7

Reflection on and Perspectives of NB HS PD

High speed and network in product development will become major issues and major competitive weapons in future global competition. This is verified through the theoretical work in Chapters 3 to 6. Four main issues seem to be important to future product development.

1. The concepts of product development are changing
2. The network based product developments of the businesses are changing
3. The success criteria of product development are changing
4. The tools of product development are changing
5. The management of product development is changing

7.1 Concept of Product Development

In these years, both researchers and industry realise how the concepts of the products and product development models and processes are changing. The old concepts of product development do not match the demands made on product development on the global market. The pressure on speed in product development has the rules of concept for product development from clear cut encapsulated concepts definition to "fuzzy" process oriented dynamic definitions.

Speed in product development is, however, a rather new issue and therefore a rather new competitive weapon. Until now most businesses have thought about speed as cutting corners in order to save time and cost. The secondary cases show that this does not pay off. Speed is important, but it is only a valuable tool when used business economically optimal to gain competitive advantage on the global market and to get profitable, new products. Speed in NB NPD must be handled with strategic care and leadership in product development. Otherwise the business can be badly punished by the market as the secondary cases verified.

7.2 Network of Product Development

Networks and working in networks are also important and relative new concepts to the businesses. Many businesses know about physical networks and have joined these for many years. However, as was verified, new networks have turned up on the global scene – digital and vertical networks together with new ways of mixing networks and handling networks characterised by a high degree of openness, flexibility, and agility. Furthermore, the new network types demand trust and openness. It is in this context that businesses have to act with their product development for the future.

7.3 Success Criteria of Product Development

In recent years, many researchers have stressed the importance of changing the focus from short-term success criteria to long-term success criteria. However, it has been difficult for businesses to adapt this advice and especially to implement such guidelines. Many researchers have therefore tried to change their research to find the reasons why businesses do not change their focus. Furthermore, researchers have made specific guidelines for businesses to help implement the changes. However, many research results have shown that not much has been done.

I claim that this is mainly due to a lack of motivation in industry to adapt these guidelines to changes. When industry can develop without changing and when the global market is still in its initial phase then there is no need for changing. My suggestion is that this will soon cease to be the case because the pressure on product development will increase tremendously when new networks enter the global market. Especially the opening up from the far East (WTO) and Eastern Europe (EU) where new an often unknown business models enter the global market will add new pressure on the ability of western businesses to compete on product development.

7.4 Tools of Product Development

As previously mentioned, the use of HS enablers have until now only been fragmented and single-minded. New business and networks show new and quite effective ways to use and mix HS enablers. We have to learn form these businesses in order to improve.

7.5 Management of Product Development

The importance of managing a business product development activities must therefore be stressed. For a long time, management of the business product development activity has been in focus. However, most often focus in product development has been on the tactical level of product development rather than on the strategic level of product development.

Taking these above mentioned facts into account we will analyse and reflect on the challenge and issues of future product development that are presented in Chapters 3, 4, 5, and 6 and paint a picture of tomorrows product development.

This could be done by looking at the relationship and interaction between product development and the 4 issues commented on in Chapters 3, 4, 5, and 6 as shown in Figure 7.1.
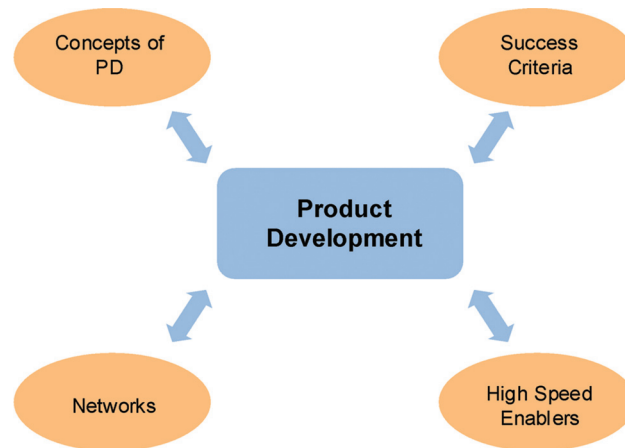

Figure 7.1   Interaction of the field of product development.

The aspect outlined in Figure 7.1 will be the issue of this chapter.

7.6 Change in Concept of Product and Product Development

From the analysis in Chapter 3 we saw major developments in our understanding of the concept of product development. In the following paragraph we will reflect on these.

7.6.1 Change of Product Concept

It is very clear that today's understanding of the product concept is not capable of defining and explaining the product. Until now we have understood the product as one physical item with a start and an end. In the future it will be characterised as a process with the following characteristics:

Table 7.1   Product characteristics – now and in future

Product Characteristics Before	Product Characteristics in the Future	Case Examples
A product	A total product A total process	
A Physical Product	From physical product to more immaterial products	
Single products	Multi-products (both physical, digital, immaterial and virtual products)	
One time encapsulation	Sequential encapsulation of a product – "never ending story"	
From product to a new product	The product changes to a process Dynamic products	
Focus on cost	Focus on direct and alternative cost	
The customer cannot change the product or is blamed if they change the product	The customer continuously changes the product together with the business	
The customers do not accept errors	The customer and the business accept trial and error	
Physical processes	Physical, digital and virtual process	

Table 7.1 shows that the core of the product becomes dynamic, rarely stable, and always under construction. The product becomes more dynamic and interactive in all areas and always in a process of continuous innovation and continuous improvement. The product becomes a total product or process and the business therefore has to "posses" more competences to fulfil the demands of the customers.

To live up to this, the business must attempt a process oriented product development model because the customer will not accept a one time delivery but will wish to receive more after the first part of the delivery has been fulfilled. The customer wants to have a relationship partner and to develop further on. The product development model and process must therefore have access to and involve more competences into the product development process. Hereby, product development must become relationship-based and long-term network based, because businesses – and SMEs in particular – cannot

have all competences in house. Short-term product development thinking will kill businesses because it is just too expensive to change to a new product development process every minute. The only stable component of product development will be to build a strategic architecture of the product development process and of the product.

7.6.2 PD Models Become Process Models

When a product concept changes to process, the concepts of product development also have to change. Dynamic product development situations – with a high degree of dynamics and with all types of product development models and processes involved in a continuous process with many start and many ends – be the challenge for the future product development in businesses.

Businesses therefore have to change to a more agile style of choosing among stage-gate models, flexible and process oriented product development models. Hereby the businesses can gain a dynamic, flexible and agile product development processes.

Businesses have to implement more flexibility and agility into their product development process.

7.6.3 Focus on Advanced Use of High Speed Enablers

In my initial research I identified approximately 10 high speed enablers. The secondary case research showed that businesses were focusing on particularly the customer, the product development model, and the product modularisation enabler. However, my hypothesis is that this might not be optimal in all cases because every product development project is unique and demands a different set-up and a different choice of high speed enablers. These enablers will come into more focus in the future but will have to develop and be used in new ways as shown in Table 7.2.

Businesses will have to put a higher priority on high speed enablers in future according to the individual product development process. Especially the HRM enabler will be in focus because know-how of the location of existing competences and access to competences will be a major core competence to gain competitive advantage to product development. Some of the high speed enablers as e.g., modularisation and e-development will become standard high speed enablers used by all businesses because these enablers will allow the business to break the physical time limit of today's product development. When products can be visualised and modelled around without encapsulation

Table 7.2   New use of high speed enablers

High Speed Enablers	New Use of High Speed Enablers
Information and Communication	Mix of all Existing Information and Communication Tools Mixed with New and High Speed Communication Tools Will be the Case
Customer satisfaction/customer focus	Customers will be involved in all phases of the product development process. We will see more beta-versions or prototypes because customers are always on the look-out for new products and will accept beta-versions.
Optimization of PD processes	Businesses will always look for continuous optimisation of the product development process
Network product development	Network and all types of network in all product development projects will be used.
Development of product development innovation	Continuous innovation will be the case
Human resource	HRM will be involved in all phases of the product development project. HRM will be very important in PD because access and overview on competences will be essential
From product to process	All businesses will turn their view from product to process
Product modularisation	All businesses use product modularisation but in a more advance way than today
E-development	All businesses use e-development as a major tool in the product development process

of the product, the businesses can keep the products "floating" until the very last moment of customer acceptance.

7.6.4 PD in Networks

Product development will have to be done more in network in the future because the product development projects demand more competences. The challenge in network based product development will be to manage and lead the network in the product development process. The major challenge and conditions in this task will be as listed in Table 7.3.

Apparently, also the network aspect in product development will change. Therefore, businesses must improve on their network competences in several areas. Businesses have to learn more of networking and find best practice of networking competences to survive in future product development on a global market.

When this is the case the product development model and process for the future turns into network based product development models with a flexible,

Table 7.3 Network challenges

Network Challenges in Future Product Development	
Network characteristics	Multi network and global networks
Numbers of networks	Many and unknown actors because some actors will have to be brought in from places where the specific competences exist.
Network construction	Interactive in all areas of the product development process. Network actors can interact on all phases in the product development process.
The core of the network based product development project	Rarely static – but with a high degree of dynamic
Management	Not static and mostly joined management or fragmented management. Management can change over the product development process. Please see the new EU 6 program which are constructed like this.
Boundaries	More risky, un-formalised and fuzzy boundaries
Important network competences	Trust
	Competence to hub up on networks
	Language and communication competences
Success criteria for a network actor	Able to do continuous improve
	Able to be innovative
	Able to learn, learn fast when "walking around"
	Able to focus on value and cost at the same time

agile, and network oriented structures. Different functions and different phases in the product development model will suddenly involve a mixture of network actors and will be placed where appropriate to the common product development project or process.

Such new challenges stress the importance of changing today's belief in product development as a physical stage- and gate model placed inside the business. The product development process has to become digitalised at first sight and placed in the environment which is most appropriate to the network based product development process and which can also operate in a virtual environment. The product development process has to become independent of the physical environment to match the demand for flexibility and agility. This stresses the importance of the high speed enablers – the information and communication and the e-development enabler.

7.6.5 People and NB HS NPD

When the speed of product development increases and the market, technology and network begin to interact more and more with an increasing mixing of these

components, the pressure on competences must increase. The network based product development projects will demand an increasing number of people and thus an increasing number of competences. However, the product development will need the participation of the employees in the product development in a more flexible and agile way where people will enter and leave the product development projects at all levels.

It is therefore interesting to examine the kind of people or functions which are involved in the product development project. Today mainly the sales, production and product development functions are said to be involved (Myrup & Hein, 1986) (Cooper, 1993). My hypothesis is that we will see more functions involved in the product development projects in the future.

7.6.6 PD Leadership and PD Management Become Central Issues

The major part of available literature on product development shows a prevailing focus on the management of the product development process within the process at a relatively tactical and operational level (Wind, 1973) (Wheelwright & Clark, 1992) (Cooper, 1993) (Ulrich & Eppinger, 1995) (Baker & Hart, 1999). This focus is merely due to the practical and theoretical challenges to manage the product development process through the product development process from idea to market introduction.

At the product development management level (PUM level) focus is on short-term success criteria such as time, cost, and performance. Furthermore, the focus is on the process within the development process. Very seldom are other product development projects inside or outside the business the centre of attention. The integration and knowledge transfer from other network based product development process is very seldom used.

PUM drifts among the four main components influencing NB HS NPD. PUM tends to be much involved in day-to-day product development management. Seen from the point of view of the initial product development management level.

PUM has however difficulties in developing and maintaining the objective strategic view of "the product development game". It is also difficult to elaborate a flexible strategic view and design to the "product development game" where all components are endogenous and exogenous variables played out and into the "product development field".

When a business solely performs PUM, the business lacks a higher strategic view of the business product development processes. The business

therefore lacks e.g., the competence to choose from different and optimal product development models and processes to gain right speed in product development. Furthermore, the business ties itself to short-term success criteria and short-term management which will not ensure long-term success or long-term competitive advantage. The hypothesis of the PhD project is that this is the reason why the product development managers of the SME businesses focus mostly on short-term success criteria and on PUM. In addition, the major reason to why SMEs do not gain right speed in PD.

Consequently, the PhD project suggests that the business focus on product development leadership (PUL). PUL affects and is closely related to learning and knowledge management of product development. Learning and PUL of NB HS NPD creates knowledge about the interaction and development of the market, technology, network, and competence component in the product development field. PUL chooses the right product development model and process and thereby the right mix of main components to "the product development field" to obtain right speed.

PUL is elaborated along with product development management (PUM) as seen in Figure 7.2 with the aim to achieve right time product development.
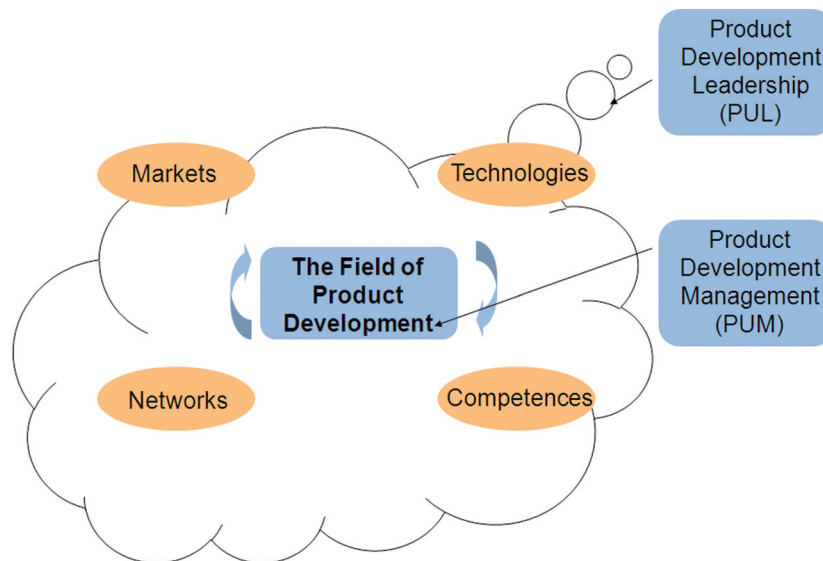
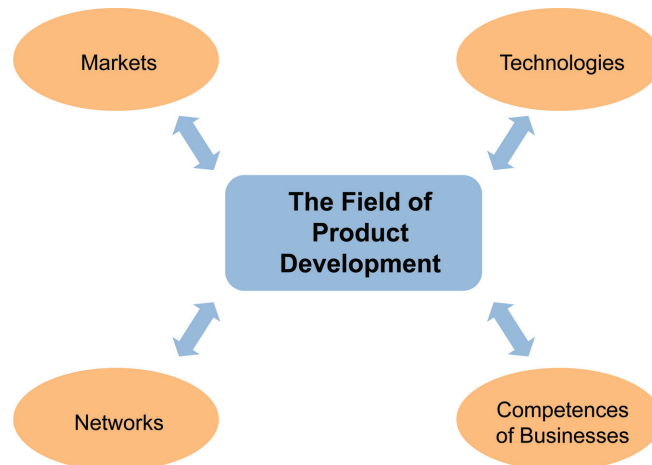**Figure 7.2**   The field of product development.

PUL is the ability and the know-how of the "game of product development". PUL is to know **why** and **what** the "game of product development" is about to decide and perform; how the right speed in businesses product development activity should be.

On the PUL level focus is on CIM, CI, and learning to create long-term success criteria such as right cost, right performance, and right time. CIM is in focus because the product development process has to be improved continuously both initially within the product development process, across product development projects, and on the market place (Corso, 2001). CI is in focus because businesses have to innovate new products and seek innovation possibilities at the start of a product development project, along the product development process, and when the product has been introduced to the market.

Additionally, my hypothesis is that in order to reach their long-term success criteria the business must have a fundamental understanding of the field of product development. This understanding is closely related to PUL.

7.6.7 Understanding "Field of PD"

The main context and components in today's "product development game" can be characterised by the following "interactive picture" of the four main components in "the field of product development" – markets, technology, networks, and competences of the businesses playing in "the field of product development" as shown in Figure 7.3 on behalf of work and content in Table 7.4.

Figure 7.3   The contents and main components of the field of product development.

Table 7.4   Shape of main components in PD game

The Main Components Context	Characteristics	Example of Markets 2002
Market (Sanchez 1996)		
Stable markets	Stable market preferences	Food industry, Furniture industry
Evolving markets	Evolving market preferences	Agriculture industry, environment industry
Dynamic markets	Dynamic market preferences	Software industry, Bio and gene industry
Technology (Sanchez1996)		
Stable technology	Stable and known technologies	Audio and video technology
Evolving technologies	Evolving technologies	Bio – technologies
Dynamic technologies	Dynamic and mixed technologies	Nano-technology
Stable networks	Networks mainly based on physical and stable networks often internal and dominated network	Industrial groups, branch groups
Evolving networks	Networks based on a mix and evolving system of networks – Physical networks, ICT – networks, virtual networks	PUIN – network group, EU – community,
Dynamic network	Networks based on a mix of dynamic networks with high degree of dynamic where network partners constantly comes in and goes out. Often there is no formal network leader.	Virtual network groups, Ambias
Business competence context (Prahalad and Hammel, 1990)	Support competences Complementary competences Core competences	

An overview of the field of product development and the interaction of the 4 components to the field of product development is vital to decide further on in the product development process. A wrong analyse will perform a wrong decision of product development model and process along with HS enablers.

The interaction of market and technology in product development has been known for several years (Wind, 1973) (Myrup and Hein, 1986) (Eppinger, 1999).

What is new is the interaction that market and technology have with different types of networks and their relation to the competences of the businesses.

Furthermore, the main components can each be of different shapes both prior to the product development project and during the product development project when "the field of product development" is being analysed.

My claim is that until now many businesses have managed and developed a "blind" high speed product development strategy seeking speed, uniqueness, and innovativeness from a tactical point of view. Without reading the characteristics of the component in "the product development field". To a large extent, the management of product development has concentrated their efforts on the establishment of high speed product development and on being an innovative firm.

This was partly due to the tendency to regard such a strategy as the survival in future competition (Cooper, 1993) (Balwin et al, 1996). Unfortunately, the combination of high speed product development, uniqueness, and being the innovative firm has proved to be far more difficult to implement than originally expected (Bessant, 1999) (MacCormac, Verganti & Iansiti, 2002). Our initial case research showed businesses which have realised several failures and problems with a strong focus on high speed and cost reduction in NB PD.

> *"Our business has lost much money because of an expensive high speed product development approach. Our product was too early in the market and then the Internet came up and everything was turned around."* (Case No. 46 – ODI, UK)

> *"We developed several E-learning products with high speed, and we built up an international competence in multimedia production with high speed because all market and all expert signs indicated a future heavy demand for e-learning products. When the product development finished and our technology and competences were ready for the evolving market – the market did not evolve as we had expected and we had to close our e-learning activities."* (Case No. 52 – M2SIRE)

> *"We invested in a new particleboard surface machine for melamine production due to a strong market want and pressure from customers and sales. When we were ready for production, the market had turned to be minimal and covered by competitors."* (Case No. 53 – NOVDK)

My secondary case observations show that these businesses forgot to read "the field of product development". They pushed the product development too fast. They developed products which performed badly on the market because the

main components were not in the right position for or had changed during the product development process. The speed of product development turned out to be either too slow or too high.

Therefore, I claim that it is necessary to focus on moving the product development activity in the business at a speed which matches the characteristics of the field of product development. I maintain that businesses should focus on right speed.

7.6.8 Management's Understanding of Incremental and Radical PD

My secondary case research showed that the case businesses were joining more unknown, dynamic and risky product development networks. The case businesses became very much dependent on and related to such types of networks and to the performance of such networks. Businesses act in this way because their product development competence often turns out to be too narrow and under a tremendous pressure for change, agility, and development. Therefore, because of "a perceived want from the product development field", many businesses force themselves into product development in uncertain and risky business areas where markets, technology, and networks are unfamiliar and where the product development task and innovation degree often exceed the competence of the businesses and turn out to be radical product development as indicated in Figure 7.4.
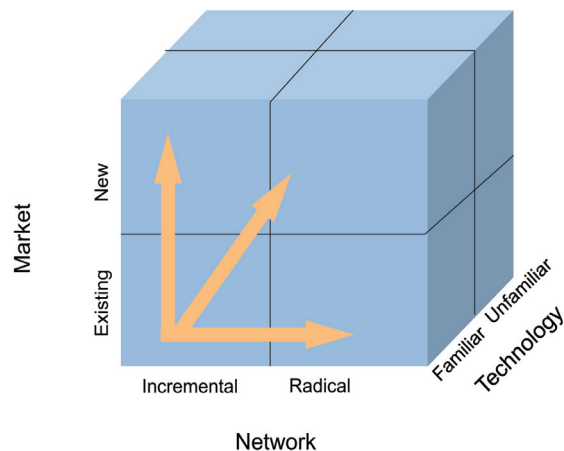
Figure 7.4   Incremental and radical PD.

Source: Lindgren & Bohn, 2002.

Therefore, in many cases the models and processes are not providing the businesses with right performance, right cost or, right speed because businesses and managers seem not to analyse and try to understand when product development are incremental and radical.

Furthermore, the learning gained by the businesses from several product development processes is rarely transferred to continuous improvement (CIM) or to continuous innovation (CI) in future product development processes of the businesses. This is because the product development processes are made radical or "one of a kind" every time, and because the knowledge transfer to other product development processes does not exist or is not formalised.

My case research shows that the main components of "the field of product development" "float" between being stable and dynamic. When markets, technology, network, and competences are changing constantly from stable to dynamic, which according to researchers will continue in the future (Fine, 1996) (Coldmann & Price, 1996) (Verganti, 2001), businessses are forced to look into new types of product development models and product development management tools. Businesses and researchers have realized that stage-gate models are effective for some product development tasks and situations but not when far more dynamic and flexible product development models seem to be more effective (MacCormac, Verganti, et al., 2001).

Therefore I claim that the management of PD must change the decision process of which PD model to use into a more agile and flexible decision process. Management must choose from many models. The choice must be related to the product development task and the characteristics on the field of product development.

7.6.9 Important Choice of PD Model

The secondary case research shows that product development managers face quite a difficult task of deciding which product development model and process are most suited for the specific product development task.

Before making such a choice, product development managers have to "read" and learn carefully about the specific "field of product development". It is our hypothesis that the choice of model and process influences the possibility of speed in product development in at least two ways. First, the height of speed which can be achieved during the product development project, secondly, the possibility to change speed and how much change of speed the business needs in the product development process.

It is verified that businesses can gain speed both in a stage-gate model and in a flexible product development model (Cooper, 1986) (McCormarck,

Verganti, Iansiti, 2001). However, the costs of changing speed differ in accordance with the chosen PD model and are influenced by the choice of product development model as indicated in Figure 7.5.
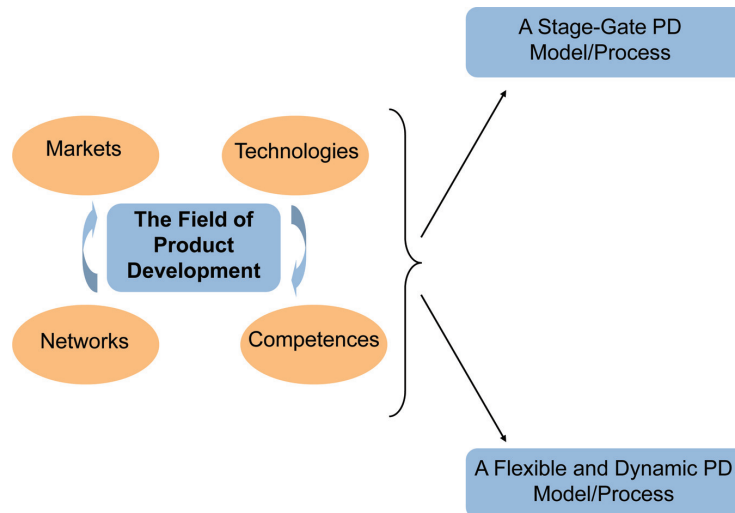

Figure 7.5   Choice of PD model and process.

Source: Lindgren & Bohn, 2002.

Firstly, the flexibility of speed possibilities is not the same in the two models. Secondly, the possibilities of performance of the final product differ from one model to the other in accordance with the point in time at which the change of speed in product development is required. Consequently, right performance, right cost, and right speed of " the field of product development" is very much related to the ability of the product development managements to "read the field of product development" both initially and as the product development progresses.

My hypothesis is that such a state of things is strongly related to learning. Additionally, managers of product development need to develop a strategic design of how to use NB HS NPD, to understand why NB HS NPD should be used, and to realise what NH HS NPD models and processes should be used. The strategic design of NB HS NPD has to be strongly related to product development knowledge and product development knowledge creation at the management level within the business. The managers of businesses have to learn about NB HS NPD and to develop and continuously improve product
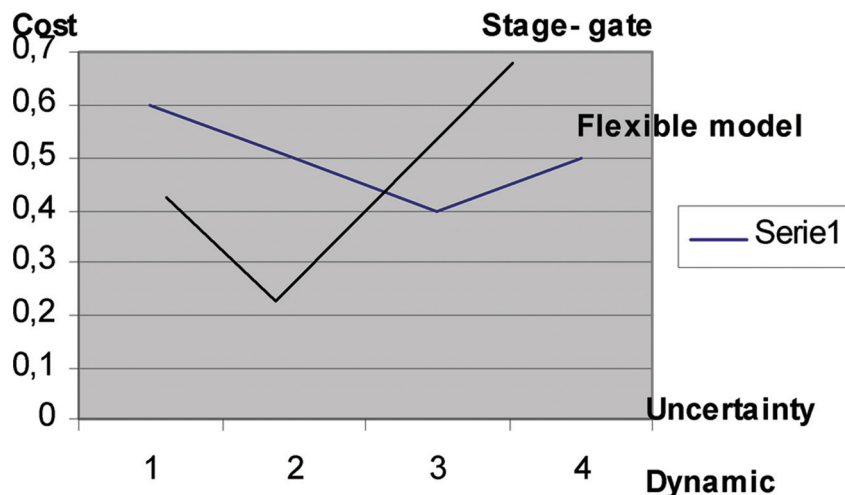
Figure 7.6   Costs of flexible and stage-gate PD models related to uncertainty and dynamic PD projects.
Source: Lindgren inspired by R. Verganti, 2002.

development leadership as indicated in Figure 7.6. Yet, learning in product development management is far from easy as my case research showed.

7.6.10 Change from Short-Term to Long-Term Success Criteria

It is my hypothese that businesses today acts on product development in a short-term way but will have to focus in the future more on management in a long term perspective – which means more focus on product development leadership”.

Speed and time will be the issue for the future product development but seen in quite another perspective than today. In some product development cases, businesses will have time enough. It will be possible to do product development 24 hours a day in all places and with all types of networks. The limits will not be time and resources but the ability to find the right time and the right resources.

Different kinds of conditions on “the field of product development” will require different kinds of speed in network based product development. Strategies on speed in network based product development for different product development conditions will therefore be central. The ability to chose the right speed in which a product development process should run will strongly be related to learning and product development leadership. Successful businesses on the market will seem as acting with short-term success criteria

but looking deeper into what is going on, a clear focus on long-term success criteria as shown in Table 7.5 will be the fact.

Table 7.5   NB HS NPD success criteria

NB HS NPD Success Criteria Short-Term Perspective	NB HS NPD Success Criteria Long-Term Perspective
High Speed – Time	Right Time – Right Speed
Cost	Right Cost
Performance	Right Performance
	Continuous Improvement
	Learning
	Continuous Innovation

The secondary case research has shown a rather "blind" focus on speed in product development. My hypothesis is that this forces sub-optimization and the development of informal product development models and processes to match the demand of speed. In future, product development managers must therefore focus more on product development leadership than on product development management. However, the hypothesis of this research is that this is still not the case in the major part of existing businesses. I want to verify this in my empirical research.

It is important for managers to realise that right speed is strongly related to learning in order to reach the long-term success criteria of the businesses – such criteria being right performance, right cost, and right time as shown in Figure 7.7.
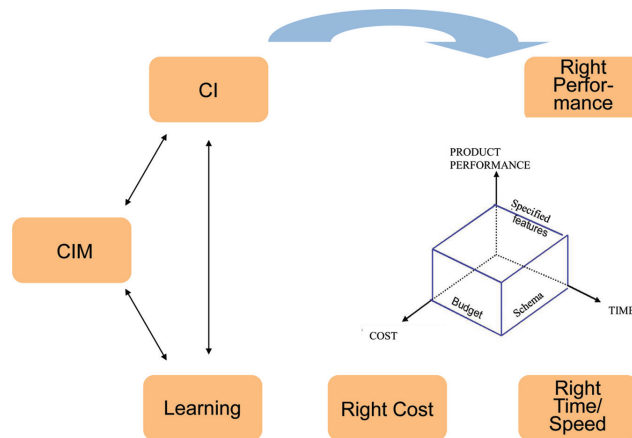
Figure 7.7   Relationship between long-term success criteria in network based product development.
Source: Lindgren & Bohn.

Learning demands knowledge and knowledge transfer. In this connection knowledge and knowledge transfer about possibilities, threats, strength and weaknesses of product development are required. This knowledge has to be made available in an open form and transferred before it can be used by other network partners to reach right speed in the businesses involved in the product development process. When product development leadership is implemented in businesses and learning interacts with CIM and CI, our hypothesis is that long term success criteria such as right performance, right cost and right speed as shown in Figure 7.7 can be gained in product development.

It is the hypothesis that the major part of businesses have not implemented learning and product development leadership. This will be verified in my empirical research.

I also claim that most businesses do not follow an analytical process of product development.

7.7 Important Issues in Future NB HS NPD

Taking all what has been mentioned above into our mind we are left with several important issues to be solved and to focus upon in future product development theory and praxis. These are as seen in Table 7.6.

Table 7.6   Important issues to future NB HS NPD

Important Issues of NB HS NPD in Future
The product development architecture
The product development process architecture
A new product development process model
Product development leadership (PUL)
Choice of high speed enablers
Choice and involvement in networks
Competence to "hub up on" networks
Trust and openness in network
Learning and dynamic learning
Long term success criteria
Analytical approach to NB HS NPD

On behalf of the above-mentioned important issues I propose new approaches to NB NPD. The existing practice of product development will not be able to match the demands on the field of product development. The product development models, product development management style

and the existing focus on the success criteria of product development will not be able to give radical competitive advantage to SMEs. I claim this on the basis of Table 7.7 which shows what I believe is the major challenge to NB PD.

Table 7.7 Components and characteristics

The Main Components Context	Characteristics	Example of Markets 2002
Market (Sanchez 1996)		
Evolving dynamic markets	The markets becomes more evolving and dynamic in all markets	The textile line of business – Zara, Case No. 1, The mobile line of business The TDC case 57
Rapid cheap power technology	The technology gives us more possibilities and more technological power. The technology will be mixed faster and in a more dynamic and agile way.	Lyngsø Case No. 38, Mobilix, Case No. 40
Dynamic mixture of networks	Networks based on a mix of dynamic networks with high degree of dynamic where network partners constantly comes in and goes out. Often there is no formal network leader.	UK Chemical, Case No. 19
Increasing pressure on businesses competence	The pressure on businesses competences increase the businesses approach to perform more agile and flexible businesses where competences moves in and out according to the product development task	Rossflex, Case No. 11
The product becomes a process	The product turn into a process and the product becomes digital or virtual until "encapsulation"	Footshoe, Case No. 4; Scooter, Case No. 55

I therefore propose a new approach to NB NPD as elaborated in Chapter 8.

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[i]Jianxin Jiao and Mitchell M. Tseng *A Requirement Management Database System for Product Definition*; Integrated Manufacturing Systems 10/3 [1999] 146–153.