 will present the result of the pilot case study in the primary case businesses. Chapter 10 will present the results of the network meetings in the PUIN group documented in the PUIN book on product development in network. Chapter 11 will present the results of the survey analysis made by the questionnaire tool *Question Mark* on SME businesses. Chapter 12 will present the results and observations of other research activities on NB HS NPD.

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## Pilot Case Study

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This chapter presents the empirical results of the pilot case studies in the research project. The presentation will be divided into four parts. First, the case businesses will be briefly presented in general terms. Secondly, an analysis of each business's NB HS NPD activities will be elaborated on behalf of the NB HS NPD framework model presented in Chapter 8 and the research questions set up in Chapter 1. Thirdly, a specific NB HS NPD project for each case business will be presented and analysed also within the above-mentioned framework model for NB HS NPD. Finally, a cross case business analysis focusing on NB HS NPD in the first stage and gates of the product development process will be offered to summarise on the empirical results of the chapter.

### 9.1 Empirical Results of Primary Case Research Evaluating HS in NB PD

#### 9.1.1 Introduction

On the basis of 10 exploratory semi-structured case studies carried out in 5 Danish and British businesses, the empirical case results can be presented. The case businesses were illustrated in Table 9.1.

**Table 9.1** Business facts on case businesses

Business	Line of Industry	Employees	Turnover
Lyngsø Industries	Software Industry	220	120 mill. DKK
The Language Centre	Multimedia – E-learning industry	6	4 mill. DKK
AKV Langholt	Food Industry	120	70 mill. DKK
Lindholst	Machine Industry	55	120 mill. DKK
GSI Lumonics	Welding machine industry	180	250 mill. DKK

All businesses were business-to-business businesses operating on global markets.

The businesses represent a variety of industries and a variety in numbers of employees, turnover, range of products etc.

The businesses were interviewed with a semi-structured questionnaire framework an example of which can be found in appendix to this book. In Chapter 2 the methodology of this case research was described in details. The case analysis was supported by questions filled out by the businesses on an Internet-based survey tool and additionally supported by telephone interviews on specific questions. These questions can be seen in appendix.

The businesses' general profiles can be found in appendix together with their websites. The individual cases will be documented and analysed within the framework model of the network based high speed product development prepared in Chapter 8.

The aim of the chapter is:

- to verify, test and give answers to the research hypotheses and questions set up earlier in Chapter 1
- to show and verify different NB HS NPD models and processes carried out under different characteristics on the field of product development
- to show different SME businesses solutions to NB HS NPD
- to reflect on which consequences high speed and right speed would have on different parameters as shown in Table 9.2

**Table 9.2** Consequences of high speed on parameters

Consequences	High Speed	Right Speed
Time		
Cost/Value		
Performance		
Market Fit		
Risk		
Security		

In Table 9.3 the contributions to the research questions of each cases are shown.

### 9.1.2 The High Tech Industry Business

LYNGSØ Industri (LYNGSO Industries) is a leading software manufacturer and systems integrator of a wide range of logistics solutions based on automatic

**Table 9.3** Hypotheses to be verified in Chapter 9

Empirical Results – Pilot Case Studies	The											
	Lyngsø Industries A/S (Lyngsø)		Language Centre (TLC)		AKV Langholt (AKV)		Lindholst (Linco)		GSI Lumonics (GSI)			
	General PD	Specific PD	General PD	Specific PD	General PD	Specific PD	General PD	Specific PD	General PD	Specific PD	General PD	Specific PD
Overall Research Questions to be Verified												
Hypothesis to be Verified and Tested												
What is network based high speed NPD?	X	X	X	X	X	X	X	X	X	X	X	X
NPD can be seen from different views (macro environment, business, product, market, customer, technology, competitive, and network view)	X	X	X	X	X	X	X	X	X	X	X	X
HS NPD is a matter of right speed and not high speed		X	X	X		X		X		X		X
What enablers to NB HS PD can be identified?	X	X	X	X	X	X	X	X	X	X	X	X

(Continued)









identification equipment. LYNGSØ Industries supplies solutions for track & trace, automation, planning and visualization of processes and assets in logistics and supply chains. For more details please see appendix. and website [www.lyngsoe-industri.dk](http://www.lyngsoe-industri.dk)

The Lyngsø product portfolio was strongly focused on physical and service products as shown in Table 9.4. However, on the new product introduction a strong focus on knowledge and consultancy products were seen.

**Table 9.4** Focus on product types

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	40	50	10
New Products	10	20	70

This could be seen as a reaction to the market needs and wants but also as a penetration of the existing product potential within the business. When looking at Lyngsø's products 40% of the products were physical products, 60% were digital products, and there were no virtual products as shown in Table 9.5. The business had 20% on physical processes, 70% on digital processes and 10% on virtual processes.

**Table 9.5** Focus on products and processes

	Physical Products	Digital Products	Virtual Products
Existing Product Portfolio	40	60	0
	Physical Processes	Digital Processes	Virtual processes
	20	70	10

Lyngsø's customers were a wide range of businesses within the transport sector, public and private service sector, as well as the sector of trade and industry. These were all customers with varied, unique requirements and wishes for their particular logistics solutions.

Lyngsø used special system technology to streamline the daily efforts of more than 1,100 businesses worldwide.

Lyngsø had a wide range of networks both on customer, supplier and other organisational institutes side. Lyngsø was very network oriented.

Lyngsø had competences within solution that ensure the customers the optimum flow of goods and utilisation of materials, information and human resources.

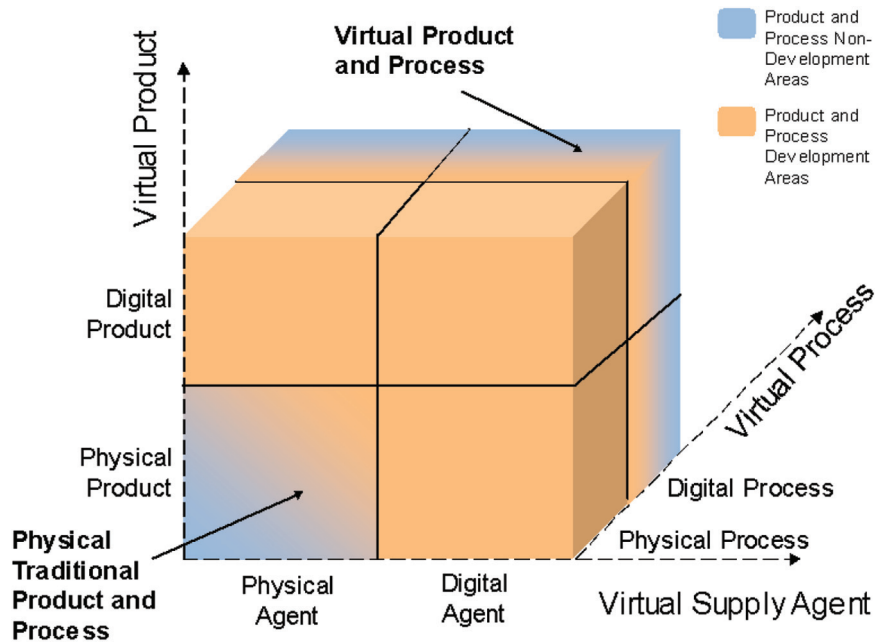
### Product Development Tasks

On the basis of the case research, Lyngsø’s task of product development could be defined as seen in Table 9.6.

**Table 9.6** Lyngsø’s product development task

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	40	50	10
New Products younger than 1 year	10	20	70
Product Development	40	30	30

Of the business’s product development tasks 40% could be related to hardware or physical products whereas 60% could be related to service and knowledge products. Obviously, Lyngsø’s product portfolio mainly focused on physical products and service products as seen in Figure 9.1. However, the



**Figure 9.1** Lyngsø’s product and process development matrix.

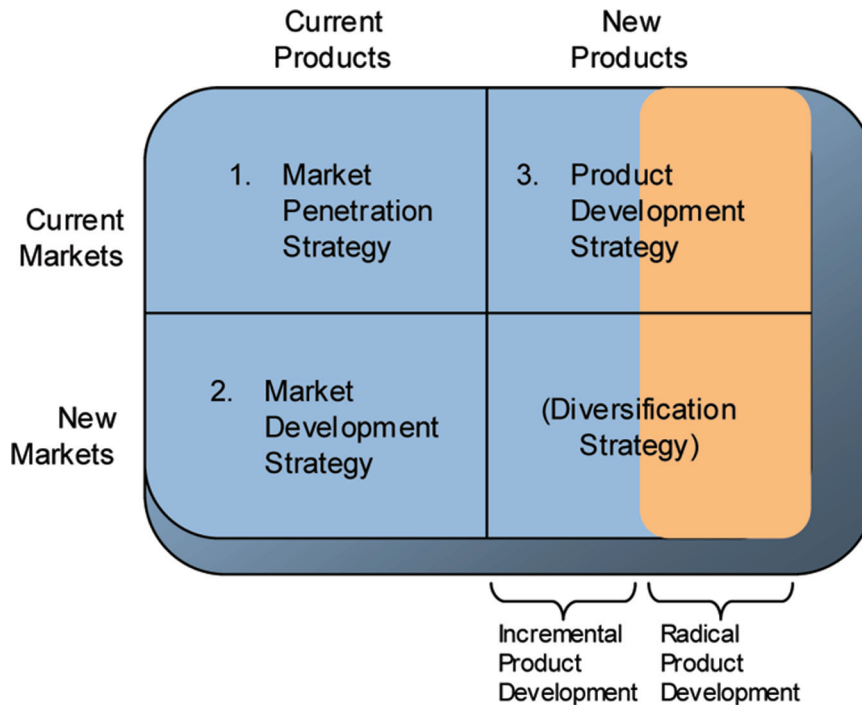
introduction of new products and the product development efforts were now strongly focused on knowledge and consultancy products.

The Lyngsø business claimed that product development projects could in general be divided into 40% strategic known and old areas and 60% unknown and new areas as seen in Table 9.7.

**Table 9.7** Product development projects in relation to strategy

	Strategic Areas	
	Known and Old Areas	Unknown and New Areas
Total Average	40	60

When applying the product/market model to the product development projects of Lyngsø, it appeared that product development projects at Lyngsø could generally be characterized as radical product development as seen in Figure 9.2.



**Figure 9.2** PD task at Lyngsø.

Additionally, Lyngø's product development projects were mainly development of old products more than three years old.

The case research also showed that the major part of product development projects on old products which were older than 3 years need big adjustments as indicated in Table 9.8. The data showed evidence of previous statements about a diminishing product lifecycle. In an overall perspective, 55% of the business's products needed big redevelopment after 1 year's lifetime. This indicated high pressure on radical product development at Lyngø Industri.

**Table 9.8** Product development in relation to product

	Old Products More than 3 Years with a Need for Small Adjustments	Old Products More than 3 Years with a Need for Big Adjustments	New Products Older than 1 Year with a Need for Small Adjustments	New Products Older than 1 Year with a Need for Big Adjustments
Total	25	35	20	20
Average (%)				

The survey also showed that 85% of the product development in the business was on known and old customer groups as indicated in Table 9.9.

**Table 9.9** PD in relation to customer groups

	Known and Old Customer Groups	Unknown and New Customer Groups
Total Average	85	15

Looking at the product development projects and at the customers' needs, we realized that 50/50% of the product development projects were related to known/old customers' needs and unknown/new customer needs as indicated in Table 9.10.

**Table 9.10** PD projects in relation to customer needs

	Known and Old Customer Needs	Unknown and New Customer Needs
Total Average	50	50

This once again indicated that Lyngø was a business which dealt with rather radical product development projects.

On the technical level Lyngø claimed that 30% of their product development projects involved new technology – radical technology areas and 70% of their projects were carried out in known areas or in development areas in

which small, incremental technology adjustments were necessary as shown in Table 9.11.

**Table 9.11** PD projects in relation to technology

	Known Technology	Known Technology with Small Adjustments (Incremental Technology)	Completely New Technology (Radical Technology)
Total Average (%)	40	30	30

The case research also showed that 50% of the product development project were related to market areas with fierce and rival competition as seen in Table 9.12. However, a large amount of projects were carried out in low competition areas. This was due to Lyngsø's high degree of radical product development.

**Table 9.12** PD projects in relation to competition

	Markets with Low or No Competition	Markets with Medium or Intensive Competition	Markets with Fierce and Rival Competition
Total Average (%)	30	20	50

Lyngsø consider 50% of their product development projects as having a high element of innovation as shown in Table 9.13. This means high pressure on Lyngsø's competences. This also designates the radical element of the product development projects at Lyngsø.

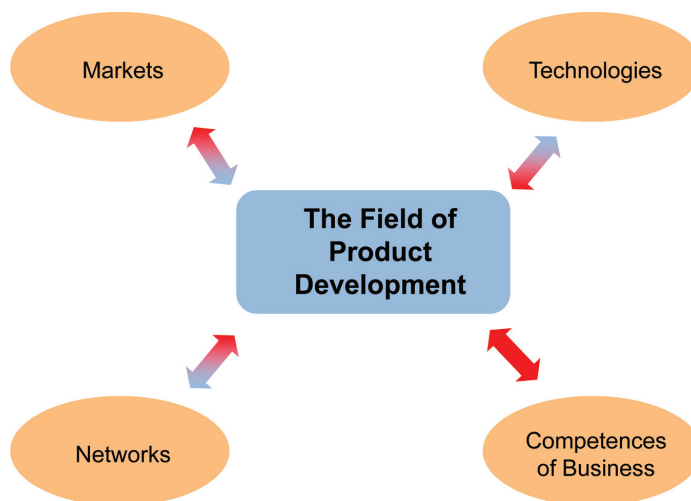
**Table 9.13** PD projects in relation to degree of innovation

	No Degree of Innovation – Routine NPD Project	Medium Degree of Innovation – Modified Product Development with Minor Demands on Adjustment (Incremental)	High Degree of Innovation – with Many Elements of Innovation (Radical Innovation)
Total Average (%)	25	25	50

Consequently, on the basis of the case research carried out at Lyngsø, the following general framework picture of the field of product development for Lyngsø Industri A/S could be verified.

Lyngsø were generally in interaction with all components on the field of product development from and outside in perspective. The field of product development was not under high pressure by any of the components in the field

of product development. Many of the product development projects were in projects rather radical and new to the market. Both the market, the technology and the network components offered Lyngsø many opportunities as indicated in Figure 9.3. Lyngsø's challenge was to find the right PD projects and develop them within the right time and to meet and develop Lyngsø's competences to the opportunities in the field of product development.



**Figure 9.3** The interaction on field of product development at Lyngsø Industri.

### General Product Development at Lyngsø

The case research showed the following general characteristics of the product development at Lyngsø as shown in Table 9.14.

**Table 9.14** Sources of PD ideas in general

Sources to Product Development Ideas in General	In Percent
Customers	36,4
Suppliers	9,1
Sales	27,3
Leadership/Management	9,1
Production	4,5
Product Development	9,1
Competition	4,5
Total	100

The product development ideas came mainly from the customers (36,4) and from the sales function (27,3%). This indicated that the product development of the business was generally strongly based on identified needs and wants in the market, and the business was therefore strongly customer/sales oriented.

### The Core – Goals and Limits for NPD Projects

The core of Lyngsø's product development project was generally formulated at the strategic level inside the business. The reason why the core of the product development project in general was specified in Lyngsø can be related to the business's ISO9001 standard, which demanded such a specification. This was further supported by the fact that formal goals and limits (goals, cost, resources etc.) for the product development project were always specified. This was illustrated in Table 9.15 below.

**Table 9.15** Goals and limits to product development

Definition of Goals and Limits to Product Development Project	
Mission	Yes
Goals	Yes
Strategy	Yes
Economic Resources	Yes
Personnel/Organisational Resources	Yes
Contact Limits to Network Partners	Yes

The goals and limits for the product development projects in Lyngsø were always defined in details in the areas as shown in Table 9.15.

Lyngsø maintained that these specifications practically always helped the business to reach the success criteria for the product development project. Generally, Lyngsø could be characterized as a planning oriented business.

### External Networks Involved in PD

To a large extent as shown in Table 9.16 the product development projects at Lyngsø were managed by the customers (60%) with Lyngsø's sales department in the second place (25%). This gave a strong indication that the product development at Lyngsø was highly market oriented and based on a network consisting of the customers and Lyngsø's sales department.

**Table 9.16** Management of projects at Lyngsø

Management of Project (%)	
Customer	60
Supplier	5
Marketing	10
Sales	25
Total	100

Lyngsø claimed that the network HS enabler was a major catalyst to high speed product development especially in the initial part of the product development process. This argument was analogous to what was found in the secondary cases (Case No. 13 Mayekawa, Case No. 11 Rossflex, Case No. 19 UK Chemicals).

Moreover, the argument was supported by the nature of the networks partners involved in the product development process.

Neither the suppliers or the competition were involved in Lyngsø's product development process. The customers were mainly involved at the initial stage and small gates of the product development process.

## General Lyngsø Product Development Model

### Formal Stages and Gates

In the case research Lyngsø claimed that they had a formal stage gate model. The model can be seen in Table 9.17. In addition, the case research could verify

**Table 9.17** Network partners involved in PD process

	Customers	Suppliers	Competition	Other Network Partners
Idea Generation	Y	N	N	N
Concept Generation	Y	N	N	N
Product Development	N	N	N	N
Process Development Phase	N	N	N	N
Idea Screening	Y	N	N	N
Concept Screening	Y	N	N	N
Proto Type Test	Y	N	N	N
Process Test	Y	N	N	N

Y = Yes

N = No

ISC = In some cases

DN = Do not know



Lyngsø’s classification of the PD model. The model was defined very much in accordance with the ISO 9001 standard. The stage and gates of Lyngsø’s formal product development model are shown in Table 9.18.

**Table 9.18** Stages and gates of Lyngsø’s formal PD model

		PD	Process	Idea	Concept	Proto	Process
Idea	Concept	Phase	Development	Screening	Screening	Type	Testing
N	Y	Y	Y	N	Y	Y	Y

The case research showed that Lyngsø’s formal product development model had three stages – a concept stage, a product development stage, and a process development stage. The business claimed that it had no formal idea stage but the initial phase of the product development process started with the concept stage.

In the screening area, the picture showed that Lyngsø had three gates – a concept screening gate, a prototype test gate, and a process test gate.

The above case research results proved that the stage gate model existed at Lyngsø. Nevertheless, the results also proved that the stage gate model was slightly different from our research hypothesis model because the formal idea stage and idea screening gate did not exist. This was due to informal stages and gates carried out beforehand.

### Informal Stage Gate

The case research showed that there was also an informal model running parallel to the formal model. Lyngsø confirmed the existence of such an informal product development model. The existence and the importance of the informal product development model in different areas at Lyngsø were interesting as seen in Table 9.19.

**Table 9.19** Stages and gates of Lyngsø’s informal PD model

		PD	Process	Idea	Concept	Proto	Process
Idea	Concept	Phase	Development?	Screening	Screening	Type	Testing
Y	Y	Y	Y	Y	Y	Y	Y

It was very interesting to see that Lyngsø’s informal product development model contained all stage and gates as defined in the research framework model. The idea stage and gate existed in Lyngsø but only on an informal basis. The Sales Manager of Lyngsø claimed that the reason for this was that

the idea stage and gate could not “live” in a strict ISO9000 model with formal procedures etc. Furthermore, he claimed that because of demands of ISO 9000 when ready for conceptualising the idea was “put” into the formal stage-gate product development model.

The Sales Manager of Lyngsø claimed that the informal product development model was important for all listed success criteria at Lyngsø. This state of affairs is illustrated in Table 9.20.

**Table 9.20** Importance of informal PD model in relation to success criteria

	Time	Costs	Performance	CIM	CI	Learning
Yes	Y	Y	Y	Y	Y	Y

Focusing on time in product development Lyngsø claimed that the informal product development model influenced in particular the idea and concept stage and gate at Lyngsø when Lyngsø wanted to achieve high speed. It was verified that the informal model was used to speed the time of product development in Lyngsø. The research discovered a high speed enabler that was not registered before in the secondary case studies.

The case research showed that an informal product development process existed and that it carried an impact on all success criteria of Lyngsø’s product development projects as seen in Table 9.20 and Table 9.21.

**Table 9.21** Influence of informal PD process on success criteria

Time	Costs	Performance	CIM	CI	Learning
Y	Y	Y	Y	Y	Y

The case research at Lyngsø gave more details on the running of informal processes at the idea and concept stage as well as on the influence on time and speed in the product development process. This will be verified later in the specific Lyngsø case.

### **Internal Functions Involved in PD Process**

In the case research carried out at Lyngsø, the following functions were involved at the different stages and gates of the product development process.

Lyngsø had a rather traditional involvement of functions at the product development stage and gates. The business was very focused on the involvement of sales, management and the product development department at the initial idea and concept stage and gates as seen in Table 9.22.

**Table 9.22** Functions participating in PD idea stage

	Marketing	Finance	Sales	Management	Production	Product Development	HRM
Idea Generation	ISC	N	Y	Y	ISC	Y	N
Concept Generation	N	N	Y	Y	ISC	Y	N
Product Development	N	N	Y	Y	ISC	Y	N
Process Development Phase	N	ISC	ISC	Y	Y	Y	N
Idea Screening	ISC	N	Y	Y	N	Y	N
Concept Screening	ISC	N	Y	Y	ISC	Y	N
Proto Type Test	N	N	ISC	ISC	Y	Y	N
Process Test	N	N	N	ISC	Y	Y	N

Y = Yes

N = No

ISC = In some cases

DN = Do not know

Sales, management, product development and marketing were the main actors at the idea stage of the product development process. The sales department was very much the initiator of the informal product development models and processes and thereby the initiator to speed the PD process at the idea stage. HRM and finance were practically not involved in the product development process; production comes in occasionally in the initial phases of the product development stage and gates but were very much involved in the final part of the product development stages and gates. Management played a major role at the initial stages and gates of the product development process.

### Focus of Success Criteria of PD Process at Lyngsø

Lyngsø Industry was very much focused on performance and continuous innovation as both received priority 1 on a scale from 1 to 5 as seen in Tables 9.23 and 9.24.

**Table 9.23** Priorities of success criteria at Lyngsø

Priorities	
Time	2
Cost	2
Performance	1
CIM	2
CI	1
L	2

**Table 9.24** Lyngsø's focus on success criteria

	Time	Costs	Performance	CIM	CI	Learning
Idea stage						
Concept stage						
PD Stage						
Process Stage						
Idea Screening						
Concept Screening						
Proto Type Test						
Process Test						
Implementation						

The reason why Lyngsø did not focus very much on time was that much of their product development could be characterised as radical product development. Nevertheless, Lyngsø's priorities of success criteria changed both during the product development stage- and gates and from PD project to PD project.

The focusing on time dominated at the product development stage, at all initial screening gates, and at the implementation stage. Lyngsø claimed that focus on time was less central when product development was very radical. Performance was then very much in focus an particular very much in focus in the last gates of the product development process. Lyngsø put a high priority on CIM at the idea stage and on CI at the concept stage. This verified that the pressure on time was reduced at Lyngsø because focus on maximal innovation, continuous improvement at the initial stages.

### The HS Enabler

The use of high speed enablers showed that all enablers were considered at Lyngsø but especially enablers Nos. 1, 2, 4, 8, and 9 were in focus as seen in Table 9.25.

**Table 9.25** HS enablers in use at Lyngsø industri

	Very Much	In Some Cases	No	Do Not Know
ICT Communication Enabler	Yes			
Customer Enabler	Yes			
PD Model Enabler		Yes		
Network Enabler	Yes			
Innovation Enabler		Yes		
HRM Enabler		Yes		
Process Enabler		Yes		
Product to Process Enabler	Yes			
Modularisation Enabler	Yes			
E-Development Enabler		Yes		

However, it was verified that Lyngsø changed enablers from project to project and also during a product development project. The customer and the network enabler were very much used in the initial product development phase but not so much in the middle of the product development phase.

The consequences for Lyngsø Industri performing high or right speed in general were reflected as seen in Table 9.26:

**Table 9.26** Consequences of high or right speed

Consequences at Lyngsø Reflected on Their General Product Development Model and Processes Related to Their Characteristic on the Field of PD	High Speed	Right Speed
Time	High speed will not give Lyngsø's product development any benefit on time because they will loose in alternative time	Right speed will give Lyngsø a competitive advantage because they will have time to develop and implement their product at the right time for the market.
Cost/Value	The direct and alternative cost will be too high and the value both direct and alternative will not match the markets demand for value.	The direct and alternative cost will diminish as both the value curve both and the cost curve both direct and alternative will match the markets demand for value. The business gains a possibility to find the right value and the right cost.
Performance	The performance on the products will either come out with a too high performance related to the market demand or a product that cannot match the performance of the market because of marketing and technological "bugs".	The performance on the products will come out with the right performance related to the market demand or a product that can match the demand for performance on the market. It will be possible to use play with perceived value because of marketing, design technology, production are matching each other.

(Continued)

**Table 9.26** Continued

Consequences at Lyngsø Reflected on Their General Product Development Model and Processes Related to Their Characteristic on the Field of PD	High Speed	Right Speed
Market fit	Will not fit the market – “over valued” and customer demand are out of fit.	Will fit the market – “valued” and customer demand are in fit
Risk	The profit will diminish and the span between value and cost will diminish. Too many cost to product development because technology are not stable.	The profit will increase diminish and the span between value and cost will diminish. Too many cost to product development because technology are not stable.
Threat	Lyngsø implement a product too early and the products will either fail to be adapted to the market or be very early copied by competitors.	Lyngsø implement a product too early and the products will either fail to be adapted to the market or be very early copied by competitors.
ROI	No return on investment or late ROI	ROI and earlier ROI
Proposal for improvement	Increase the innovation capacity – use more PD enabler, Innovation enabler and modularisation enabler Be careful about the product architecture and choice of product development model. A right product architecture will give the possibility to use the Modularisation HS enabler later in the product development process and in the future, which can make Lyngsø speed product development further seen from a competitive and customer perspective.	

### **The PD Case – “A New High Tech Airport Promotion Tool”**

The sales director of Lyngsø Industri met a supplier at the airport in Singapore while the sales director was investigating another new product development project at the airport in Singapore. The supplier initiated the possibility of a new product development project for Lyngsø. The product development idea was only possible to realise when the two network partners joined each other in the development, and the competences of the network partners would strongly complement each other.


The product development task could be characterised as radical on the technological side because the product development component was not previously known in Lyngsø, neither were the side effects known. The PD project was radical on market dimensions because until now competitors had not had this product feature in their products and the customers had not been presented to this product before. It was new to the market. The technology suddenly offered the possibility of doing what the supplier explained as an idea and concept. On the market side the product development would be an incremental “add on” to some other physical existent products. The customers were known and familiar. On the whole, the result of the product development task could be a radical breakthrough product if success was achieved. It would give the customer a possibility to have added value to their existing products whereby they could gain a big increase in turnover. The product development project could in the research frame work be characterised as shown in Table 9.27.

**Table 9.27** Perspectivising the “Lyngsø Singapore case”

Dimension	Incremental	Radical
Where was the idea discovered?	On the field of product development by a network partner – a supplier.	
Initiator of idea	Network partner – a supplier	
Product type	Hardware 40% software 60% Physical product 20% Digital product 40% Virtual product 40%.	
Consequences for product core		new core
Placement in product development stage		idea stage
Innovation degree		High
Market		New
Customer needs		New
Customer group	Old and known	
Technology		New
Network	Old	
Innovation degree and challenge to competence	Middle	

(Continued)

**Table 9.27** Continued

Dimension	Incremental	Radical
Product management	Loin Management	
Competition	Low not existent	
Strategic importance	low and long term not critical	
Success criteria	Performance – high Cost – middel Speed – middel CI – none CIM – none Learning – none	
Product development task	Incremental	Radical 
PD model – formal	Network based stage gate model	
Functions involved in initial phase	Sales	
Partners involved in initial phase	Supplier and in concept customer	
Enablers involved	Network enabler, Innovation enabler in the initial phase.	

As can be seen the product development project was very much radical to Lyngsø and was in the area of what Lyngsø normally dealt with in relation to product development projects. The case showed that the pressure on time was hardly existent because neither the customer nor the competitors knew about the radical idea.

Therefore, focus was more on performance and continuous innovation as usually in Lyngsø Industri's product development. However, both network partners knew that competitors could come up with a similar product in a short time. Therefore, some pressure on time did exist.

Related to the framework model of NB HS NPD and the Lyngsø PD model the case can be analysed and reflected upon with nearly the same contents as those of the general product development at Lyngsø. This is due to the fact that the Singapore case has nearly the same characteristics as Lyngsø's general product development model and product development task. The NB PD model does not change because of the new project.

### 9.1.3 The Language Centre – “The Multimedia Learning Business”

The Language Centre were specialists in the publication of software for use in language learning, both CBT (Computer-Based Training) and WBT (Web-Based Training). The Language Centre expertise included authoring, product



design, storyboard writing, production, marketing and distribution. The Language Centre competence was the area of languages, but the businesses technological expertise could be used for all types of training courses.

Until 2003 the TLC product portfolio had been strongly focused on physical products and on the new product introduction as seen in Table 9.28.

**Table 9.28** Focus on product types

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	100	0	0
New Products	100	0	0

When looking at TLC’s products the business claimed that 100% of the products were physical products and 100% of the products dealt with physical processes.

TLC had a very high focus on physical products and processes but some of these products had potential or were to some extent what could be called digital products as seen in Table 9.29.

**Table 9.29** Focus on products and processes

	Physical Products	Digital Products	Virtual Products
Existing Product Portfolio	80	20	0
	Physical Processes	Digital Processes	Virtual processes
	100	0	0

### Product Development in General at TLC

On the basis of the case research, TLC’s task of product development could be defined as seen in Table 9.30.

**Table 9.30** TLC’s PD task

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	100	0	0
New Products (3 years)	100	0	0
Product Development	80	10	10

Of the business’s product development tasks 80% could be related to hardware or physical products, whereas 20% can be related to service and

knowledge products. As can be seen in Figure 9.4, TLC’s product portfolio mainly focused on physical products but the product development efforts were now also to some extent on service and knowledge/consultancy products.

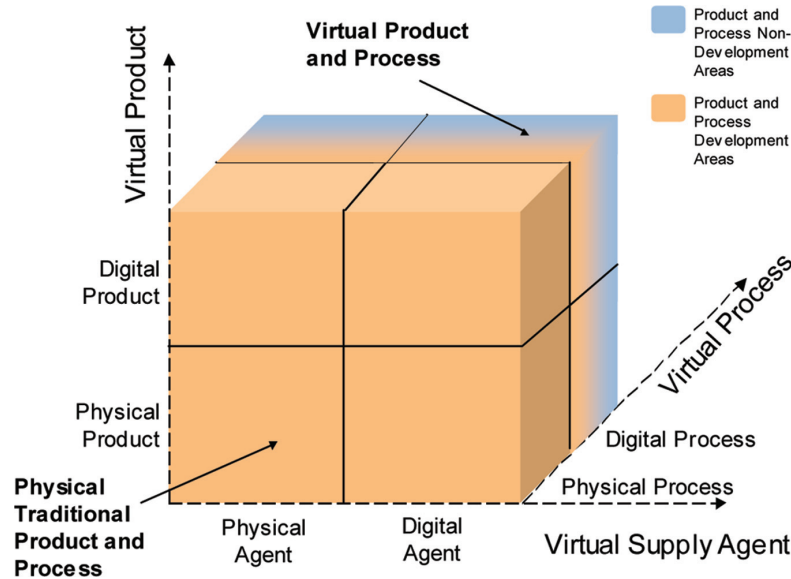


Figure 9.4 TLC’s product and process development matrix.

TLC also claim that product development projects could in general be categorised into 100% strategic known and old areas as seen in Table 9.31.

**Table 9.31** PD projects in relation to strategy

	Strategic Areas	
	Known and Old Areas	Unknown and New Areas
Total Average	100	0

The product/market model showed that TLC’s product development projects were characterised as incremental product development as seen in Figure 9.5.

The product development projects of TLC were mainly on new products older than 1 year (100%) with needs of small adjustments. This was due to a market with very short lifecycles and many introductions of incremental product developments. In other words, the core of the products live for a longer

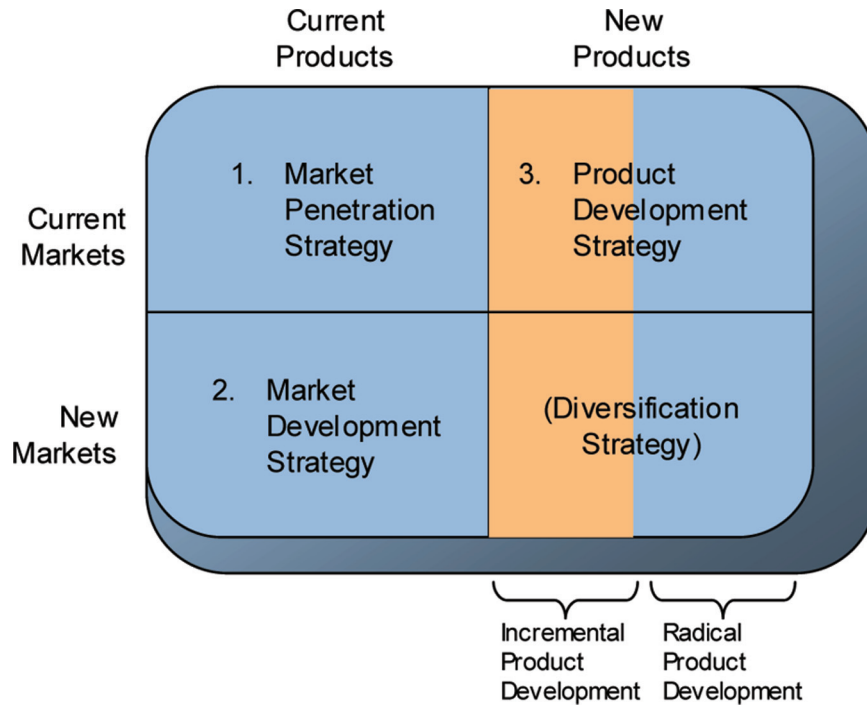


Figure 9.5 PD task at TLC.

time, but the “rings” around the product were continuously under pressure for development. They were rather dynamic.

The case research showed that out of the product development projects the main product development projects were on products that need small adjustments as seen in Table 9.32. The data showed evidence of what had been said about a diminishing product lifecycle. This indicated a high pressure on incremental product development at TLC.

Table 9.32 PD in relation to product

	Old Products	Old Products	New Products	New Products
	More than 3	More than 3	Older than 1	Older than 1
	Years with a	Years with a	Year with a	Year with a
	Need for	Need for Big	Need for	Need for Big
	Small	Adjustments	Small	Adjustments
	Adjustments		Adjustments	
Total Average (%)	0,0	0,0	100,0	0

Moreover, the survey showed that 100% of the product development in the business were on known and old customer groups as seen in Table 9.33.

**Table 9.33** PD in relation to customer groups

	Known and Old Customer Groups	Unknown and New Customer Groups
Total Average	100	0

Looking at the product development projects and customer needs it appeared that 100% of the product development projects were on known/old customers needs as seen in Table 9.34.

**Table 9.34** PD projects in relation to customer needs

	Known and Old Customer Needs	Unknown and New Customer Needs
Total Average	100	0

Obviously, this was another indication of a business who dealt with rather incremental product development projects.

On the technical level TLC claimed that 80% of their product development projects were into known technology – and 10% into incremental technology areas as seen in Table 9.35. Another 10% were in areas of radical technology areas where big technology adjustments were necessary. This indicates that the product development at TLC at this dimension was very incremental.

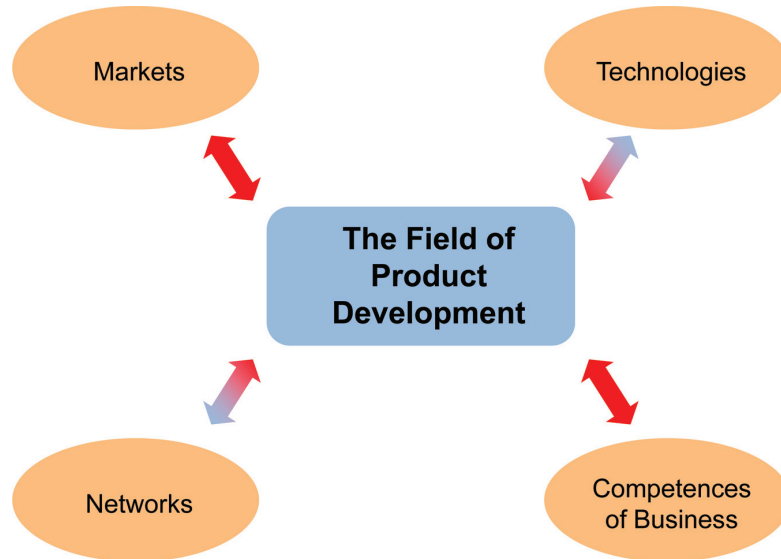
**Table 9.35** PD projects in relation to technology

	Known Technology	Known Technology with Small Adjustments (Incremental Technology)	Completely New Technology (Radical Technology)
Total Average (%)	80	10	10

The case research showed that 100% of the product development projects were related to market areas with high and rival competition as seen in Table 9.36. This indicates that TLC was under a very intense pressure from the market by competitors; especially by global competitors – illustrated in Figure 9.6.

**Table 9.36** PD projects in relation to competition

	Markets with Low or No Competition	Markets with Medium or Intensive Competition	Markets with Fierce and Rival Competition
Total Average (%)	0	0	100



**Figure 9.6** The interaction on TLC's field of PD.

TLC considered 20% of their product development projects as having a high element of innovation and another 80% in areas with medium innovation degree as seen in Table 9.37. This indicated that the product development projects at TLC at this area was between incremental and radical innovation.

**Table 9.37** PD projects in relation to degree of innovation

	No Degree of Innovation – Routine NPD Project	Medium Degree of Innovation – Modified Product Development with Minor Demands on Adjustment (Incremental)	High Degree of Innovation – with Many Elements of Innovation (Radical Innovation)
Total Average (%)	0	80	20

The case research showed the following general characteristics of the product development in TLC.

TLC was generally in interaction with all components on the field of product development from an inside out perspective. The field of product development was under high pressure from all components in the field. Many of the product development projects at TLC were into rather incremental

areas of product development. Both the market, the technology and the network components offered TLC many opportunities but the cost of product development were very high because there were high costs on developing contents to the e-learning products. TLC's challenge was to find the right speed for several PD projects and develop them within right time to harvest the market at the optimal time. However, a continuous innovation activity was necessary to keep the business in business.

As a network business with a big outsourcing activity TLC had no problems finding competence to develop the new products. Instead the problem was to find the right competences at the right costs and at the optimum time for product implementation on the market.

### **The General TLC Product Development Model**

Sources to product development ideas in general were formed as follows.

The product development ideas at TLC came from different sources but mainly from the management (30%), the sales function (20%), and the competitors (20%) as seen in Table 9.38. This indicated that the business's product development in general was based on identified needs and wants in the market. Compared to the other case businesses more functions were involved in the idea generation, as can be seen in Table 9.38. This was due to a strong management effort to involve and make all functions responsible of product development and also because the business was so small that everybody had to be involved in or at least informed of product development projects going on in the business.

**Table 9.38** Sources of PD ideas in general

Sources to Product Development Ideas in General	In Per Cent
Customers	15,0
Sales	20,0
Leadership/Management	30,0
Product Development	15,0
Competition	20,0
Total	100

### **The Core – Goals and Limits for NPD**

The core of a product development project was in general formulated in the business. The reason why the core of the product development project in general was specified in TLC, was the management's strong focus on the

strategic critical issue for the business to formulate the core of a product development project at the start of a project. Product development projects was vital for TLC and can mean life or death for the business. This was further supported as the formal mission, goals, and strategy for the product development project was always specified together with the economic resources as seen in Table 9.39.

**Table 9.39** Goals and limits to PD

Definition of Goals and Limits to Product Development Project	
Mission	Yes
Goals	Yes
Strategy	Yes
Economic Resources	Yes
Personnel/Organisational Resources	No
Contact Limits to Network Partners	No

Personnel/organisational resources and contact limit to network partners were not specified. TLC focus strongly on the strategic limits of product development projects whereas the rest was up to the product development team behind the product development project.

Surprisingly TLC said that these overall specifications were not important for the business to reach the success criteria of the product development project. This meant that TLC had a clear feeling that although efforts were made to carry out the strategic planning behind the product development projects, such efforts were not always tantamount to the product development project meeting the success criteria.

### **Formal Stages and Gates**

In the case research TLC claimed that they had a formal stage- gate model. The case research showed that the formal stage- and gates model has the same stage and gates as our hypothesis model.

The case research showed that TLC’s product development model had 4 stages – an idea, concept, product development, and process development stage. On the screening area the picture showed that TLC had 4 gates – an idea screening, a concept screening, a proto type test, and a process test gate as seen in Table 9.40.

The above case research results proved that the stage gate model existed at TLC and that the stage-gate model was equal to our research hypothesis model.

**Table 9.40** Stages and gates of TLC's formal PD model

		Process					
Idea	Concept	PD Phase	Development Phase	Idea Screening	Concept Screening	Proto Type	Process Testing
Y	Y	Y	Y	Y	Y	Y	Y

TLC confirmed that an informal product development model did not exist in the business. The lack of existence of an informal product development model in TLC was interesting as this indicates that small businesses may not need to establish informal product development models and processes. This may explain higher speed and lower cost for SMEs in product development because there are no informal model and processes to consume alternative time and cost.

### Internal Functions Involved in PD Process

In the case research at TLC the following functions were involved in the different stages and gates in the product development process.

TLC had a characteristic involvement of functions involved in the product development stages and gates. All functions were involved except HRM. The reason for this was the very small size of TLC where all function were concentrated on a single or on very few employees as seen in Table 9.41. HRM did not really exist. The function was integrated in the manager function.

**Table 9.41** Functions participating in PD idea stage

	Marketing	Finance	Sales	Management	Production	Product Development	HRM
Idea Generation	Y	Y	Y	Y	Y	Y	N
Concept Generation	Y	Y	Y	Y	Y	Y	N
Product Development	Y	Y	Y	Y	Y	Y	N
Process Development	Y	Y	Y	Y	Y		
Phase Idea						Y	N
Screening	Y	Y	Y	Y	Y	Y	N
Concept Screening	NA	Y	Y	Y	Y	Y	N
Proto Type Test	Y	Y	Y	Y	Y	Y	N
Process Test	Y	Y	Y	Y	Y	Y	N

Y = Yes

N = No

ISC = In some cases

DN = Do not know



### External Networks Involved in PD

To a large extent, the product development projects at TLC were managed internally and only by the management of the product development department (100%). Management played a major role in teambuilding in the product development projects.

This gave a strong indication that the management of product development at TLC was strongly concentrated internally and based on strong management by the manager of TLC. This was quite another management model compared to the other case businesses except Lindholst case.

The argument was further supported when looking at the network partners involved in the product development process as seen in Table 9.42.

**Table 9.42** Network partners involved in PD process

	Customers	Suppliers	Competition	Other Network Partners
Idea Generation	Y	N	N	N
Concept Generation	N	N	N	N
Product Development	N	Y	N	Y
Process Development	N	N	N	Y
Phase Idea				
Screening	N	N	N	Y
Concept Screening	N	Y	N	Y
Proto Type Test	Y	N	N	Y
Process Test	Y	Y	N	Y

Y = Yes

N = No

ISC = In some cases

DN = Do not know

The competitors were not involved in the product development process at all. This was due to the very fierce competition in the market (Manager TLC). The customers were mainly involved in the idea phase and the prototype and process test phase. The suppliers were mainly involved from the middle to the late part of the product development.

### Focus on Success Criteria of PD Process

TLC was very much focused on nearly all success criteria; both short term and long term success criteria as seen in Table 9.43.

**Table 9.43** Priorities of success criteria at TLC

Priorities	
Time	1
Cost	2
Performance	1
CIM	1
CI	1
L	1

TLC's high focus on time often resulted in higher costs than expected. Although TLC tried to learn from previous product development projects to continuously diminish costs. However, so far this approach had not been successful. This was due to the fact that TLC started all PD projects as radical development projects. Furthermore, TLC had not gained a learning curve on product development. Yet, the prioritising changed during the product development stages and gates as seen in Table 9.44.

**Table 9.44** TLC's focus on success criteria

	Time	Costs	Performance	CIM	CI	Learning
Idea						
Concept						
PD Stage						
Process Stage						
PD Test						
Idea Screening						
Concept Screening						
Proto Type Test						
Process Test						
Implementation						

The time focus was very much concentrated on the screening gates when CIM was prioritised on the idea and concept stage. This was something to do with the focus on incremental adjustment and high pressure from competition where small adjustments could result in a competitive advantage (Manager TLC). At the product development and process stage, focus was very much on cost and not much on value.

### The HS Enablers

The use of high speed enablers showed that all enablers were considered at TLC as seen in Table 9.45, whereas the HRM and the modularization enablers were not so much considered.

**Table 9.45** HS enablers used at TLC

	Very Much	In Some Cases	No	Do Not Know
ICT Communication Enabler	Yes			
Customer Enabler	Yes			
PD Model Enabler	Yes			
Network Enabler	Yes			
Innovation Enabler	Yes			
HRM Enabler		Yes		
Process Enabler	Yes			
Product to Process Enabler	Yes			
Modularisation Enabler		Yes		
E-Development Enabler	Yes			

TLC claimed to focus on many HS enablers. However, it was verified through the case discussion that TLC changed enablers from project to project and also during a product development project.

The consequences for TLC performing high or right speed in general were reflected as seen in Table 9.46:

**Table 9.46** Consequences reflected on general PD model and processes

Consequences at TLC Reflected on their General Product Development Model and Processes Related to their Characteristics on the Field of PD.		
	High Speed	Right Speed
Time	TLC is under high pressure on time and cost from “the field of product development”. Especially the market and the technology press TLC to continuously lower cost and increasing introduction on new products. The product life cycle of the products are diminishing continuously incremental new product must be introduced to the market at high speed	Right speed in TLC means high speed but with a focus to competitive advantage TLC will in this market not have time to develop and implement their product at a slow speed A market oriented out side in management style is necessary at TLC. The field of product development” has to be analysed carefully to find the right time for product introduction.

(Continued)

**Table 9.46** Continued

Consequences at TLC Reflected on their General Product Development Model and Processes Related to their Characteristics on the Field of PD.	High Speed	Right Speed
Cost/Value	The direct and alternative cost are too high and the value both direct and alternative do not match the markets demand for value and perceived value.	The direct and alternative cost will diminish as both the value curve and the cost curve directly and alternatively will match the market's demand for value when TLC focus on perceived value it will gain bigger profitability. The business gains a possibility to find the right value and the right cost.
Performance	The product either comes out with a too high performance related to the market demand or the product cannot match the performance of the market because of marketing and technological "bugs".	The product comes out with the right performance related to the market demand or the product can match the demand for performance on the market. It will be possible to use and play with perceived value because of marketing, design technology, production are matching each other.

**Table 9.46** Continued

Market fit	Will not fit the market – “over valued” or “under valued” and customer demand are out of fit with the product.	Will fit the market – “value” and customer demand are in fit
Risk	The profit will diminish and the span between value and cost will diminish. Too many costs to product development because technology is not stable. And its very expensive to develop content.	The profit will increase because the span between value and cost will increase. Cost to product development because technology are not stable.
Threat	TLC implement a product too early and the products will either fail to be adapted to the market or be very early copied by competitors.	TLC implement a product at the right time continuously and the products are adapted immediately to the market. It will be very difficult for the competitors to copy the product and if so the competitors will be too late before a new incremental product development has taken place.
ROI	No return on investment or late ROI	ROI and earlier ROI
Proposal for improvement	Increase the customer enabler – use more the modularisation enabler and formulate the product architecture very carefully at the very initial idea and concept stage. Secure the possibility of fast variation and diminish cost continuously. Focus on perceived value and right time.	

**Product Development Case – “A New Multimedia Learning Product”**

The managing director of TLC met the new buying manager of Bogpa to discuss how TLC could sell more of their new language series. At the same meeting the managing director asked the buying manager how the competitor’s product was selling. The buying manager told him that the competitor’s product was sold at a much higher price and was – to some extent – of a

better quality; for instance it had a few more features, a smarter package that the customers liked etc. However, the market for the language products and multimedia products in general was stagnating mainly because consumers were illegally copying the products. A pressure from substitute products was also very strong. The buying manager wanted a new product from TLC which could match the competitor's product and play "the game of perceived value" and prevent illegal copying.


At first sight, the product development task could be characterised as incremental on the technological side because the component as well as the side effects were known in the business before. The PD project could be characterized as incremental on the innovative side because everybody would have the possibility to include this product feature in their products. In terms of market, the product development could be characterised as radical to TLC because TLC had to come up with some new perceived value to the customers – however, this was mainly to the end user. The customer dimension was incremental because the business customer was known and familiar. Altogether, on the face of it the result of the product development task could be considered an incremental breakthrough on the market, if success was reached. It would give TLC a possibility to differentiate the businesses' products and thereby gain a major increase in turnover. However, when carefully analysing the product development project the core of the product was changing very dramatically because TLC now had to move the business from thinking inside out to an outside in thinking. The TLC business had to play the game of perceived value which was quite different from previously when high quality and best performance had been the game. Furthermore, the business had to develop an "anti copy" product.

Special characteristics of the development task is seen in Table 9.47:

**Table 9.47** Characteristics of development task

Dimension	Incremental	Radical
Where was the idea discovered	On the marketplace	
Initiator of idea	Customer	
Product type	Hardware 5% Software 95%	
Consequences for product core		Modified to radical modification of the core
Placement in product development stage		Concept stage
Innovation degree		High to TLC

**Table 9.47** Continued

Market		Old and mature market
Customer needs		Stable interest
Customer group	Old	
Technology		Old and stable
Network		Old
Competence's		To some extent new – “perceived value”.
Product management	the business	
Competition		High and radical
Strategic importance		high, important, short term and critical – survival
Success criteria	CI – none CIM – some Learning – none	Performance – high on perceived performance Cost – high on diminishing the cost Speed – very high – pressure from competitors
Product development task		
PU model – formal	Stage gate model	
Functions involved in initial phase	Sales and production	
Partners involved in initial phase	Business and customer	
Enablers involved	Customer enabler	

**Perspective on “TLC Bogpa Case”**

As can be seen, the product development project was to some extent radical to TLC. The case shows that the pressure on time was very much existent because customer and competitors pressed for new products. Therefore, focus was on time, speed and perceived performance. Usually in TLC product development focus was on performance and cost.

Related to the framework model of NB HS NPD and the TLC development model the case could be analysed and reflected upon with another content as of the general product development at TLC. This was due to the fact that the BOGPA case [www.bogpa.dk](http://www.bogpa.dk) was different from the characteristics of TLC’s general product development model and task.

**Table 9.48** Perspectives and reflection on High Speed related to TLC and the Bogpa case

Consequences at TLC Reflected on their General Product Development Model and Processes Related to their Characteristic in the Field of PD.	High Speed	Right Speed
Time	High speed will not give TLC product development any benefit on time because they will loose in alternative time	Right speed will give TLC a competitive advantage because they have time to develop and implement their new product at the right time. However right speed in this case is both focused on high speed and perceived value because of the characteristics on the field of product development.
Cost/Value	The direct and alternative cost will be too high and the value both direct and alternative will not match the markets demand for value and perceived value.	The direct and alternative cost will diminish as both the value curve will increase and the cost curve diminish direct alternative will match the markets demand for value. The business gains a possibility to find the right value and the right cost.
Performance	The performance on the products will either come out with a too high performance related to the market demand or a product that cannot match the performance of the market because of marketing and technological “bugs” or the technology is out of date.	The performance on the products will come out with the right performance related to the market demand or a product that can match the demand for performance on the market. It will be possible to use play with perceived value because of marketing, design technology, production are matching each other.
Market fit	Will not fit the market – either “over valued” or “under valued” and customer demand are out of fit.	Will fit the market – “valued” and customer demand are in fit



**Table 9.48** Continued

Risk	The profit will diminish and the span between value and cost will diminish. Too many cost to product development because technology are not always stable.	The profit will increase because the span between value and cost will increase. Cost to product development will diminish because the market is ready to the product. Implementation and because TLC will choose when technology are stable.
Threat	TLC implement a product too early and the products will either fail to be adapted to the market or be very early copied by competitors.	TLC implement a product at right time and the products will be adapted to the market or be very early copied by competitors.
ROI	No return on investment or late ROI	ROI and earlier ROI
Proposal for improvement	Increase the innovation capacity – use more PD enabler, innovation enabler and modularisation enabler with focus on product architecture – use the e-development enabler more intensively.	

### 9.1.4 AKV Case – “The Biochemical Business”

#### Business Description

The AKV Langholt business was a modern potato flour plant situated in Northern Jutland approximately 15 km north of Aalborg. The business was owned by approximately 300 potato growers. The business was a co-operative and the owners had committed themselves to supplying the business with the required raw materials. The business also produced seed potatoes, various sorts of potato starch and various potato sorts for cooking. Potato juice is a by-product resulting from the production of potato flour. Potato juice is the cell sap which has been thinned with water. The product is distributed with an organic fertilizer distributor or with a tanker bearing trailing pipes. Another by-product from the production of potato flour is potato pulp which is used for cattle fodder

The AKV Langholt business can be seen on [www.akv-langholt.dk](http://www.akv-langholt.dk).

The AKV product portfolio was strongly focused on 100% physical products as seen in Table 9.49. There was no change on the new product introduction.

**Table 9.49** Focus on product types

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	100	0	0
New Products	100	0	0

This could be seen as a strategy from the business to focus only on physical products and fulfil the needs and wants of the markets in this area. The business had also 100% focus on physical processes and no focus on digital or virtual processes as seen in Table 9.50.

**Table 9.50** Focus on products and processes

	Physical Products	Digital Products	Virtual Products
Existing Product Portfolio	100	0	0
	Physical Processes	Digital Processes	Virtual processes
	100	0	0

The market for AKV was very stable but with a very intense rivalry and pressure on price. The technology was strongly dynamic and evolving in these years and offering new opportunities. The network was very stable and narrow minded. However, AKV had a strong network cooperation with the French business Cerestar Pharma [www.cerestarpharma.com](http://www.cerestarpharma.com)

### Product Development in General at AKV

The case research showed the following general characteristics of the product development at AKV.

Sources to product development ideas in general were formed as seen in Table 9.51:

**Table 9.51** Sources of product development ideas in general

Sources to Product Development Ideas in General	In Per Cent
Customers	15,0
Suppliers	5,0
Sales	50,0
Production	25,0
Competition	5,0
Total	100

The product development ideas came mainly from the sales function (50%), the production department (25%), and the customers (15%). This indicated that the business's product development in general was based on identified needs and wants in the market but that the production department played a central role in generating new ideas. The new products were mainly discovered by internal research by the network partner Cerestar Pharma – who were an important product development network partner.

### The Core – Goals and Limits for NPD Projects

In most cases, the core of a product development project was formulated in the business. The reason why the core of the product development project in general was specified in AKV could be related to the business's ISO9001 standard, which demands such a specification. This was further supported as the formal goals and limits (goals, cost, resources etc.) for the product development project were in most cases specified as seen in Table 9.52.

The goals and limits for the product development projects in AKV always included detailed definitions in the areas as shown in Table 9.52.

**Table 9.52** Goals and limits to product development

Definition of Goals and Limits to Product Development Project	
Mission	Yes
Goals	Yes
Strategy	Do not know
Economic Resources	Yes
Personnel/Organisational Resources	Yes
Contact Limits to Network Partners	Yes

As can be seen from Table 9.52, AKV had always specified missions, goals, economic resources, limits of personal and organisational resources and which contact limits to network partners existed for the specific product development project. According to the managing director, the strategy for the product development project was not known initially. The strategy depended on the idea and was often formulated in the course of the PD process. The business said that such initial goal and mission helped the business to reach the success criteria of the product development project.

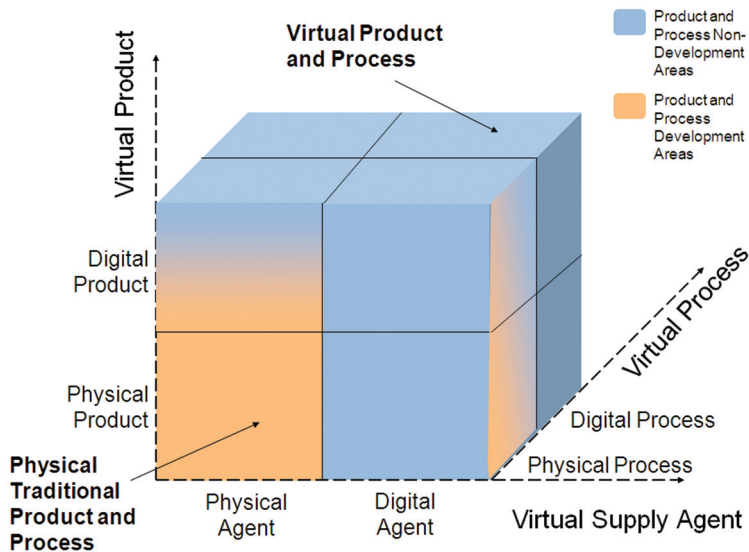
### Product Development Tasks

On the basis of the case research, AKV's task of product development could be defined as seen in Table 9.53.

**Table 9.53** AKV product development tasks

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	100	0	0
New Products	100	0	0
Product Development	100	0	0

Of the business’s product development tasks 100% could be related to physical products. As can be seen in Figure 9.7, AKV was strongly focused on physical products and the introduction of new products and the product development efforts were strongly related in the same line of business.



**Figure 9.7** AKV’s product and process development matrix.

AKV also claimed as seen in Table 9.54 that in general, product development projects could be divided into 95% strategic known and old areas and 5% unknown and new areas.

**Table 9.54** PD projects in relation to strategy

	Strategic Areas	
	Known and Old Areas	Unknown and New Areas
Total Average	95	5

The product/market model gave the following picture as shown in Figure 9.8 of AKV's product development project.

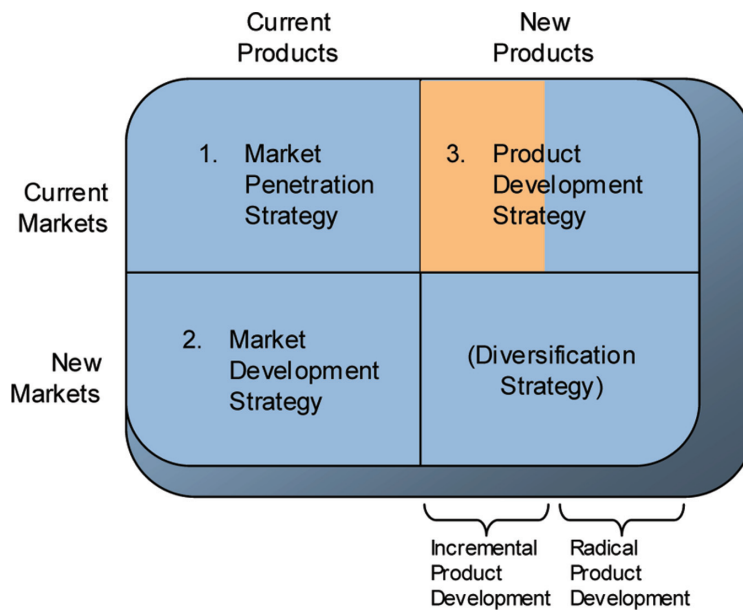


Figure 9.8 PD tasks at AKV.

The AKV product development projects were mainly situated in areas of a rather well known and incremental product development area as seen in Table 9.55.

Table 9.55 Product development in relation to product

	Old Products		New Products	
	More than 3 Years with a Need for Small Adjustments	Old Products More than 3 Years with a Need for Big Adjustments	Older than 1 Year with a Need for Small Adjustments	New Products Older than 1 Year with a Need for Big Adjustments
Total Average (%)	40	10	30	20

The case research showed that of all the product development projects, the major part were Product development projects on products that needed small adjustments. The data showed evidence of what had been said about a diminishing product lifecycle. In an overall perspective 50% of the business's

products had to have redevelopment after 1 year's lifetime. This indicated a pressure on product development at AKV. AKV did not have a large need for major adjustment on product development on their products. This could either indicate a stable industry concerning market and technology and/or a product development ability at AKV to meet the demands of the customers.

The survey further showed that 90% of the product development in the business was on known and old customer groups as seen in Table 9.56.

**Table 9.56** PD in relation to customer groups

	Known and Old Customer Groups	Unknown and New Customer Groups
Total Average	90	10

The product development projects and customer needs showed that 95% of the product development projects were on known/old customer needs and 5% were on unknown/new customer needs as seen in Table 9.57.

**Table 9.57** PD projects in relation to customer needs

	Known and Old Customer Needs	Unknown and New Customer Needs
Total Average	95	5

Table 9.58 showed yet another indication of a business which dealt with rather incremental product development projects.

**Table 9.58** PD projects in relation to technology

	Known Technology	Known Technology with Small Adjustments (Incremental Technology)	Completely New Technology (Radical Technology)
Total Average (%)	80	15	5

On the technical level AKV claimed that 5% of their product development projects were into new technology – radical technology areas and 95% were in areas of known or development areas where small incremental technology adjustments were necessary.

The case research also showed that 45% of the product development projects were related to market areas with high and rival competition and another 45% to markets with middle to intensive competition. This indicated

that AKV was in a mature and rival industry which could be characterised with high competition; especially on price as seen in Table 9.59.

**Table 9.59** PD projects in relation to competition

	Markets with Low or No Competition	Markets with Medium or Intensive Competition	Markets with Fierce and Rival Competition
Total Average (%)	30	20	50

AKV saw 50% of their product development projects as having no element of innovation as seen in Table 9.60.

**Table 9.60** Innovation degree at AKV Langholt

	No Degree of Innovation – Routine NPD Project	Medium Degree of Innovation – Modified Product Development with Minor Demands on Adjustment (Incremental)	High Degree of Innovation – with Many Elements of Innovation (Radical Innovation)
Total Average (%)	25	25	50

However, the innovative part was solved by the businesses’ cooperation with the network partner Cerestar Pharma. Cerestar Pharma had all the necessary experts and they continuously develop new products to the market. This was another example which showed that product development projects were mainly incremental at AKV.

## The AKV Product Development Model

### Formal Stages and Gates

In the case research AKV claimed that they did not have a formal stage- gate model. However, the case research showed there was an informal product development model running in the business which had nearly the same structure as the stage- and gates of a formal product development model. This model is shown in Table 9.61.

**Table 9.61** Stages and Gates of AKV’s formal PD model

	Idea	Concept	PD Phase	Process Development Phase	Idea Screening	Concept Screening	Proto Type	Process Testing
	N	Y	Y	Y	N	Y	Y	Y

The case research showed that AKV's informal product development model had 4 stages – an idea stage, a concept stage, a product development stage, and a process development stage. The business claimed that it had no idea and concept screening which meant that their product development model used direct prototyping very much.

On the screening area the picture showed that AKV could identify 2 gates – a proto type gate, and a process test gate. The business could not identify an idea or a concept screening phase. This could be related to the high degree of incremental product development which may not need the considerable effort of screening at the idea and concept gates.

The above case research results proved that the stage gate model existed in AKV but that the stage- gate model was slightly different from our research hypothesis model because the idea gate and concept gate could not be identified or did not exist. Further the AKV business had a informal PD model very much related to the network partner Cerestar Pharma.

### Informal Stages and Gates

AKV confirmed that an informal product development model existed in all stage and gates in the business. In this area the informal model should be understood as a model that was existing besides the normal product development model the business practice as seen in Table 9.62.

**Table 9.62** Informal PD model at AKV Langholt

Idea	Concept	PU Phase	Process Development?	Idea Screening	Concept Screening	Prototype	Process Testing
Y	Y	Y	Y	Y	Y	Y	Y

The informal product development model was important for especially the time and cost success criteria at AKV as seen in Table 9.63.

**Table 9.63** Importance of informal PD model in relation to success criteria

	Time	Costs	Performance	CIM	CI	Learning
Yes	Y	Y	0	0	0	0
To some extent	0	0	Y	Y	0	Y
No	0	0	0	0	Y	0
Do not know	0	0	0	0	0	0
Not answered	0	0	0	0	0	0

Focusing on time in product development the informal product development model had influence, particularly in the idea and concept stage and



gate at AKV. The case research showed explicitly that the informal product development model influenced the success criteria of product development within AKV.

### Internal Functions Involved in PD Process

In the case research at AKV the following functions as shown in Table 9.64 were involved in the different stage- and gates in the product development process. AKV had a special characteristic in involvement of functions at the idea stage as all functions except HRM were involved at this stage.

**Table 9.64** Functions participating in PD idea stage

	Marketing	Finance	Sales	Management	Production	Product Development	HRM
Idea Generation	Y	ISC	Y	Y	Y	Y	N
Concept Generation	Y	N	Y	ISC	Y	ISC	N
Product Development	ISC	N	ISC	ISC	Y	Y	N
Process Development	N	N	N	N	Y	ISC	N
Phase Idea							
Screening	Y	Y	ISC	ISC	Y	ISC	Y
Concept Screening	Y	N	Y	Y	Y	ISC	N
Proto Type Test	N	ISC	ISC	N	Y	ISC	N
Process Test	N	N	N	N	Y	NA	N

Y = Yes

N = No

ISC = In some cases

DN = Do not know

Sales, marketing and the product development department were the main actors in the idea stage of the product development process. This also indicated that to a large extent the sales department was the initiator of the product development models and processes. It seemed as if AKV seek a very early commitment and screening to the product development as most functions were involved in the idea and concept screening stages and gates. Subsequently, AKV seemed to rely on production. HRM and economics were practically not involved in the product development at all. Management played a major role in the initial stages and gates of the product development process but was barely involved until just before product implementation in the market as seen in Table 9.64.

## External Networks Involved in PD

### PU Management

To a large extent, the product development projects at AKV were managed by the customers (85%) as seen in Table 9.65. This strongly indicates that product development at AKV was exceptionally market oriented and based on a network between customers and AKV.

The argument was furthermore supported when looking at the network partners involved in the product development process as seen in Table 9.65.

**Table 9.65** Management of projects at AKV

Management of Project (%)	
Customer	85
Do not Know	15
Total	100

The competitors and other network partners were not involved in the product development process. The customers were involved in nearly all phases of the product development process. The supplier was strongly involved subsequent to the generation of the idea as seen Table 9.66.

**Table 9.66** Network partners involved in PD process

	Customers	Suppliers	Competition	Other Network Partners
Idea Generation	Y	N	N	N
Concept Generation	Y	Y	N	N
Product Development	Y	Y	N	N
Process Development	N	N	N	N
Phase				
Idea Screening	Y	N	N	N
Concept Screening	N	N	N	N
Proto Type Test	Y	Y	N	N
Process Test	Y	Y	N	N

Y = Yes

N = No

ISC = In some cases

DN = Do not know

**Focus of Success Criteria of PD Process**

AKV Industry was very much focused on performance and time as these criteria had received 1<sup>st</sup> and 2<sup>nd</sup> priority on a scale from 1 to 5 as seen in Table 9.67.

**Table 9.67** Priorities of success criteria at AKV

Priorities	
Time	2
Cost	3
Performance	1
CIM	3
CI	4
L	4

The long-term success criteria did not receive high priority at AKV as seen in Table 9.67 and Table 9.68. Prioritising changed during the product development stages and gates.

**Table 9.68** AKV’s focus on success criteria

	Time	Costs	Performance	CIM	CI	Learning
Idea						
Concept						
PD Stage						
Process Stage						
PD Test						
Idea Screening						
Concept Screening						
Proto Type Test						
Process Test						
Implementation						

The focus on time was very pronounced at the initial product development stage. At all initial screening gates the focus was on cost. Performance came very much into focus at the last gates of the product development process.

**HS Enablers**

The use of high speed enablers showed that especially enabler number 2 and 9 were in focus as seen in Table 9.69. Three enablers, viz. nos. 1, 3, and 10 were not considered.

**Table 9.69** AKV's use of HS enablers

	Very Much	In Some Cases	No	Do Not Know
ICT Communication Enabler	Yes		Yes	
Customer Enabler				
PD Model Enabler			Yes	
Network Enabler		Yes		
Innovation Enabler		Yes		
HRM Enabler		Yes		
Process Enabler		Yes		
Product to Process Enabler		Yes		
Modularisation Enabler	Yes			
E-Development Enabler			Yes	

### **Product Development Case – “A New Chemical Ingredient...”**


The managing director of AKV received a re-complaint from one of AKV's essential customers. The quality of the latest delivery was not within the defined and agreed tolerance areas. The managing director ordered the production manager to examine the problem and come up with the explanation and reason for the complaint. The production manager found new ingredients in the product which made the process react radically different at the customer's production line. The management team held a meeting and after some discussion they agreed that they had discovered a new product idea which would be radical to the market – new to the market. They agreed on speeding the product development process to get a first mover advantage.

### **Product Development Task**

The product development task could be characterised as radical on the technological side because the component was not known before in the business; neither were the side effects known. The task could be characterised as radical on the innovative side because no competitive products offered this feature. The product would be new to the market. On the market side the product development was incremental because the customer was known and familiar. All in all, the result of the product development task could be a radical breakthrough product if success was reached. It would give the customer a possibility to run their production faster whereby they could achieve a big cost reduction in the production. The question was how much would the customer pay for the product? Some further special characteristics can be seen in Table 9.70.

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**Table 9.70** Special characteristics of the development task

Dimension	Incremental	Radical
Where were the idea discovered	Internal the business – production – due to a reclamation from a customer	
Initiator of idea	Director and production manager	
Product type	Hardware 50% Software (knowledge of the process and combination of chemicals) 50%	
Consequences for product core		modification of core and ad to functions
Placement in product development stage		concept stage
Innovation degree		high
Market		old and mature
Customer needs		new
Customer group	Old	
Customer technology		new
Technology		new
Network		old
Competences		new and unknown
Product management	the business manager	
Competition		high
Strategic importance	high, important, middle term and critical – competitive advantage	
Success criteria	Cost – middle CI – none CIM – some Learning – none	Performance – high Speed – very high
Product development task	Incremental Radical	
PD model – formal	Stage gate	
Functions involved in initial phase	Management and production	
Partners involved in initial phase	business alone firstly – internal product development project afterwards prototyping with one or two main customers.	
Enablers involved	HRM – enabler and a new enabler to the PhD research – the Management enabler. The product development enabler – Rapid prototyping.	

### 9.1.5 Lindholst – “The Food Machine Business”

Lindholst was a medium-sized business which produce machinery for the food industry, particularly poultry slaughterhouse machinery. During the last 10–15 years up to 2003, the business had become a market leader of machinery for this line of business.

The Lindholst product portfolio was strongly focused on physical and service products. However, on the new product introduction a small implementation on new products on knowledge and consultancy products were seen.

This could be seen as a reaction to the market needs and wants but also as a penetration of the existing product potential within the business. When looking at Lindholst’s products Table 9.71 – 80% of the products were physical products and 20% were digital products.

**Table 9.71** Focus on product types

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	75	25	0
New Products	80	15	5

75% concern physical processes and 25% digital processes as seen in Table 9.72.

**Table 9.72** Focus on products and processes

	Physical Products	Digital Products	Virtual Products
Existing Product Portfolio	80	20	0
	Physical Processes	Digital Processes	Virtual processes
Existing Product Portfolio	75	25	0

Lindholst had a very high focus on physical products and processes but it seemed as if there was a minute tendency to shift focus from physical to digital and service/knowledge based products. This could be a reaction or a response to a market need.

The market was experiencing a huge pressure on price. There were large customers in the market who were focusing on cost and efficiency. New technology was constantly being introduced to the market, and new and often unknown networks were introduced. A high pressure on the competences of the businesses was felt.

### PD in General at Lindholst

The case research showed the following general characteristics of the product development at Lindholst.

Product development ideas at Lindholst came from different sources but mainly from the customers (20%), the sales function (20%), and the product development department as seen in Table 9.73. This indicates that in general the business's product development was based on identified needs and wants in the market and consequently on the product development department. Compared to the other case businesses, more departments were involved at Lindholst during idea generation. This was due to strong management efforts to involve and make all functions responsible of product development.

**Table 9.73** Sources of PD ideas in general

Sources to Product Development Ideas in General	In Per Cent
Customers	20,0
Suppliers	5,0
Marketing	5,0
Sales	15,0
Leadership/Management	10,0
Production	10,0
Product Development	15,0
Competition	20,0
Total	100

### Core Goals and Limits for NPD Projects

As a general rule, the core of a product development project was formulated in the business. The reason why the core of the product development project was specified at Lindholst was their strong focus on the formulation of the product development project core at the start of a project. This was also supported by the fact that formal mission, goals, and strategy for the product development project were always specified.

The economic resources, personal/organisational resources and contact limit to network partners were not specified. Here, Lindholst had a strong focus on the strategic limits of their product development projects whereas the rest was up to the product development team behind the project in question.

As can be seen from Table 9.74, Lindholst said that such overall specifications were important for the business to reach the success criteria of the product development project.

**Table 9.74** Goals and limits to PD

Definition of goals and Limits to Product Development Project	
Mission	Yes
Goals	Yes
Strategy	Yes
Economic Resources	No
Personnel/Organisational Resources	No
Contact Limits to Network Partners	No

### Product Development Tasks

On the basis of the case research, Lindholst's product development task could be defined as shown in Table 9.75.

**Table 9.75** Lindholst's PD task

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	75	25	0
New Products	80	15	5
Product Development	80	15	5

Of the business's product development tasks 80% could be related to hardware or physical products whereas 20% could be related to service and knowledge products.

As can be seen Lindholst's product portfolio was mainly focused on physical products and service products. However, the introduction of new products and the product development efforts were now also slightly on knowledge and consultancy products.

Lindholst also claim that in general product development projects could be divided into 80% strategic known and old areas and 20% unknown and new areas as seen in Table 9.76.

**Table 9.76** PD projects in relation to strategy

	Strategic Areas	
	Known and Old Areas	Unknown and New Areas
Total Average	80	20

The product/market model gave the following a picture seen in Figure 9.9 of Lindholst's product development project situated in areas of rather incremental product development.



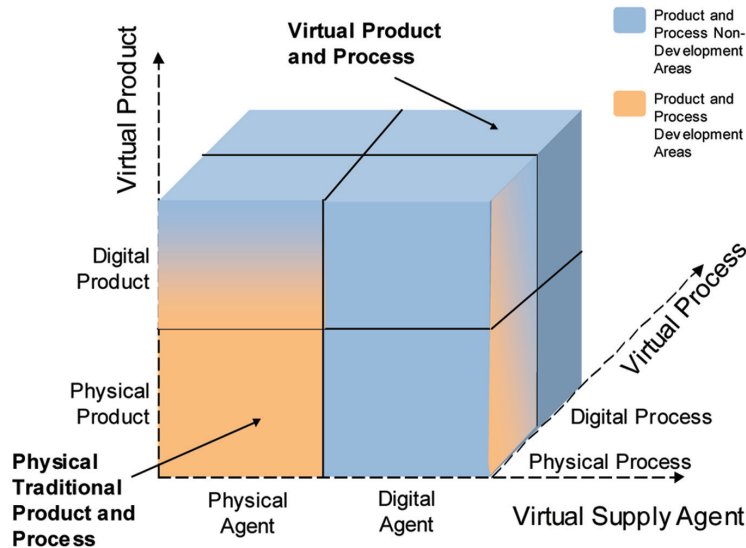


Figure 9.9 Lindholst's product and process matrix.

Lindholst's product development projects were mainly on new products older than 1 year (60%) and old products older than 3 years (40%) as seen in Table 9.77.

Table 9.77 PD in relation to product

	Old Products		New Products	
	More than 3 Years with a Need for Small Adjustments	Old Products More than 3 Years with a Need for Big Adjustments	Older than 1 Year with a Need for Small Adjustments	New Products Older than 1 Year with a Need for Big Adjustments
Total Average (%)	0	40	0	60

The case research showed that out of all product development projects the main projects were on products that need big adjustments. The data showed evidence of what had been said about a diminishing product lifecycle. In an overall perspective, the product development at Lindholst concerned major adjustments and major redevelopment after 1 year's lifetime. This indicated a high pressure on radical product development at Lindholst.

The survey also showed that 90% of product development in the business was on known and old customer groups as seen in Table 9.78.

**Table 9.78** PD in relation to customer groups

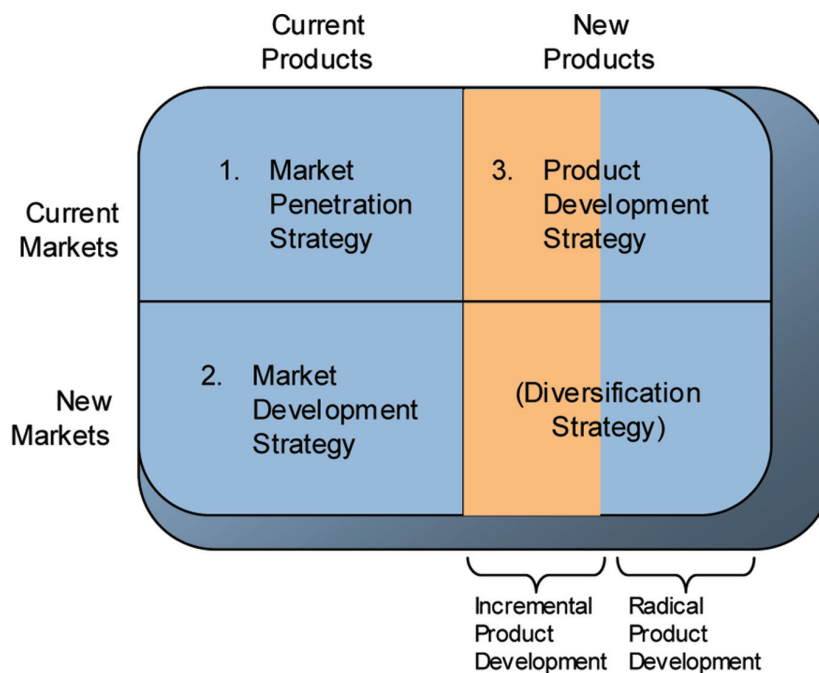
	Known and Old Customer Groups	Unknown and New Customer Groups
Total Average	90	10

Looking at the product development projects and customer needs we observe that 80% of the product development projects were on known/old customer needs and 20% on unknown/new customers needs as seen in Table 9.79.

**Table 9.79** PD projects in relation to customer needs

	Known and Old Customer Needs	Unknown and New Customer Needs
Total Average	80	20

This is yet another indication of a business which deals with relatively incremental product development projects as indicated in Figure 9.10.



**Figure 9.10** PD tasks at Lindholst.

On the technical level, Lindholst claimed that 70% of their product development projects were on new technology – radical technology areas and 30% were in areas of known technology or development areas where small incremental technology adjustments were necessary as seen in Table 9.80.

**Table 9.80** PD projects in relation to technology

	Known Technology	Known Technology with Small Adjustments (Incremental Technology)	Completely New Technology (Radical Technology)
Total Average (%)	15	15	70

This indicated that product development at Lindholst was very radical on the technological side.

The case research showed that 50% of the product development projects were related to market areas with high and rival competition. There were no product development projects in low competition areas as seen in Table 9.81.

**Table 9.81** PD projects in relation to competition

	Markets with Low or No Competition	Markets with Medium or Intensive Competition	Markets with Fierce and Rival Competition
Total Average (%)	0	50	50

Lindholst considered 35% of their product development projects with a high element of innovation and another 35% in areas with medium innovation degree as seen in Table 9.82. This indicated that the product development projects in this area at Lindholst were rather radical.

**Table 9.82** PD projects in relation to degree of innovation

	No Degree of Innovation – Routine NPD Project	Medium Degree of Innovation – Modified Product Development with Minor Demands on Adjustment (Incremental)	High Degree of Innovation – with Many Elements of Innovation (Radical Innovation)
Total Average (%)	30	35	35

## The Lindholst PD Model

### Formal Stages and Gates

In the case research Lindholst claimed that they had a formal stage gate model. The case research showed that the stages and gates of Lindholst's formal model were identical to the stages and gates of our hypothesis model.

The case research showed that Lindholst's product development model had 4 stages – a concept stage, a product development stage, and a process development stage. In the screening area the picture showed that Lindholst had 4 gates – an idea screening gate, a concept screening gate, a proto type test gate, and a process test gate.

The above case research results proved that the stage gate model exists at Lindholst and that the stage gate model was identical to our research hypothesis model.

### Informal Stage and Gate

Lindholst confirmed that an informal product development model also existed in the business. The existence and the importance of the informal product development model at Lindholst on different areas were interesting; see below in Table 9.83.

**Table 9.83** Stages and gates of Lindholst's formal PD model

Idea	Concept	PD Phase	Process Development Phase	Idea Screening	Concept Screening	Proto Type	Process Testing
Y	Y	Y	Y	Y	Y	Y	Y

It is very interesting to see that the informal product development model at Lindholst mainly played a role in the lower levels of the product development process. The idea and concept stage and gate hold no informal stages or gates as seen in Table 9.84. My observation was that this was due to

**Table 9.84** Stages and gates of Lindholst's informal PD model

Idea	Concept	PU Phase	Process Development	Idea Screening	Concept Screening	Prototype	Process Testing
N	Do not know	Y	Y	N	N	Y	Y

immense involvement and openness at the initial stages and gates at Lindholst. Furthermore, pressure on speed in the middle and lower part of the product development phase caused a need for informal models.

As previously explicated, the informal product development model was important to the time and speed success criteria. Moreover, Lindholst claimed that the informal product development model influences all long term success criteria – CIM, CI, and learning. This scenario differed very much from those of the other businesses examined.

### Internal Functions Involved in Product Development Process

In the case research at Lindholst the following functions were involved in the different stages and gates of the product development process. The Lindholst business had a quite characteristic involvement of functions taking part in the product development stages and gates.

Although it seemed as if the business was very focused on involvement of sales, management and the product development department in the initial idea- and concept stage and gates.

Sales, marketing, management and the product development department were the main actors at the idea stage of the product development process. HRM and finance were not involved in the product development as seen in Table 9.85. Production enters the development in the middle stage of

**Table 9.85** Functions participating in PD idea stage

	Marketing	Finance	Sales	Management	Production	Product Development	HRM
Idea Generation	ISC	N	ISC	ISC	N	Y	N
Concept Generation	N	N	ISC	ISC	N	Y	N
Product Development	N	N	N	ISC	Y	Y	N
Process Development	N	N	ISC	ISC	ISC	Y	N
Phase							
Idea Screening	ISC	N	ISC	ISC	N	Y	N
Concept Screening	ISC	N	ISC	ISC	N	Y	N
Proto Type Test	N	N	N	N	ISC	Y	N
Process Test	N	N	N	N	ISC	NA	N

Y = Yes

N = No

ISC = In some cases

DN = Do not know

the product development process. Management played a major role in the teambuilding in the product development projects.

## External Networks Involved in Product Development

### PU Management

To a large extent, the product development projects at Lindholst were managed internally by the product development department (70%) as seen in Table 9.86. This gave a strong indication that the management of product development at Lindholst was strongly concentrated internally and based on a strong leadership by Lindholst. This was quite another management model as the ones seen in the other businesses of this research.

**Table 9.86** Management of projects at Lindholst

Management of Project (%)	
Sales	10
Production	20
Product Development	70
Total	100

The argument was further supported when looking at the network partners involved in the product development process as seen in Table 9.87.

**Table 9.87** Network partners involved in PD process

	Customers	Suppliers	Competition	Other Network Partners
Idea Generation	Y	N	N	N
Concept Generation	Y	N	N	N
Product Development	N	N	N	N
Process Development	N	N	N	N
Phase				
Idea Screening	Y	N	N	N
Concept Screening	Y	N	N	N
Proto Type Test	Y	N	N	N
Process Test	Y	N	N	N

Y = Yes

N = No

ISC = In some cases

DN = Do not know

The suppliers and the competitors were not involved in the product development process; moreover the customers were mainly involved in the initial phase of the product development process. Other network partners were not involved.

**Focus of Success Criteria of PD Process**

Lindholst was very much focused on performance and continuous innovation as these received priority 1 on a scale from 1 to 5 as seen in Table 9.88.

**Table 9.88** Priorities of success criteria at Lindholst

Priorities	
Time	2
Cost	2
Performance	1
CIM	2
CI	2
L	2

The priorities changed during the product development stages and gates as seen in Table 9.89. The focus on time was very predominant at the product development stage, at all initial screening gates, and at implementation. Performance was very much in focus at the final gates of the product development process. Lindholst put a high priority on CIM, on the idea stage, and CI in the concept stage and this meant that the pressure on time was lower because Lindholst wanted to have maximal innovation and continuous improvement at these stages.

**Table 9.89** Lindholst’s focus on success criteria

	Time	Costs	Performance	CIM	CI	Learning
Idea						
Concept						
PD Stage						
Process Stage						
PD Test						
Idea Screening						
Concept Screening						
Proto Type Test						
Process Test						
Implementation						

## HS Enablers

The use of high speed enablers showed that all enablers were considered at Lindholst but especially enablers nos. 1, 2, 4, 8 and 9 were in focus as seen in Table 9.90. Lindholst tried to mix the enablers to the product development task.

**Table 9.90** Use of HS enablers at Lindholst

	Very Much	In Some Cases	No	Do Not Know
ICT Communication Enabler	Yes			
Customer Enabler	Yes			
PD Model Enabler		Yes		
Network Enabler	Yes			
Innovation Enabler		Yes		
HRM Enabler		Yes		
Process Enabler		Yes		
Product to Process Enabler	Yes			
Modularisation Enabler	Yes			
E-Development Enabler		Yes		

## Product Development Case – “A New Chicken Slaughter Machine”


The product development team was gathered around the managing director to discuss an idea for a new machine for hanging up chickens for slaughtering at one of the business’s major and main customers. If Lindholst could develop the new product it would be a new to the market product and Lindholst would have gain a first mover advantage. However there were high pressure on time from the customers side because of some environmental new regulations.

### Product Development Task

The product development task could be characterised as radical on the technological side. On the innovative side, the task could also be characterised as radical because no competitor had this product feature in their products. This would be new to the market. However, the task could be characterised as incremental on the market side because the customer was known and familiar. Yet, altogether the result of the product development task could be a radical breakthrough product if success was reached as the component would give the customer the possibility to run his production faster and thereby gain a big cost reduction in the production. Furthermore it would give the customer environmental benefits regarding their working environment. Finally, it would improve the quality of customers final product. In Table 9.91 the special characteristics of the PD task are seen.



**Table 9.91** Special characteristics of the PD task

Dimension	Incremental	Radical
Where was the idea discovered	External the business – customer and sales – due to a strong customer need to solve a working environmental problem and a need for faster production in the chicken slaughter	
Initiator of idea	Customer	
Product type	Hardware 50% Software (knowledge of the technology to solve the hanging up process of chicken for slaughtering) 50%	
Consequences for product core		Modification of core and ad to functions
Placement in product development stage		Concept stage
Innovation degree		High
Market		Old and mature
Customer needs		New
Customer group	Old	
Customer technology		New
Technology		New
Network		Old
Competence's		New and unknown
Product management	The business – manager	
Competition		High
Strategic importance		High, important, short term and critical – competitive advantage
Success criteria	Cost – middle Speed – middle CI – none CIM – some Learning – none	Performance – high
Product development task		
PU model – formal	Stage gate	
Functions involved in initial phase	Management, product development	
Partners involved in initial phase	Customer and the business	

### 9.1.6 GSI Lumonics – “The Welding Machine Business”

GSI Lumonics was one of the largest and most resourceful worldwide providers of laser-based manufacturing systems and components.

GSI Lumonics helped customers to create and enhance the value of their products through the use of lasers.

The GSI product portfolio was strongly focused on physical and service products. However, in connection with a new product introduction a small implementation on service together with consultancy products and new products on knowledge were seen.

This could be seen as a reaction to the market needs and wants but also as a penetration of the existing product potential within the business. An observation of GSI's products showed that 80% of the products are physical products and 20% were digital products. 65% concern physical processes and 35% digital processes as seen in Tables 9.92, 9.93 and illustrated on behalf of the data in Figure 9.11.

**Table 9.92** Focus on product types

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	80	15	5
New Products	70	25	5

**Table 9.93** Focus on products and processes

	Physical Products	Digital Products	Virtual Products
Existing Product Portfolio	80	20	0
	Physical Processes	Digital Processes	Virtual processes
Existing Product Portfolio	65	35	0
Product Development	55	45	0

GSI had a very high focus on physical products and processes but it seemed as if there was a small tendency to shift focus from physical to digital and service/knowledge based products and to digital processes. This could be a reaction or a response to a market need and hence a change of products.

The market for GSI Lumonics' products was characterised by larger customers and with fierce competition, yet with a strong relationship between customer and supplier. The technological development was very intense and dynamic and new network partners were constantly entering the market.

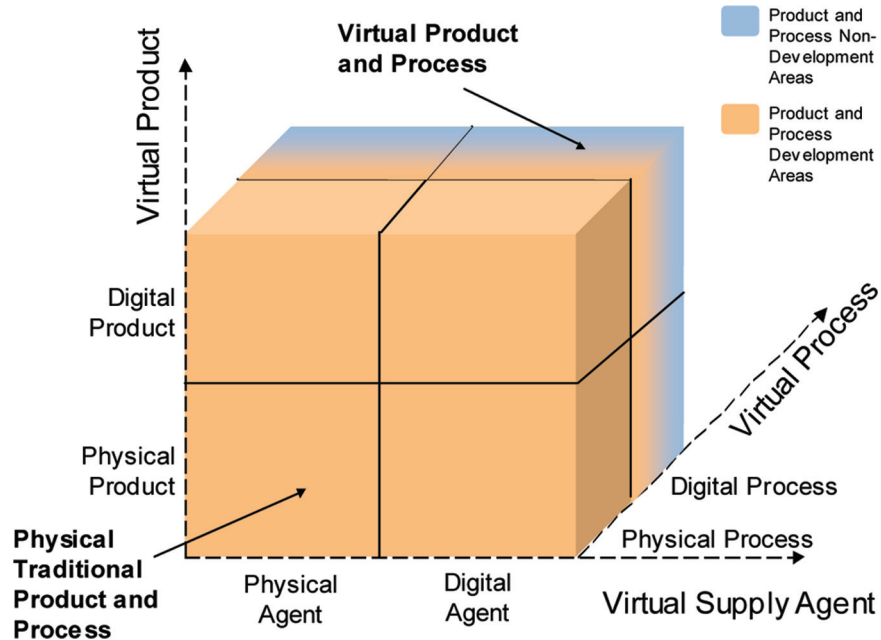


Figure 9.11 GSI's product and process development matrix.

The pressure on the competences of the businesses was very high and as a consequence, GSI Lumonics had many network partners and ad hoc consultants.

### PD in General GSI

The case research showed the following general characteristics of the product development in GSI.

The product development ideas at GSI came from different sources but mainly from the customers (25%), the sales function (20%), and the product development department (20%) as seen in Table 9.94. This indicated that the business's product development in general was based on identified needs and wants in the market and at product development department. Compared to the other case businesses more departments at Lumonics were involved in the idea generation. This was due to a strong management effort to involve and make all functions responsible for product development. Furthermore, GSI used other sources such as universities and research centres to generate new ideas for products.

**Table 9.94** Sources of PD ideas in general

Sources to Product Development	
Ideas in General	In Percent
Customers	25,0
Suppliers	10,0
Marketing	5,0
Sales	20,0
Leadership/Management	5,0
Production	5,0
Product Development	20,0
Competition	5,0
Others	5,0
Total	100

### The Core – Goals and Limits for NPD Projects

In general, the core of a product development project was formulated in the business. The reason why the core of the product development project in general was specified at GSI strong focus on formulating the core of a product development project at the start of a project and the very high cost of developing a new product. This was further supported as the formal mission, goals, and strategy for the product development project were always specified as seen in Table 9.95.

**Table 9.95** Goals and limits to product development

Definition of Goals and Limits to Product Development Project	
Mission	Yes
Goals	Yes
Strategy	Yes
Economic Resources	Yes
Personnel/Organisational Resources	Yes
Contact Limits to Network Partners	Yes

The financial resources, personal/organisational resources and contact limit to network partners were always specified. GSI had here a strong focus on the strategic limits of the product development projects. Particular to GSI a strong development together with the main customers often with prototype development of big plants in house GSI was important. These plant were afterwards destroyed and built up again at the customer's production line.

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Because of very fierce and intense competition there was huge focus on which network partners could and should be involved in the product development.

As can be seen from Table 9.95 GSI said that such overall specifications were important for the business to reach the success criteria of the product development project.

**Product Development Tasks**

On the basis of the case research GSI's task of product development could be defined as seen in Table 9.96.

**Table 9.96** GSI's product development task

	Physical Products	Service Products	Knowledge and Consultancy
Existing Product Portfolio	80	15	5
New Products (3 years)	70	25	5
Product Development	70	25	5

Of the business's product development tasks 70% could be related to hardware or physical products whereas 30% could be related to service and knowledge products. As appears from Table 9.96 GSI's product portfolio mainly focused on physical products and service products. However, the introduction of new products and the present product development efforts now also moved towards knowledge and consultancy products as can be seen in Table 9.97.

**Table 9.97** PD projects in relation to strategy

	Strategic Areas	
	Known and Old Areas	Unknown and New Areas
Total Average	85	15

GSI also claimed that in general product development projects could be divided into 85% strategic known and old areas and 15% unknown and new areas.

The product/market model gave the following picture as seen in Figure 9.12 of GSI's product development project situated in the area of rather incremental product development.

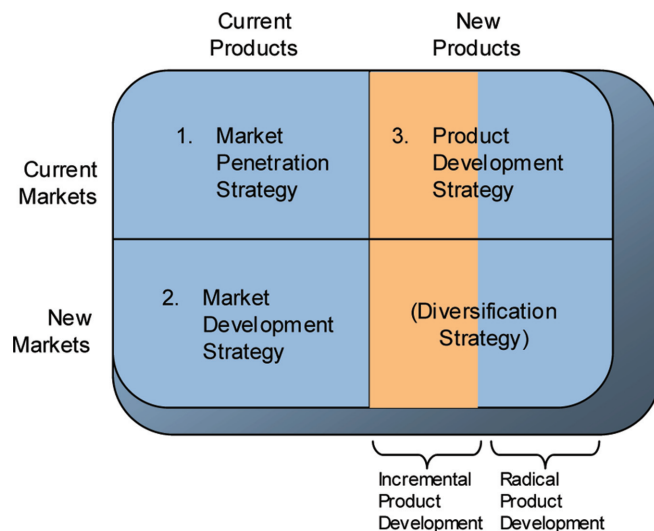


Figure 9.12 PD tasks at GSI.

GSI’s product development projects were mainly on old products older than 3 years (70%) and only 30% on products older than 1 years (30%).

Table 9.98 PD in relation to product

	Old Products		New Products	
More than 3 Years with a Need for Small Adjustments	Old Products More than 3 Years with a Need for Big Adjustments	Old Products Older than 1 Year with a Need for Small Adjustments	New Products Older than 1 Year with a Need for Big Adjustments	
Total Average (%)	20,0	50,0	25,0	5,0

The case research showed that out of the product development projects the main product development projects were products that need big adjustments (55%). The data showed evidence of GSI’s deviation from the theory of diminishing product lifecycle. This was due to the lifetime of the products which were characterised by large investments both directly and indirectly concerning installation costs etc. In an overall perspective the product development at GSI were major adjustments and major redevelopment after 3 years of lifetime. This indicated a high pressure on radical product development at GSI.

The survey also showed that 90% of the product development in the business was on known and old customer groups as seen in Table 9.99.

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**Table 9.99** PD in relation to customer groups

	Known and Old Customer Groups	Unknown and New Customer Groups
Total Average	90	10

Looking at the product development projects and the customer needs we could see that 80% of the product development projects were on known/old customer needs and 20% on unknown/new customer needs as seen in Table 9.100.

**Table 9.100** PD projects in relation to customer needs

	Known and Old Customer Needs	Unknown and New Customer Needs
Total Average	80	20

This designates a business which dealt with rather incremental product development projects on this dimension.

On the technical level GSI claimed that 65% of their product development projects were in new technology – radical technology areas and 35% in areas of known or development areas where small incremental technology adjustments were necessary. This indicates that product development at GSI was very radical on the technological side as seen in Table 9.101.

**Table 9.101** PD projects in relation to technology

	Known Technology	Known Technology with Small Adjustments (Incremental Technology)	Completely New Technology (Radical Technology)
Total Average (%)	10	25	65

The case research showed that 50% of the product development project were related to market areas with high and rival competition. Only 10% of the product development projects were in low competition areas as seen in Table 9.102.

**Table 9.102** PD projects in relation to competition

	Markets with Low or No Competition	Markets with Medium or Intensive Competition	Markets with Fierce and Rival Competition
Total Average (%)	10	35	55

GSI considered 55% of their product development projects to be in high competition areas.

GSI considered 40% of their product development projects to have a high element of innovation and another 45% to be in areas with medium innovation degree as seen in Table 9.103. This indicates that the product development projects at GSI were rather radical.

**Table 9.103** PD projects in relation to degree of innovation

	No Degree of Innovation – Routine NPD Project	Medium Degree of Innovation – Modified Product Development with Minor Demands on Adjustment (Incremental)	High Degree of Innovation – with Many Elements of Innovation (Radical Innovation)
Total Average (%)	15	45	40

## The GSI Product Development Model

### Formal Stages and Gates

In the case research GSI claims that they had a formal stage- gate model. The case research showed that the formal model had the same stages and gates as our hypothesis model.

The case research showed that GSI’s product development model had 4 stages – a concept stage, a product development stage, and a process development stage. In the screening area the picture showed that GSI has 4 gates – an idea screening gate, a concept screening gate, a prototype test gate, and a process test gate as seen in Table 9.104.

**Table 9.104** Stages and gates of GSI’s formal PD model

	Idea	Concept	PD Phase	Process Development Phase	Idea Screening	Concept Screening	Proto Type	Process Testing
	Y	Y	Y	Y	Y	Y	Y	Y

The above case research results proved that the stage gate model existed at GSI and that the stage gate model was identical to our research hypothesis model.

### Informal Stages and Gates

GSI confirmed that an informal product development model also existed in the business. The existence and importance of the informal



product development model at GSI were interesting as can be seen in Table 9.105.

**Table 9.105** Stages and gates of GSI's informal PD model

		Process					
Idea	Concept	PD Phase	Development Phase	Idea Screening	Concept Screening	Proto Type	Process Testing
Y	Y	Y	Y	Y	Y	Y	Y

It was very interesting to see that the informal product development model of GSI plays a role in all parts of the product development process. My observation was that this was due to the necessity of major investments in both the formal and informal product development models and processes. Furthermore, the pressure on speed in the middle and lower part of the product development phase caused a need for informal models.

As previously stated, the informal product development model was important to the time and speed success criteria. Moreover, GSI claimed that the informal product development model influenced cost and performance success criteria but also CI and learning as seen in Table 9.106.

**Table 9.106** Importance of informal PD model in relation to success criteria

	Time	Costs	Performance	CIM	CI	Learning
Yes	Y	Y	Y	0	Y	Y
To some extent	0	0	0	Y	0	0
No	0	0	0	0	0	0
Do not know	0	0	0	0	0	0
Not answered	0	0	0	0	0	0

Focusing on CI and Learning in product development the informal product development model influenced particularly the upper and middle part of the product development phase.

**Internal Functions Involved in Product Development Process**

The case research at GSI showed that the following functions as shown in Table 9.105 were involved in the various stages and gates of the product development process.

Although it seemed as if the business was very focused on involvement of the product development department at the initial idea and concept stage and gates, all departments except finance were involved in the initial stages and gates of the product development as seen in Table 9.107.

**Table 9.107** Functions participating in PD idea stage

	Marketing	Finance	Sales	Management	Production	Product Development	HRM
Idea Generation	Y	N	Y	Y	Y	Y	N
Concept Generation	Y	Y	Y	Y	Y	Y	N
Product Development	Y	Y	Y	Y	Y	Y	N
Process Development	ISC	Y	ISC	Y	Y	Y	N
Phase							
Idea Screening	Y	Y	Y	Y	Y	Y	N
Concept Screening	Y	Y	Y	Y	Y	Y	N
Proto Type Test	Y	Y	Y	Y	Y	Y	N
Process Test	Y	Y	Y	Y	Y	NA	N

Y = Yes

N = No

ISC = In some cases

DN = Do not know

Our case research showed a business based very much on team management where all levels and functions had responsibilities to product development as seen in Table 9.107. Sales, marketing, management and the product development department were the main actors in the idea stage of the product development process but HRM and production were also involved in the product development as the very radical product development projects demand also their skills and competences. The financial department entered the product development project very early in the product development process because the product development project at GSI took a lot of resources and demanded a lot of financial calculation beforehand. Management played a major role in the teambuilding in the product development projects and as can be seen later in the case analysis, management supports the product development group with external consultancy because there was a strong need for external management competence in the heavy weight product development projects.

## External Networks Involved in Product Development

### PD Management

The product development projects in GSI were very much managed as a combination of internal and external product development management. However, the management of product development at GSI as seen in

Table 9.108 was strongly concentrated internally and based on a strong leadership by GSI's management group. This was quite another management model compared to the other case businesses as seen in Table 9.108.

**Table 9.108** Management of projects at GSI Lumonics

Management of Project (%)	
Customer	10,0
Supplier	10,0
Marketing	5,0
Sales	10,0
Management	10,0
Production	10,0
Product Development	30,0
Common Leadership	15,0
Total	100

The argument was additionally supported when looking at the network partners involved in the product development process.

The suppliers and the customers were involved in the product development process and external consultancies were also placed with management responsibilities. The management of the product development project was a combination of team management and functions or external partners with management responsibilities of particular parts of the product development project. The customers were involved in essentially all product development phases especially in radical product development projects.

**Focus of Success Criteria of Product Development Process**

GSI was very much focused on time, performance, continuous innovation and learning as these criteria received priority 1 on a scale from 1 to 5 as seen in Table 9.109.

**Table 9.109** Priorities of success criteria at GSI

Priorities	
Time	1
Cost	3
Performance	1
CIM	3
CI	1
L	1

However, the priorities changed during the product development stages and gates as seen in Table 9.110.

**Table 9.110** GSI Lumonics' focus on succes criteria

	Time	Costs	Performance	CIM	CI	Learning
Idea						
Concept						
PD Stage						
Process Stage						
PD Test						
Idea Screening						
Concept Screening						
Proto Type Test						
Process Test						
Implementation						

The focus on time was predominant at the process development stage and at all initial generation stages. Performance was very much in focus at all gates of the product development process. GSI put a high priority on CI and learning in the generation stage because new technology, market needs, and networks had to be learned and innovated to develop the competence of GSI. Cost was very much in focus at the concept stage and gate as product development projects were very costly for GSI to implement.

### HS Enablers

The use of high speed enablers showed that all enablers were considered at GSI and more enablers than we had seen in other case businesses as seen in Table 9.111.

**Table 9.111** HS product enablers used at GSI

	Very Much	In Some Cases	No	Do Not Know
ICT Communication Enabler	Yes			
Customer Enabler	Yes			
PD Model Enabler		Yes		
Network Enabler	Yes			
Innovation Enabler	Yes			
HRM Enabler	Yes			
Process Enabler		Yes		
Product to Process Enabler	Yes			
Modularisation Enabler	Yes			
E-Development Enabler	Yes	Yes		

### Product Development Case – a New Welding Machine

The management team was gathered around 4 new product development tasks. The discussion centred on the way in which to develop 4 central product development projects parallel and at same time. One product development task were considered as rather incremental but however placed inside one of GSI Lumonics new products sold to one of the strategic important customers.

However, the product development management considered the product development task to be of a character that it would be potential to outsource to a sub supplier. It was decided to do so also because the existent product development department at GSI Lumonics did not have the time to do the development task.

### Product Development Task

The product development task was characterised by the management group as somewhere between radical and incremental on the technological side because the technology was known – power supply, beamer, and steering was known technology. The product development project also seems to be incremental on the innovative side but turned out to be radical. The product development task was incremental on the market side as the customers were known and familiar. However, altogether the result of the product development task could be a radical breakthrough product if success was reached because it would leave the competitors behind for some span of time.


Special characteristics of the development task are shown in Table 9.112.

**Table 9.112** Special characteristics of the development task

Dimension	Incremental	Radical
Where was the idea discovered	Internal the business – product development, management – due to a strong business need to gain an competitive advantage in the laser welding market specifically the automobile production	
Initiator of idea	The business	
Product type	Hardware 50% Software(knowledge of the technology to solve the laser welding process)	

(Continued)

**Table 9.112** Continued

Dimension	Incremental	Radical
Consequences for product core		Modification of core and ad to functions
Placement in product development stage		Concept stage
Innovation degree		Regarded as middle but turned out high
Market		Old and mature
Customer needs		New
Customer group	Old	
Customer technology		New
Technology		New
Network		Old
Competence's		New and unknown
Product management		The sub-supplier - product development manager
Competition		High
Strategic importance		High, important, short term and critical – competitive advantage
Success criteria	Cost – middle advantage CI – none CIM – none Learning – none	Performance – high Speed – high – competitive first mover
Product development task		
PU model – formal	Stage gate	
Functions involved in initial phase	Management, product development	
Partners involved in initial phase	Sub-supplier and the business	
Enablers involved	The network enabler	

## 9.2 Cross-Section of Case Results

The case examination proved partly a general status for the product development situation of the businesses, partly a specific status for a specific product development course in the businesses. In this paragraph the main emphasis is on the general, empirical observations made during the case examination.

### 9.2.1 General Results

#### Product and Process Portfolio of Case Businesses

The case examination showed that the existing product portfolio differed from one business to another. Nevertheless, there was a clear focus on hardware

and physical products. Similarly, the products most recently developed by the businesses were primarily hardware and physical products. However, it was evident that the share of service, knowledge, and consultancy was growing. Especially new product development was increasing in these areas.

### **Birth of Product Development Ideas**

An examination of the case businesses showed that the ideas to the product development of the business may be borne by many different sources. However, the primary sources seem to be the customers, the sales department, the management, and the product development department. The idea creation turned out to be rather more subtle than indicated by my immediate hypothesis as the ideas are created before, during, and after the course of a product development. In particular, many small, incremental product development ideas were created after the implementation of the product on the market.

### **Product and Product Development Task**

Additionally, the case examination demonstrated that product development was not concerned primarily with changing the actual core of the product but rather with adapting certain partial elements of the product to the market, i.e. related product development.

Thus, the core of the product could be relatively stable and fixed in its product development phase, while the “rings” surrounding the products may be under pressure and undergoing continuous development. The question was when the development in the outer rings will bear an impact on the core of the product.

### **Goals and Framework**

It was evident from the case examination that the businesses would generally specify goals and budgets for a product development project prior to the establishment of the project. Some of the businesses were forced by their ISO 9000 standard to make such specifications whereas other businesses did it in order to set up milestones to steer by.

The overall mission of a product development project was generally less specifically formulated. On the other hand, personnel and organisational resources were most often formulated in all case businesses.

The drawing-up of a strategy and the interface to the networks partners was seldom prepared at the beginning of a product development project.

Apparently, these two areas were much more dynamic than others and were the object of continuous definition throughout the product development course concurrently with the emergence of needs and demands.

It was characteristic that the strategic importance of a product development project may influence the wording of the goals and framework of the product development project. In other words, there was a tendency to draw up all parts of the goals and frameworks of the product development in the case of important product development projects.

### **Product Development Task**

The actual product development tasks in the case businesses were characterised by being primarily what was previously known as incremental product development tasks. The product development task were mainly found within known and old strategic areas, i.e. product market areas. Similarly, the businesses characterized the innovation degree of their project as existing mainly in the low innovation area. Thus, only very few of the case businesses worked deliberately and mainly in the high innovation area. However, major variations in the product development profile were found in the case businesses.

Similarly, the product development tasks of the businesses were characterised by being primarily placed in old markets with known customer need and known customer groups. Likewise, the customer technology – i.e. production technology – which the businesses contemplated using in order to fulfil the needs of their customers was known by the business.

On the other hand, the businesses quite often had to include several basic technologies in order to solve the product development task, and my observations generally showed an growing degree of technological mergers and mix in the solving of product development tasks. In this aspect my case research demonstrated a general pressure on the competences of the businesses in terms of mastering and acquiring the competence to mix and employ several technologies in their product development. This was also the “root” of a growing use and involvement of external network partners with special competences required in order to solve the product development task. However, the businesses were still committed to the use of known and geographically close network partners.

The product development tasks were generally aimed at competitive areas with medium to high competitive intensity. In other words, product development was used to provide the businesses with a competitive advantage or “first mover advantage” and to evade a unilateral competitive situation in which focus was solely on price and quality.



Thus, the radicality and incrementalness of a product development task can be worded in many different ways.

### **Product Development Life Cycle**

One of the characteristics of product development were that the products of the businesses were generally in need of re-development and major adjustments after a life of three years in the market. Furthermore, there is a tendency among the businesses to carry out product development on products with only one year and less than three years of life on the market.

This indicates that the life cycles of the products were diminishing but at the same time it seemed to signify that the modularisation outlook had not been sufficiently integrated in the product development plans of the businesses as major adjustments of the products were often required.

### **Product Development Model of Case Businesses**

The case examinations showed that the businesses were generally adhering to a formal stage-gate model with four stages and three gates. The idea phase for the businesses, however, was less clear and less formalised. Similarly, the idea and concept phases were often less formalised and burdened with a demand for “high speed”.

All case businesses confirmed that they had informal product development models and processes running parallel to their formal models and processes. The informal models and processes were particularly intensive in the idea phase and in the middle part of the product development phase. The informal models and processes came into being especially when there was a pressure on time and where the need for creativity was “far above the common measure”; i.e. in cases where product development could not take its optimal course within the formally determined framework.

The persons responsible for the product development were acquainted with the informal product development models and processes and were aware of their influence on the product development success criteria.

It was an outstanding characteristic that the small businesses did not have as many informal models and processes.

### **Product Development Success Criteria**

Generally, the case businesses focused on the short-term success criteria such as time, costs, and performance. The businesses differed widely when

prioritising the importance of the success criteria. Similarly, focus on success criteria differed in accordance with the product development stages and gates. Thus, the time and performance factor was generally in focus in the idea phase, the product development phase, and the prototype test phase. The time and costs factor were in focus in the screening phase and the process development phase. Focus on long-term success criteria was very limited.

The managers of the product development of the businesses realised that the informal product development models and processes were important to the business's product development success criteria – especially time and cost but also to a lesser degree CI. The managers of product development were generally not convinced that the performance of the product was influenced by the informal product development models and processes. Furthermore, they were uncertain as to whether CIM and learning were influenced by such models and processes.

Generally, I observed that in situations where competition was fierce and turbulent, pressure on the speed of product development increased considerably. Time is generally prioritised very highly in the implementation phase.

### **Functions Involved in Product Development Process**

Generally, the businesses had a traditional approach to identifying the functions to be included in the product development process. Marketing, sales, management, and product development were the leading functions involved in the initial phases of product development, whereas production and finance seemed to be the leading functions in the middle and – especially production – in the last phases of product development. HRM hardly ever played a part in the product development of the businesses.

It was a distinguished feature that finance only became involved in the product development at a very late point of the concept phase; often not until the concept screening phase. Several businesses only involved finance subsequent to the development of the concept which meant that the finance department could easily turn into a “bottleneck” in terms of time, budget, and acceptance of the development projects.

### **Management and Choice of Management for PD Projects**

It was a telling example that the managers of the businesses' product development were found on the top management level. Furthermore, the choice of

management was practically always made by the top management itself. On the part of the management focus was specifically on the short-term success criteria and PDM. In other words, the PDM and PDL level was thoroughly mixed.

The case examination showed that there could be various approaches to the managerial style when the objective was to ensure high speed in product development. The very authoritarian managerial style could be exceptionally advantageous in the middle and the end of the product development phase when there was a need to put extraordinary pressure on time in order to reach the market in time. Similarly both the authoritarian and the flexible and team based managerial style would produce excellent results at the time of concept development or when the product development is “stuck” and there was a need for extraordinary measures to exceed the limits of product innovation.

Generally, in terms of management, the introduction to the idea phase and the actual idea phase seemed to be less organised and less controlled. Though in some cases this may be accidental.

Furthermore, the case examination showed that small businesses tend to manage their product development projects themselves and directly by the top management.

### **Participation in External Networks**

The businesses examined tended to involve their customers in the first phases of product development; specifically the idea phase. Most often the suppliers were involved at a later point of the product development phase. The competitors were hardly ever involved in the product development of the examined businesses. The use of other external product development partners was strongly limited and primarily focused on the idea and concept generation phases. However, there were major variations in the management and managerial style of the businesses when the businesses represented both the hierarchical, traditional managerial style, the flexible managerial style, the very decentralized managerial style, and the team based managerial style.

The case examination showed that businesses placed in markets with fierce competition were less prone to enter into network cooperation.

### **Use of High Speed Enablers**

High speed enablers employed by the businesses were generally the customer enabler, the product development model enabler, and the modularisation

enabler. To a lesser extent the network enabler was in focus. The businesses' use of the e-development enabler was limited. However, there were major differences between the businesses' use of the high speed enabler.

## 9.2.2 Summary of Case Examination

Table 9.113 sums up on the main results of my case examination.

Dimension	Results
Product Type	Primarily physical products (65%), service (20%), and knowledge and consultancy (5%) Primarily physical processes (70%), digital processes (30%), and virtual processes (0%)
Idea Generation	Before, during, and after the product development phase Primarily by customers, sales, and product development
Consequences to Core of Product “Goals and Framework”	Related product development, seldom alterations of the core of the product Mission not always formulated Goals and budget not always formulated Use of personnel/organisational resources formulated and specified Strategy, interface, and contact to network partners normally not formulated. More dynamic <i>pari passu</i> with the arising needs and demands from product development
Strategic Area	Known strategic areas (95%), unknown strategic areas (5%) Low degree of innovation (85%), high degree of innovation (15%) Old markets (80%), new markets (20%) Old customer needs (85%), new customer needs (15%) Old customer groups (90%), new customer groups (10%) Known customer technology (70%), unknown customer technology (30%) Technologically old areas (65%), technologically new areas (35%) Known networks (90%), new networks (10%) Weak competitive environments (10%), medium competitive environment (30%), fierce competitive environment (60%)

(Continued)

**Table 9.113** Continued

Dimension	Results
Innovation Degree	
Market	
Customer Needs	
Customer Group	
Customer Technology	
Technology	
Network	
Competition	
Product Life Cycle	Generally diminished Often need for product development adjustments Often need for product development on products with less than 3 years On the market
Product Development Model	Mainly stage-gate model Normally 4 stages and 3 gates Informal product development models exist in the businesses often as a result of pressure on time and creativity
Management of Product Development	Very focused on short-term success criteria; time, costs, and performance Very focused on PDM and hardly ever on PDL Top-managed; choice of manager made by top-management itself Different managerial styles authoritarian, decentralized, and team based managerial style
Functions Involved in Product Development	Traditional functions involved; marketing, sales, product development, and management primarily in the initial phases. Finance in the concept screening phases. Product typically not involved until the last part of the concept phase and in the product development phase. HRM not involved in product development phase
Prioritizing Success Criteria for Product Development	Performance – high, especially in the idea and prototype phase Costs – medium to high especially in the screening phase and the last parts of the product development phase Time – High in idea, screening, and product development phase CI – hardly ever prioritised CIM – hardly ever prioritised Learning – hardly ever prioritised

### 9.3 Summary

Table 9.114 shows the results of verification on the different hypotheses.

**Table 9.114** Verification table

Chapter 9 Empirical Results – Pilot Case Studies		Verified/Not Verified
Overall Research Questions to be Verified	Hypotheses to be Verified and Tested	
1. What is network based high speed NPD	HS NPD can be seen from different view (Macro environment, business, product, market, customer, technology, competitive and network view)	Verified
	HS NPD is a matter of right speed and not high speed.	Verified
2. What enablers to NB HS PD can be identified?	Businesses use different HS enablers.	Verified
	HS enablers are identical to the 10 enablers – 1–10	Partly verified
	There can be more than these 10 enablers to HS PD	Verified
	The enablers will play a different role according to the PD situation and project (Secondary focus)	Verified
	The customer enabler, the network enabler and the PD model enabler plays an important role in the upper phase of the HS PD phase.	Partly verified
3. What framework models and processes in the idea and concept stage/gate of high speed product development based on networks can be measured	The HS PD projects can be divided into to radical and incremental PD projects	Verified
	The radical and the incremental PD projects follow different generic HS PD models and processes and can thereby be described by different generic frameworks	Partly verified
4. What success criteria can be used for measuring high speed product development based on networks?	The success criteria for HS PD are dependent on the specific PD project – radical or incremental	Verified

**Table 9.114** Continued

Chapter 9 Empirical Results – Pilot Case Studies		Verified/Not Verified
Overall Research Questions to be Verified	Hypotheses to be Verified and Tested	
	HS PD success criteria can be formulated as short term and long term success criteria	Verified
	Time, cost and performance are central success criteria in a short term perspective	Verified
	Continuous improvement (CIM), continuous innovation (CI), and learning are central success criteria in a long term perspective to reach right time, right cost and right performance in NB HS PD.	Not verified

