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MANAGEMENT OF KNOWLEDGE IN INNOVATION

- A case study of SKF Nova

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Executive Summary

SKF Nova is a fully owned subsidiary of the SKF Group. The company has provided the ability to develop ideas slightly outside the scope of the SKF strategy into products and services. The output of SKF Nova have eventually been spun-in the SKF divisions. The study was initiated to improve the transfer of the output of SKF Nova to recipients within the SKF group.
By merging theories of innovation and technology management, Organisational learning and Knowledge Management, this Master thesis aims at exploring the knowledge frontiers within three important and rapidly developing fields of management - Knowledge Management, Technology and Innovation Management and Organisational Learning. The report is mainly intended for the management and the employees working at SKF Nova.
Regardless of the type of industry, companies and their innovation process are becoming increasingly knowledge-based for each day that passes by, and intellectual assets take the predominant role in defining market value.[1] Accordingly, the shifting sources of global competitive advantage call for new strategies and approaches to manage both knowledge and innovation.[2] In response to this, a know-who based approach to Knowledge and Innovation management has been recently developed by linking leading-edge theories to practice oriented cases.
The study reveals seven main problems of the general innovation process of the SKF group, perceived by representatives of the Automotive, Service and the Industrial division. Based on the needs perceived by representatives of the SKF group, the study concludes that the know-who approach can potentially provide an important opportunity for SKF Nova to support the SKF group in the future. In addition to the concrete needs, several potential future offerings of SKF Nova demanded by the respondents have been presented. The conclusion is that there is a large divisional demand for the services of SKF Nova within the SKF group.

To represent a valuable resource to the SKF group in the future, SKF Nova must to adapt to the problems and opportunities perceived by the potential customers within the SKF group. The study reveals that some major areas where the divisions ask for the services of SKF Nova concern the successful implementation of change, to participate in the development processes of the SKF divisions and the ability to avoid re-invention of the wheel through participation in different innovation projects all over the firm.
The study provides two potential future business scenarios of SKF Nova intended to ensure the future value adding of SKF Nova. Each business scenario includes a process and a recommendation of relevant skills required to support the scenario. The study concludes that networking with external firms, social competence, global cross-functional experience and the ability to perform both incremental and radical innovation become increasingly important for SKF Nova to win the race. These findings indicate that the demand for the services of SKF Nova considers unique, i.e. complementary competency not elsewhere found within the SKF group.
The study concludes that the use of a cross-functional team during the weakest link of the innovation process, i.e. the knowledge transfer, provides one means to manage the knowledge transfer. A new activity of the innovation process called “Design of new business” is suggested to improve the exits. To further improve the management of the knowledge transfer process and effectively screen ideas, the study suggests the use of a tool called the ITT-

[1] Harryson, S. J. (2000).p.xiii.
[2] Harryson, S. J. (2000).p.xiii.

typology. The ITT-typology advocates that companies need to set-up an appropriate transfer process depending on the technological uncertainty associated with the new technology.

The study concludes that independently of the form of innovation SKF Nova will perform in the future, a critical success factor will consider the ability to present the knowledge SKF Nova possesses and the way that SKF Nova can contribute to the profit of the SKF group. Since SKF Nova is a knowledge-based organisation, an effective management of knowledge is required.
A Knowledge Management model has been developed to support the value adding of the two scenarios. Using the model, SKF Nova can potentially combine knowledge considering technology push from the external firms, with input representing market pull from the potential recipients within the SKF group.

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1 Introduction

1.1 Background

SKF Nova is a fully owned subsidiary of the SKF Group that develops new products, processes, services and businesses that have a potential to contribute to the profit of the SKF group. SKF Nova has existed since 1973. The company has presently twenty-four employees.

SKF Nova has since its creation had the role of a business incubator and a greenhouse for innovation within the SKF group. The company has provided the ability to develop ideas into products and services slightly outside the scope of the SKF strategy. The products and services of SKF Nova have eventually been spun-in the SKF divisions. The ideas traditionally developed at SKF Nova have generated new successful businesses that have greatly contributed to the profit and related diversification of the SKF group. Twenty percent of the current profit of the SKF group is traceable to businesses originally grown at SKF Nova. Most of the businesses traditionally grown at SKF Nova represent radical innovations that would have been difficult or impossible to develop within the regular SKF divisions and factories. SKF Nova has provided the advantages of flexibility, entrepreneurial spirit and quick adjustment to change. These features tend to be significant for small organisations. Large organisations like the SKF group tend to be more structured and trimmed to achieve cost effective mass production. The above sentences tell that the cultures of SKF Nova and the SKF group have been different in the sense that they can be considered complementary. It has been the role of SKF Nova to contribute to the innovation of the SKF group. It is not always easy to combine two such different cultures though. Innovation implies change and many people resist uncertainty. The introduction of change can cause frustration and tension especially if there is a lack of information, knowledge and most importantly, a shared understanding between the different stakeholders involved. This study was initiated to improve the transfer of the output of SKF Nova to recipients in the SKF group.

An exit from SKF Nova represents a transfer of knowledge and responsibility from SKF Nova to the recipient within the SKF group. SKF Nova is one out of many units within the SKF group that has traditionally performed innovation. Since SKF Nova is just a small unit within the large SKF organisation, the exit from SKF Nova is strongly influenced by the culture of the SKF group. This means that the general problems and opportunities of the global innovation process of the SKF group do affect the exits from SKF Nova.
In the middle of the study, the 26:th of October 2001 the executive committee of the SKF Group took a decision concerning the financing of SKF Nova. During its entire history SKF Nova used to be a unit funded by the SKF group. The decision was to expose the company to competition in a market economy. During year 2002 SKF Nova will get only 50 % funding, the rest will have to be covered by customer orders. From year 2003 SKF Nova shall cover all expenses by customer orders.
The new situation of SKF Nova implies a radical change in the relation to the SKF group. SKF Nova needs to evolve from behaving as a relatively independent business incubator, to offering its services to the SKF divisions. The present challenge of SKF Nova is to become a valuable resource for the SKF divisions. The ability to introduce options for change in the SKF group assumes a relation based on mutual trust and shared interests. To determine the future role of SKF Nova within the SKF group it is important to understand the need of the

different units within the group. The perceived need of the different SKF units combined with the existing resources of SKF Nova provide the basis for the future business process of SKF Nova.

1.2 Purpose

This study intends to investigate how Knowledge Management can be used by SKF Nova to reduce the friction of the exits. Knowledge Management can potentially improve the quality of the communication; ensure the right knowledge at the right time thereby reducing the uncertainty of all stakeholders involved in a transfer. Knowledge Management may also increase the ability of SKF Nova to anticipate the needs of the SKF group.
Considering the new financial situation, SKF Nova may not benefit as much from solutions entirely based on the historic pre-requisites of SKF Nova. The scope of this study has been changed and business scenarios have been developed to take the potential future role of SKF Nova within the SKF group into consideration.

1.3 The scope the project

The 26:th of October 2001 the executive committee of the SKF Group took a decision concerning the financing of SKF Nova. During its entire history SKF Nova used to be a unit funded by the SKF group. The decision was to expose the company to competition in a market economy. During year 2002 SKF Nova will get only 50 % funding, the rest will have to be covered by customer orders. From year 2003 SKF Nova shall be entirely self-supporting.

The new situation of SKF Nova implies a radical change in the relation to the SKF group. SKF Nova needs to evolve from behaving as a relatively independent business incubator, to offering its services to the SKF divisions. The present challenge is to become a valuable resource to the SKF divisions. There is also the possibility to eventually take on external commissions.

By ensuring a successful transfer of knowledge throughout the innovation process, SKF Nova can potentially become an increasingly valuable resource to the SKF group.

To investigate how Knowledge Management can be used to improve the transfer of knowledge throughout the innovation process of SKF Nova, the following questions have been established:

- What are the opportunities, problems and critical success factors of the current mapping of the innovation process of SKF Nova and the SKF group?
- How can SKF Nova add value to the SKF group?
- What knowledge must be included in a successful exit?
- How can SKF Nova use Knowledge Management to improve the transfer of knowledge throughout the innovation process to increase the number of successful exits?

1.4 Delimitation

The divisions that have experienced the exits from SKF Nova in the past are the only potential recipients within the SKF group that has been included in the study. These divisions are the Industrial, the Service and the Automotive divisions.

The Knowledge Management model suggested by the study presents strategic guidelines to effectively manage the knowledge created by the employees of SKF Nova. The model does not intend consider the potential future implementation of the model.

1.5 Disposition

Chapter one presents the background, purpose, scope, delimitation and disposition of the study. The second chapter presents the Problem discussion and the Frame of reference. The Problem discussion is intended to give a brief presentation of the theories that have been selected to provide the theoretical basis of the thesis. The Frame of Reference considers how the theories are used to solve the practical problems. Chapter three presents the methodological design of the study. The fourth chapter presents the empirical data, including situations analysis and the main opportunities and problems perceived by the respondents.

The fifth chapter presents the analysis that includes three different parts. The first part of the analysis considers two potential future business scenarios of SKF Nova. The second part of the analysis considers the knowledge transfer from SKF Nova. The third part of the analysis outlines a potential future Knowledge Management model of SKF Nova.

The sixth chapter considers the validation of the study and presents a comparison of the empirical findings of the study with the results of previous research. The seventh chapter presents the conclusions, recommendations and suggestions for further research based on the findings of the study. Chapter eight presents the primary and the secondary references of the study.
The Appendix of the study includes a detailed process description of the suggested process to support In-house innovation. The Appendix further includes a "tool-box" with models that may be useful to the employees of SKF Nova. Lastly a table of figure is enclosed to the Appendix.

1.5.1 Reading instructions

Some parts of the study may be of interest to the employees of SKF Nova. My advice to these readers is not to read the whole study. The most interesting part composes chapter five, which presents the analysis including two potential business scenarios of SKF Nova, a tool to evaluate ideas that is called the ITT-typology and the Knowledge Management model. To get a more holistic understanding also of the context of the thesis and the underlying motives to the processes and models developed, I recommend the following reading order:

1. Executive summary
2. Conclusion including recommendations
3. Background
4. Purpose
5. The Scope of the project
6. Chapter four, part two: Perception of Problems and opportunities

7. Chapter five: Two potential business scenarios and the Knowledge Management model
8. Chapter four: Section 4.5.1 which specifically includes two headings that may interest the employees of SKF Nova: "Some critical aspects considering the future role of SKF Nova" and "Some suggestions of potential future opportunities of SKF Nova"

2 Theory

2.1 Problem discussion – Corporate Development and Change

The perspective advocated by DELTA will be used to structure both the theoretical and the empirical chapters of the study.

DELTA focuses on the fundamental cornerstones of an organisation and on the relations between them. [3] The four main cornerstones of an organisation are according to DELTA the organisational images, the stakeholders, the development goals and the development process. By focusing on these four aspects and the relations between them, DELTA intends to provide a holistic understanding of the reality of a system. [4] The focus of DELTA is illustrated in the figure below.

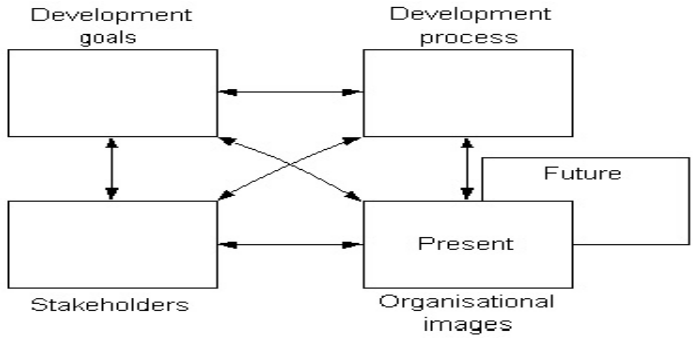


Figure 1 - The holistic perspective taken by DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

The cornerstones of DELTA compose an architecture. An architecture represents the organisational structure of a practically and attractively organised social environment.[5] The word architecture implies principles to create a harmonic design. [6]
The architecture includes relationships between individuals, artefacts and between people and artefacts. [7] The relationships between the four cornerstones of DELTA are not static. By considering also the changing nature of these relationships, the holistic perspective taken by DELTA does account for the dynamic nature of organisations. DELTA proceeds from the present state of the organisation and relates that to the desired future state. The ultimate objective of DELTA is the continuous improvement of the enterprise, through improving the manageability of complex development processes.[8] Each enterprise composes a system that transforms an input to an output.

The intention of this thesis is to improve the future functioning of SKF Nova. According to the DELTA framework, management can be defined in terms of a continuous process of designing and developing attractive information environments. [9] These environments serve the purpose of connecting individuals in order to co-ordinate their actions and accomplish

[3] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).
[4] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).
[5] Magoulas, T. & Pessi, K. (1998).p.5.
[6] Magoulas, T. & Pessi, K. (1998).p.5.
[7] Magoulas, T. & Pessi, K. (1998).p.5.
[8] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).
[9] Enquist, H. & Magoulas, T. & Bergenstjerna, M.& Holmquist, M. (2001).

specific aims. [10] Any improvement of the information environment will imply change in the organisational images of SKF Nova. This will in turn affect the stakeholders, the development goals and the development process of SKF Nova.

The Problem discussion is intended to give a brief presentation of the theories that will be used to improve the organisational images of SKF Nova. The Problem discussion will mainly consider three aspects of DELTA;

- The organisational images
- The relation between the development goals and the organisational images
- The relation between the stakeholders and the organisational images

The stakeholders, the development process and the development goals will be shortly described as change in one of the cornerstones will imply change of the other cornerstones.

2.1.1 Stakeholders

According to Checkland (1981) the improvement of a system firstly requires an identification of the customers, actors and the owners of the system.[11] The customers are the people that would be the victims/beneficiaries of the activities of the company in question. The actors are the people who would perform the activities. The owners refer to the people that can stop the activity.

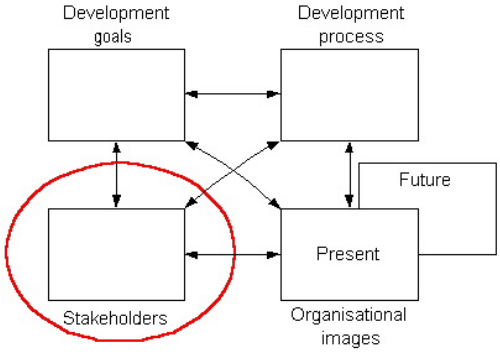


Figure 2 - The organisational images of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

2.1.2 Development goals

The development goals of a company define the immediate goals needed to reach the vision and the business objectives. According to DELTA strategic development goals should cover the entire company. [12] Common development goals will help avoid the sub-optimisation created when individual functions within the organisation optimise their own capabilities at the expense of wider synergy with other functions. [13]

[10] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).
[11] Checkland, P. (1981).
[12] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).
[13] Zairi, M. (1999). p.87-97.

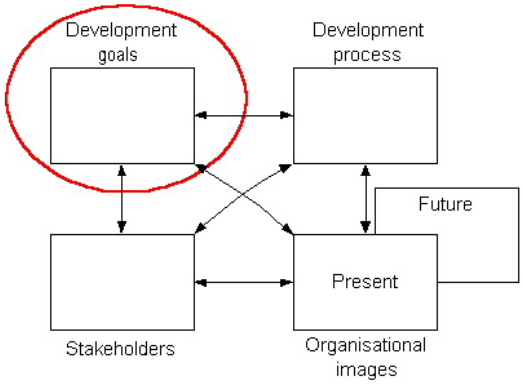


Figure 3 – The development goals of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. , 2001).

2.1.3 Development process

The development process is the process of constantly refining the business process of a company. SSM represents a development process that is composed by seven steps.[14] SSM is used by this study to explore and define suggestions for improvement of SKF Nova. SSM will be explained in detailed in the next chapter that considers the method.

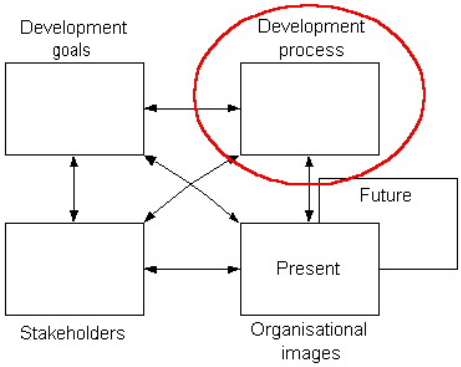


Figure 4 – The development process, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

2.1.4 Organisational images

SKF Nova performs innovation. Some relevant theories have been selected to provide an understanding of the present and potential future organisational images of SKF Nova. The theories selected cover three areas:

- Innovation and technology management
- Different types of product development strategies
- Two different approaches to knowledge management.

[14] Checkland, P. (1981).

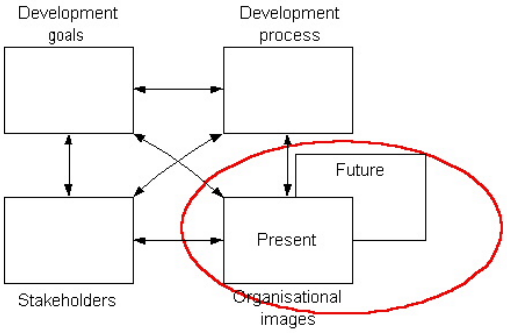


Figure 5 - The organisational images of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

To improve the functioning of SKF Nova, an understanding of the unique value added by SKF Nova to the innovation process of the SKF group is needed. Such an understanding must be shared by the different stakeholders within the SKF group. For such an understanding to evolve, an overview of the advantages of large and of small organisations is relevant. Initially an effort is made to present a background to the role of SKF Nova within the SKF organisation. The following section describes a usual dilemma of large companies that very much applies to the present relation between the SKF group and SKF Nova.

The organisational dilemma of innovation

The creation and exploration of inventive technologies and knowledge appear to require small and organic organisational structures, whereas rapid innovation through effective exploration of that knowledge, in contrast, calls for large and rigid organisations.[15] Companies trying to achieve both creative invention and rapid innovation are most likely to be caught in this dilemma.[16]

As suggested by the figure below, this dilemma can be described along the two critical dimensions that seem to influence the organisation's capability to explore and exploit knowledge, i.e. size of the organisation and the degree of managerial hierarchy. [17] While the left-hand square (creativity of networks) seems to be most adequate for organic knowledge flows that stimulate creative invention, the upper right-hand square (process networks) depicts the ideal conditions for well-structured and efficient processes. [18] Accordingly for innovation to happen, both small organic organisations and a large hierarchic unit are typically required. [19] This calls for a management approach that converges the two shaded opposite ideal positions without moving into the undesired positions of massive (exaggerated) chaos or decentralised bureaucracy. [20] The two white fields of organisational des-equilibrium seem to work against innovation. [21]

[15] Harryson, S. (2000).p.5.
[16] Harryson, S. (2000).p.5.
[17] Harryson, S. (2000).p.5.
[18] Harryson, S. (2000).p.5.
[19] Harryson, S. (2000).p.5.
[20] Harryson, S. (2000).p.5.
[21] Harryson, S. (2000).p.5.

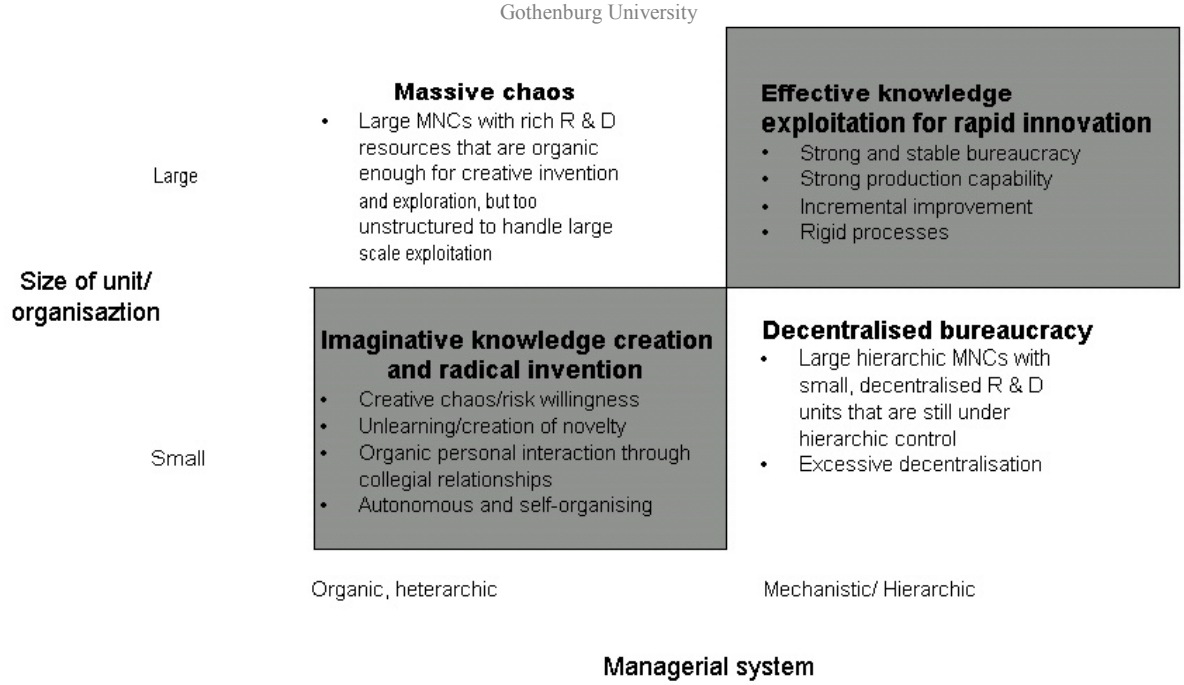


Figure 6 - The organisational dilemma of innovation, (Harryson 2001).

Innovation and technology Management

The following section intends to provide a basic understanding of innovation and technology management.

Research covering from idea to implementation

Zairi (1999) has performed an extensive Bench Marking study covering best practice Management of Innovation. Some of the companies included in the study were 3M, Cadillac, Rank Xerox, IBM, Rover Group, Ford, AT & T, HP, and Kodak Ltd. Zairi concludes that looking at the low proportion of ideas that are turned into innovations, it is extraordinary that so little effort is put into developing an effective project management system. [22] There is no applied academic skill base that systematically looks at the process of moving from idea to implementation and evolving best practice from it, yet this could be a key to dramatically improved corporate competitiveness. [23] The study reveals that most companies have concluded that a system is needed for determining where the highest risks of failure are in the process. [24]

Innovation is often associated with all the parameters that determine success

Why innovate? The following arguments in favour of innovation have been collected from the above quoted study of best innovation practice: [25]

- Superior long-term financial performance is associated with innovation
- Customers are increasingly demanding innovation
- Competitors are increasingly getting better at copying past innovations
- New technologies enable innovation

[22] Zairi, M. (1999). P.99.
[23] Zairi, M. (1999). P.99.
[24] Zairi, M. (1999). P.99.
[25] Zairi, M (1999). p.306.

- What used to work does not work any more

Some common organisational problems associated with innovation

Why do most businesses fail according to the research? Most new businesses fail due to failure in execution, insufficient attention to the "weakest link in the chain", excessive optimism, insufficient feedback, and poor cash flow.[26] The research suggests that training people in "project management of innovation" can dramatically improve the chances of success, helping companies avoid such problems as follows: [27]

- Believing that the last five- percent of the project will take five percent of the time. It may actually take as long as the first 95 percent! This can cause major cash flow problems or crises of confidence.
- The first customer is eager to buy. There is no such ting as a first customer. Everyone wants to be the second customer with someone else acting as guinea pig.
- Not involving the manufacturer or having quality, sales and commercial input in the early stages.
- Omitting to check regulations and IPR issues.
- Not communicating regularly or often enough.

Some expected characteristics of the likely future winners of the "innovation industry"

Two large studies of best innovation practice have concluded that there can be no general recipe for success. [28] Different companies have a different history and are at different stages in their development cycle. However, all companies agreed on the importance of a series of general characteristics:[29]

- The ability to change
- The ability to closely co-operate with customers
- The ability to anticipate future customer needs
- The ability to constantly learn from external firms
- Measures and benchmarks to identify innovation progress against long-term targets
- Clear goals and innovation strategies that are shared by the employees of different functions
- Constant strive to introduce new and differentiated products
- The ability to benefit from a creative culture:

  " In this organisation, it is more acceptable to seek forgiveness than permission. People need to know that if they try something new and fail, they will not be punished. We expect innovations from everyone. That means that we have failures in every department, in every function. It is part of life." (3M)[30]

Characteristics related to project management [31]

- To use cross functional teams

[26] Zairi, M (1999). p.102.
[27] Zairi, M (1999). p.102.
[28] The Winning Report (1997) and Partnerships with People (1997)
[29] Zairi, M (1999). p.85.
[30] Zairi, M (1999). P.84.
[31] Zairi, M (1999). P.200.

- To allocate full budget authority and choice for hand-picking the project members to the project leader
- To use a "stage gate" process to support the teams
- An emphasis on measurement, using performance drivers such as resource utilisation, technical advancement, risk management, system solution, speed and technical performance
- Periodic reviews involving senior management

Procedural approach

There is a broad consensus of opinion that the idea-to-implementation process described in Innovation Project Management and called the Bob Cooper Stage gate process is the most widely used and respected.[32] Coopers methodology is based on a study of attempts, both successful and unsuccessful, to innovate in over 2000 different projects in North America and Europe. [33] He has distilled a process using short feasibility studies and little organisational inference and expenditure but with target outcomes in time and required understanding. [34] At the end of each study, a review group from the company looks at the outcome and agrees to either end the study or to define further resource allocation and required outputs for the next stage. [35] This moves progressively through the life of a project with the amount of resource allocated steadily increasing and the requirements becoming increasingly stiff so that the project can continue its progress. [36]

Conceptual approach

According to Zairi (1999) the Stage gate approach is well understood and documented, but it appears to handle only part of the problem. [37] In addition to this procedural approach of moving from idea to implementation, there seem to be a conceptual approach needed, which requires the project managers to apply a series of judgements in the early phases. [38] These judgements are normally considered much later –too late – in the project. Many firms, according to Zairi (2000) still regard the innovation process as an exercise in technology transfer. [39]

Different types of product development strategies

The static and the dynamic perspective

The static and the dynamic perspective represent two different approaches to product development. [40] The static development strategies are Serial development, Semi-parallel development, parallel development, and Concurrent Engineering (CE). [41]

Companies that use the static approach tend to be characterised by limited flexibility to changes, detailed long-term planning, and a highly centralised decision making process. On

[32] Zairi, M. (1999). P.99.
[33] Zairi, M. (1999). p.99.
[34] Zairi, M. (1999). p.99.
[35] Zairi, M. (1999). p.99.
[36] Zairi, M. (1999). p.99.
[37] Zairi, M. (1999). p.99.
[38] Zairi, M. (1999). p.99.
[39] Zairi, M. (1999). p.100.
[40] Ottosson, S. (1999), p. 63.
[41] Ottosson, S. (1999), p. 63.

the contrary, a dynamic firm is characterised by a general long-term planning, detailed short-term planning, a high amount of flexibility and decentralised decision making. [42]

Serial development
The product development has traditionally been sequential with strict rules concerning the sequence and timing of different work activities.[43]The approach is linear; the different activities are product construction, process construction, marketing and sales. Between the phases there are decision gates that determine whether the next phase should be undertaken or not.[44]
An inherent feature of the serial approach tends to be that the members of the product construction department do not communicate with the users of the product. The result of this is often that the products developed do not imply optimal usability. [45] The main driver of the serial approach is ”technology push”.[46]
Another serious disadvantages of the serial approach are that the different functions of the company often do not communicate. This often leads to a situation where different functions start viewing each other as enemies. A common situation is that the sales force members claim that the new product is difficult or impossible to sell. [47] Despite its disadvantages, the serial approach is presently the most commonly development approach used among companies.[48]

Semi parallel development
The main difference between the semi parallel and the serial method is that the activities of a later phase are initiated before all activities of the preceding phase are finished. This implies that different activities can be iterated until a satisfying standard is reached.[49] Using the semi parallel approach, the development time can be reduced to 60 % compared with the serial approach.
The Japanese car industry is the precursor of the semi parallel development method, which is also called the ”Waterfall method”. The activities within each function of the semi parallel approach still follow a strict sequence. The output of one activity serves as an input to the next. [50]

Parallel development
The parallel method implies cross-functional teams to perform all activities. All activities are initiated at the same time. [51]
A main advantage of integrating the teams is that this reduces the war between different functions of the company. The main driver of the parallel method is ”market pull”.[52]

A major weakness of the parallel method is that it excludes radical innovations from the innovation process, this since a market can only initialise it need. It can be claimed that there does not exist any market need, i.e. pull, for a radical innovation until the product has been

[42] Ottosson, S. (1999), p. 63.
[43] Ottosson, S. (1999), p. 63.
[44] Ottosson, S. (1999), p. 63.
[45] Ottosson, S. (1999), p. 63.
[46] Ottosson, S. (1999), p. 66.
[47] Ottosson, S. (1999), p. 63.
[48] Pasad, B. & Wang, F. & Deng, J. (1998), p.121-135.
[49] Ottosson, S. (1999), p. 68.
[50] Ottosson, S. (1999), p. 68.
[51] Ottosson, S. (1999), p. 71.
[52] Ottosson, S. (1999), p. 71.

introduced on the market and a larger amount of users have understood the advantages of the product. This makes the parallel method best suited for re-engineering (product renewal, further development and product preservation). This method is not suited for new product development.[53] According to the experience very few important innovations have originated from customer enquiries.[54]

Concurrent Engineering

The CE approach aims at carefully control and monitor the development process in order to re-use as much as possible of already existing knowledge. This makes CE best suited for product renewal and preservation of large corporations.[55]
Cross-functional teams are used. The most important product requirements originate from customer enquiries and interviews.[56]

Dynamic product development

In order to break up the static behaviour thereby increasing the creativity and speed of the innovation process, DPD was developed. [57] DPD advocates cross-functional teams, common project facilities, and a dynamic strategy. Many small decisions are used instead of milestones that involve many people from different functions. The user should be in focus during the entire development process. The most important product and process requirements originate from own studies of the user environment and the user. Market studies are replaced with active marketing. This because one order is considered to be more valuable than positive market studies.[58]

According to DPD, small flexible teams of 8-10 people should perform new product development. The development of large complex projects should be broken up into smaller sub-projects, i.e. modules. The sequential development stages of the different static approaches are not a characteristic of the DPD approach. Instead the process includes much iteration between the activities. The product concept is developed over time as experiences are gained during the development process. The development process is dynamic in the sense that product modules, models and prototypes are developed in parallel. [59]
DPD is an approach that advocates radical innovation. All types of corporations can use it. DPD can also be used for incremental innovation and maintenance of existing products. According to the DPD approach, in the initiation phase the resources should be concentrated on actively creating ideas. These should be immediately evaluated against the business plan or need that the team are currently working toward. The dynamics of DPD is achieved through the use of a flexible approach that is adjusted to the specific requirements of each unique development situation.[60]

[53] Ottosson, S. (1999), p. 71.
[54] Östholm, I. (1996).
[55] Ottosson, S. (1999), p. 73.
[56] Ottosson, S. (1999), p. 73.
[57] Ottosson, S. (1999), p. 80.
[58] Ottosson, S. (1999), p. 80, 112.
[59] Ottosson, S. (1999), p. 80.
[60] Ottosson, S. (1999), p. 81.

Two different knowledge management strategies

A company needs to have a clear strategy for knowledge management before making an investment in this field.[61] Harysson (2000) suggests that there are two very different and partly opposed approaches to knowledge management: [62]

- The library approach that focuses primarily on codification and reuse of knowledge.
- The know-who approach based more on connecting the right people into human networks.

According to Hansen & Nohria & Thierney, there are three factors to consider in order to determine the choice of strategy: the *level of standardisation* of the product or service, the *degree of innovativeness* and the *reliance on explicit or tacit knowledge.* [63]

The library approach is particularly suitable in situations where reuse of easily codified knowledge brings a business impact. [64] Dell is a well-known user of this approach. [65] Dell gains competitive advantage by re-using customised configurations, which saves money and time. [66]Companies that gain their competitive advantage primarily by sharing and enhancing tacit knowledge for the creation of new and innovative solutions are more likely to gain their competitive advantage from the know-who based approach. [67]

2.1.5 The relation between the stakeholders and the organisational images

Organisational learning, knowledge management and informal organisational networks provide some potential means to improve the functioning of SKF Nova. The output of SKF Nova is knowledge. Improvement of the capability of SKF Nova to learn, to manage knowledge and to create informal relationships depends to a great extent on the stakeholders involved.

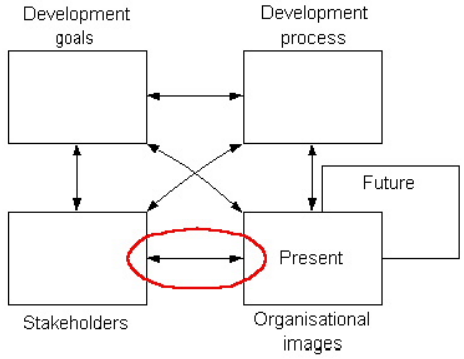


Figure 7 - The relation between the stakeholders and the organisational images of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

[61]Harryson, S. (2000).p.248.
[62]Harryson, S. (2000).p.248.
[63] Hansen, M. & Nohria, N. & Thierney, T. Harvard Business Review, March-April 1999.
[64]Harryson, S. (2000).p.248.
[65]Harryson, S. (2000).p.248.
[66]Harryson, S. (2000).p.248.
[67]Harryson, S. (2000).p.248.

Organisational learning through conversion of knowledge

One of the most well known theories of organisational knowledge creation is created by Nonaka (1994):

The central theme of Nonaka's theory resides in a dynamic interaction between the different modes of knowledge conversion.[68] These modes are socialisation, externalisation, combination and internalisation.[69] According to Nonaka organisational knowledge creation happens when all four modes of conversion are explicitly managed to form a continual cycle, shaped by a series of shifts of the modes.[70] Nonaka has identified specific key triggers to induce these shifts. These shifts are presented below:

- *Socialisation* usually starts with the building of a field of interaction, which facilitates the sharing of member's experiences and perspectives.
- *Externalisation* is triggered by successive rounds of dialogue in which metaphors can be used to enable team members to articulate their own perspectives, and thereby reveal hidden tacit knowledge that is otherwise hard to communicate.
- *Combination* is facilitated by co-ordination between team members, divisions and business units.
- *Internalisation* is triggered by the iterative processes of trial and error and learning by doing, by which concepts are articulated and developed in concrete forms.

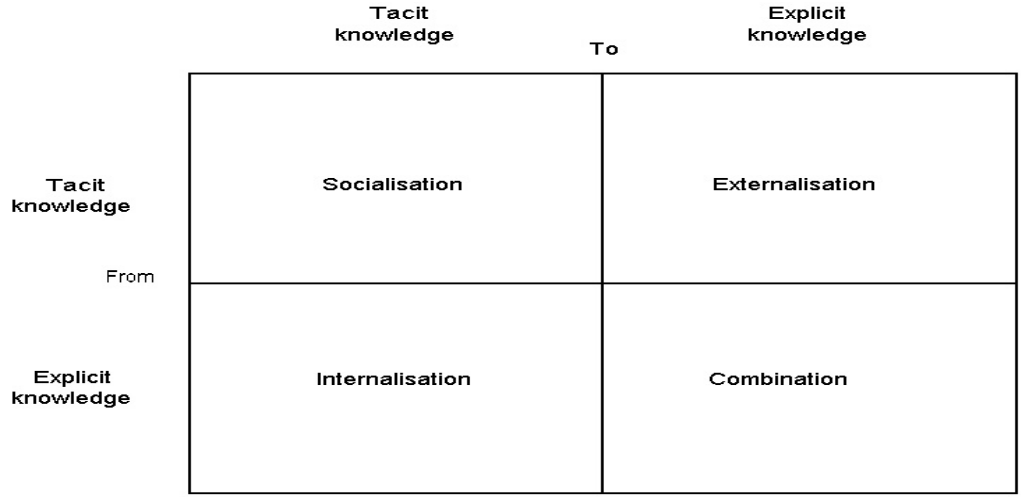


Figure 8 - Nonaka's knowledge matrix, (Nonaka 1994).

Nonaka (1994) explains organisational learning in detail using a spiral of knowledge creation.[71] Refer to Nonaka (1994) for a more detailed discussion about this.[72]

Senge (1999), who popularised learning organisations in his book *the fifth discipline*, described them as places "where new and expansive patterns of thinking are nurtured and where people are continually learning how to learn together".[73]

[68] Nonaka, I. (1994).p.20.
[69] Nonaka, I. (1994).p.20.
[70] Nonaka, I. (1994).p.20.
[71] Nonaka, I. (1994).p.20.
[72] Nonaka, I. (1994).p.20.
[73] Senge, P. (1999).

The library approach to knowledge management

How does KM create value for an organisation and its customers? Organisations are discovering that managing knowledge creates value by increasing productivity and fostering innovation.[74] Teece (2000), argues that knowing how to select, interpret, and integrate information into a usable body of knowledge is a far more valuable individual and organisational skill than simply being able to give the answer to a discrete question or a series of questions. Competitive advantage depends upon the creation and exploitation of difficult-to-replicate non-tradable assets, of which knowledge assets are the most important.[75] KM is the process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets and to develop new opportunities.[76]

Traditional KM emphasises that knowledge creates value when shared knowledge is reused.[77] "Managing knowledge creates value by reducing the time and expense of trial and error or the reinvention of the wheel." [78]

Learning how to learn
Wiig (1993) claims that knowledge workers must learn to develop good understandings of how they can organise knowledge in their minds and in their work environment while learning to use it more effectively and make new knowledge accessible for use. [79] Each individual needs to develop understandings and concepts how to think about and evaluate knowledge and human reasoning as used in their work. [80] They must be aware of what is needed to codify knowledge to pass it on to others through training. [81] They must also understand how knowledge is included in the work products and procedures they create and even in the organisation's culture and practices. [82] In other words, knowledge workers must acquire an understanding "knowledge about knowledge" or "meta-knowledge". [83]

Barriers to sharing knowledge

Researchers have concluded that incentives alone are not sufficient for knowledge sharing to occur widely.[84] Cultural, economic and process barriers must be overcome. People frequently hoard knowledge because they believe that knowledge is power. [85] The result is that both individuals and the organisation are less productive than they could be, as synergies that are related to re-use of knowledge are not being obtained.[86]

Different levels of knowledge

[74] KM Working Group of the Federal chief Information Officers Council, 2001, p.1.
[75] Teece, D. (2000), p.44.
[76] Quintas, P. & Lefrere P. & Jones, G (1997), p.385.
[77] KM Working Group of the Federal chief Information Officers Council, (2001), p.1.
[78] Quintas, P. & Lefrere P. & Jones, G (1997), p.385.
[79] Wiig, K. (1993).p.136.
[80] Wiig, K. (1993).p.136.
[81] Wiig, K. (1993).p.136.
[82] Wiig, K. (1993).p.136.
[83] Wiig, K. (1993).p.136.
[84] KM Working Group of the Federal chief Information Officers Council, 2001, p.1.
[85] KM Working Group of the Federal chief Information Officers Council, 2001, p.12.
[86] KM Working Group of the Federal chief Information Officers Council, 2001, p.12.

According to Sanchez, R. strategically managing flows of knowledge in product creation requires recognition of some basic differences in the kinds of knowledge a firm may have. [87] He further argues that these different kinds of knowledge reflect different levels of understanding that a firm can develop about its product creation processes.[88] There are three levels of understanding that characterise three different kinds of knowledge that can exist within an organisation. [89] These levels are know-how, know-why and know what. [90]

Informal knowledge networks

Motives to share knowledge

Modern industrial development processes of new technologies are characterised by an increasing complexity and interdependence of different actors combining different knowledge assets.[91] In a complex innovation process, informal networks, i.e. loose relationships between firms, as well as between scientists and engineers is a new institutionalised form of industrial organisation, capable of dealing better with learning under high know-how requirements.[92]

According to Quintas & Lefrere & Jones (1997), few companies have the capability to ”go-it-alone” and cover the waterfront of technologies required to innovate in the many product markets where technologies are fusing across disciplinary boundaries. [93] When sources of knowledge are widely dispersed, such collaboration is likely to be extensive. [94] Companies continuously need to acquire new knowledge from external sources to enable them to innovate effectively. [95]

Pyka (2000), claims that during the early stages of the innovation process, when still no standards exists, production as well as demand are on a small scale, leading to high product prices and a small industry output. Due to the degree of novelty, innovation processes are characterised by a high degree of technological uncertainty. The uncertainty often does not allow either a prediction of the timing, or the technological features or the economic consequences of these innovations.[96]

To overcome these financial and technological bottlenecks, informal networks seem to be a promising industrial device to push forward collectively technological progress by exploring and exploiting the extensive technological opportunities offered by voluntary know-how exchange.[97] Informal relationships show the advantage of being simple, uncomplicated and therefore less expensive concerning co-ordination efforts.[98] Some of the key features stimulating collaboration are uncertainty about technological development and diffusion and the discontinuous nature of innovation.[99]

[87] Sanchez, R. (1996), p. 135.
[88] Sanchez, R. (1996), p. 135.
[89] Sanchez, R. (1996), p. 135.
[90] Sanchez, R. (1996), p. 135.
[91] Pyka, A. (2000). p.26.
[92] Pyka, A. (2000). p.26.
[93] Quintas, P. & Lefrere P. & Jones, G. (1997), p. 389.
[94] Quintas, P. & Lefrere P. & Jones, G. (1997), p. 389.
[95] Quintas, P. & Lefrere P. & Jones, G. (1997), p. 389.
[96] Pyka, A. (2000). P.26.
[97] Pyka, A. (2000). p.26.
[98] Pyka, A. (2000). p.26.
[99] Balthasar, A. & Bättig, C. & Thierstein, A. & Wilhelm, B. (2000),p. 523.

Learning capabilities represents a strong motive to share knowledge between different firms

- Informal networks can lead to positive win-win situations in the innovation activities of firms participating in the respective networks.
- An improved capability to meet the requirements for adaptations due to evolving technologies improving the efficiency.
- Synergetic benefits caused by the amalgamation of different knowledge fields often results in the creation of something totally new, helping all actors involved overcome technological constraints.[100]

These learning capabilities provide a strong motive to behave co-operatively. [101] At he same time there is a trade-off between the opening up of extensive opportunities, the acquisition of knowledge and potential losses due to cheating and opportunism.[102]

[100] Pyka, A. (2000). p.28.
[101] Pyka, A. (2000). p.26.
[102] Pyka, A. (2000). p.26.

2.2 Knowledge and Innovation Management - A Frame of Reference

The Frame of reference is intended to present how the theories selected in the problem discussion will be used to solve the opportunities and problems of SKF Nova and the SKF group. The theories presented in the Frame of reference will eventually be used to develop two business scenarios of SKF Nova and a knowledge management model. The scenarios and the model to be developed will result in changes in the present and potential future organisational images of SKF Nova.

The frame of reference will concentrate on two of the aspects of DELTA that has already been introduced in the Problem discussion. These aspects are:

- The organisational images
- The relation between the stakeholders and the organisational images

2.2.1 Organisational images

The theories selected to improve the organisational images of SKF Nova cover two different drivers of innovation, innovation and technology management and management of the technology transfer process.

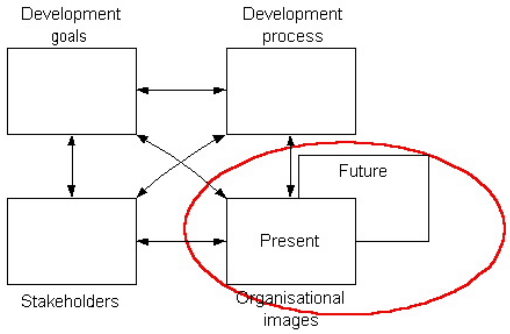


Figure 9 - The organisational images of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

Market-pull versus technology-push

SKF Nova does perform innovation. What are the drivers of innovation? The origin, i.e. driver of a business idea can either be a market pull or a technology push.[103]

It can be claimed that true innovation refers to the creation of radically new products for new markets. Such an activity involves a very high level of uncertainty. It is relevant to argue that neither maintenance of the existing business of a company, nor refinement of the existing business represents innovation. The two last activities should instead be called product development. There is some confusion in the use of the concept innovation though, and this is why product development is called incremental innovation in this thesis.

[103] Ottosson, S. (1999), p. 71.

Incremental innovation
An idea that is generated by a market pull will most certainly be categorised as incremental innovation.[104] According to Zairi (1999), *market orientation* represents the principal cultural foundation of the learning organisation.[105] It has further become a prerequisite to profitability and success of most organisations.[106] Because of its emphasis on developing information about customers and competitors, the market driven business is well positioned to anticipate the developing needs of its customers and respond to them through the adoption of innovative products and services.[107] This ability gives the market-driven business an advantage in the speed and effectiveness of its response to opportunities and threats.[108]From a market perspective, a new product refers to a product that is perceived to be new by the customers.[109]

Radical innovation
An idea that originates from a technology push however, will probably be categorised as radical innovation.[110] The reason is that there cannot exist any market need, i.e. pull, for a radical innovation until the product has been introduced on the market and a larger amount of users have understood the advantages of the product. This makes the development approaches that start with a customer inquiry best suited for incremental innovation, i.e. maintenance of mainstream business and adding value to present business.[111]

From a business perspective, the efficient creation of radical new business should start with a study of the business pre-requisites, thereafter end-user need studies and product alternative studies.[112] Determination of the need based on different market studies does not give a solid ground except in the case of incremental innovation.[113]

Innovation and Technology Management

The entrepreneurial business
It takes special effort for the existing business to become entrepreneurial and innovative. [114] It is not size that is an impediment to innovation; it is the existing operation itself and especially the existing successful operation.[115] This requires that the business be organised as a successful innovator. [116] An innovator upsets and disorganises. [117] His task is creative destruction. [118]

In parallel with the product development, the process development has become an increasingly important source of competitive advantage.[119]The aim of process development is

[104] Ottosson, S. (1999), p. 71.
[105] Zairi, M. (1999), p.35.
[106] Zairi, M. (1999), p.35.
[107] Zairi, M. (1999), p.35.
[108] Zairi, M. (1999), p.35.
[109] Ottosson, S, (1999), p. 71.
[110] Ottosson, S. (1999), p. 71.
[111] Ottosson, S. (1999), p. 71.
[112] Ottosson, S. (1999), p. 71.
[113] Östholm, I. (1996).
[114] Drucker, P. (1985), p.137.
[115] Drucker, P. (1985), p.136.
[116] Drucker, P. (1985), p.31.
[117] Drucker, P. (1985), p.23.
[118] Drucker, P. (1985), p.23.
[119] Ottosson, S. (1999), p. 31.

to ensure that a product or service can be produced, that the product or service fulfil the customer requirements and that the requirements on delivery speed and production costs are met.[120]

Some specific characteristics of managing technology development
Developmental work always tend to imply: [121]

- The creation of something new
- The change of something that exists
- Uncertainty
- Greater consumption of time than what was originally expected

These conditions, i.e. pre-requisites have great impact on the management of innovation. [122]

Product development phases
Tatikonda & Rosentahl (2000) suggest that there are two major phases in considering innovation: project planning and project execution. The project planning phase includes choosing the project to work on, setting product and project targets, and putting in place the key resources and mechanisms to accomplish the development effort. The project execution phase involves actually carrying the project through completion.[123]
Often, before the project execution starts there is no precise understanding of the detailed project tasks, task sequence, task interdependencies and task times.[124] According to Tatikonda & Rosentahl (2000), this requires a shift from thinking solely about detailed project planning to also considering the context within which the project work is accomplished, i.e. the project execution. The Project Management Institute (PMI), the professional organisation of project managers, cites, ”project execution as the single most important factor in the success or failure of new products”.[125]

Successful execution of product development projects
An important factor improving the chances of successful project implementation is according to Tatikonda & Rosentahl (2000), to regard each innovation project as unique. [126] Their study considers two important characteristics of innovation projects. The first is that such a project draws on equipment, skills, resources and personnel from diverse functional areas that must work together to achieve the objectives of the project. [127] Secondly, such projects face many forms of uncertainty, one of which is technology uncertainty.[128]

Pyka (2000) argues that one means that could potentially reduce the technological uncertainty inherent in the product development could be through the active collaboration with external partners in an external network. The suggested knowledge exchange could possibly increase the chances of project success. [129]

[120] Ottosson, S. (1999), p. 41.
[121] Omsén, A. (1992), p. 143.
[122] Omsén, A. (1992), p. 143.
[123] Tatikonda, M. & Rosentahl, S. (2000), p.402.
[124] Tatikonda, M. & Rosentahl, S. (2000), p.403.
[125] Project Management Institute. (1998).
[126] Tatikonda, M. & Rosentahl, S. (2000), p.402.
[127] Tatikonda, M. & Rosentahl, S. (2000), p.402.
[128] Tatikonda, M. & Rosentahl, S. (2000), p.402.
[129] Pyka, A. (2000). p.26.

Structure versus flexibility
Tatikonda & Rosentahl (2000) reveal that project execution methods are positively associated with project execution success. Their research suggests that firms should ”balance firmness and flexibility” in product development. They argue that effective product development execution requires organisational flexibility within a structure; i.e. firmness in the sense of having a pre-determined structure and flexibility in the nature of work within that structure.[130]

Ottosson (1999) suggests that highly structured processes work well as long as the purpose is to maintain mainstream business or to add value to already existing business. Considering radical innovation, greater process flexibility is required since creativity is difficult to plan. [131]

Static versus dynamic development processes
The research concerning innovation processes reveals that different types of development processes have different purposes and that they are intended to generate different results. [132] The static development approaches are characterised by sequential development stages. [133] The processes are highly structured using detailed checklists to follow. [134] The Dynamic product Development method (DPD) includes iteration between the activities. [135] All activities are initialised at the same time. The use of cross-functional teams ensures quality and efficient communication. The dynamics is achieved through the use of a flexible approach that is adjusted to the specific requirements of each unique development situation.[136] The product concept is developed over time as experiences are gained during the development process. [137] Modules, models and prototypes are developed in parallel. [138]

An advantage of the dynamic approach is quick verification and adjustment to customer requirements. [139] A disadvantage of the dynamic approach is that it places higher requirements on the actors involved in the development process. [140] The more flexibility in the process the more important is it that the project leader and at least some of the project members have considerable practical experience. [141]

In summary an effective innovation process:
- Has a pre-determined structure
- Ensures flexibility in the nature of work within that structure[142]
- Considers the unique characteristics of each idea
  - Maintain mainstream business
  - Add value to present business
  - Create radical new business

- Provides the ability to tailor make the process

[130] Tatikonda, M. & Rosentahl, S. (2000), p.402.
[131] Ottosson, S. (1999), p. 46.
[132] Ottosson, S. (1999), p. 99.
[133] Ottosson, S. (1999), p. 99.
[134] Ottosson, S. (1999), p. 99.
[135] Ottosson, S. (1999), p. 99.
[136] Ottosson, S. (1999), p. 81.
[137] Ottosson, S. (1999), p. 81.
[138] Ottosson, S. (1999), p. 80.
[139] Ottosson, S. (1999), p. 81.
[140] Ottosson, S. (1999), p. 81.
[141] Ottosson, S. (1999), p. 81.
[142] Tatikonda, M. & Rosentahl, S. (2000), p.402.

- Encourages cross-functional development

Management of the technology transfer process

Companies need a system for determining the highest risk of failure of the innovation process
The study of best practice innovation management performed by Zairi (2000) reveals that most companies have concluded that a system is needed for determining where the highest risks of failure are in the innovation process. [143] Many firms, according to Zairi (2000) still regard the innovation process as an exercise in technology transfer. [144]

The ITT-typology
Tatikonda & Stock (2000) have developed one system called the Inward Technology Transfer Typology (ITT). The ITT typology considers the technology transfer at the project, rather than at the firm level of analysis.
A typology is a classification scheme. The classifications are ideal types, each of which represents a unique combination of organisational attributes.[145]

The ITT typology identifies along the diagonal the best choice of technology transfer process type by matching the technology uncertainty of the technology to be transferred and the organisational interaction between the technology source and recipient. [146] There are four transfer process types (arrayed along the diagonal): arms-length purchase, facilitated purchase, collaborative hand-off, and co-development. [147] Each transfer process type represents the best match, or fit, between technology uncertainty and organisational interaction. [148] The four transfer process types are shortly described below.

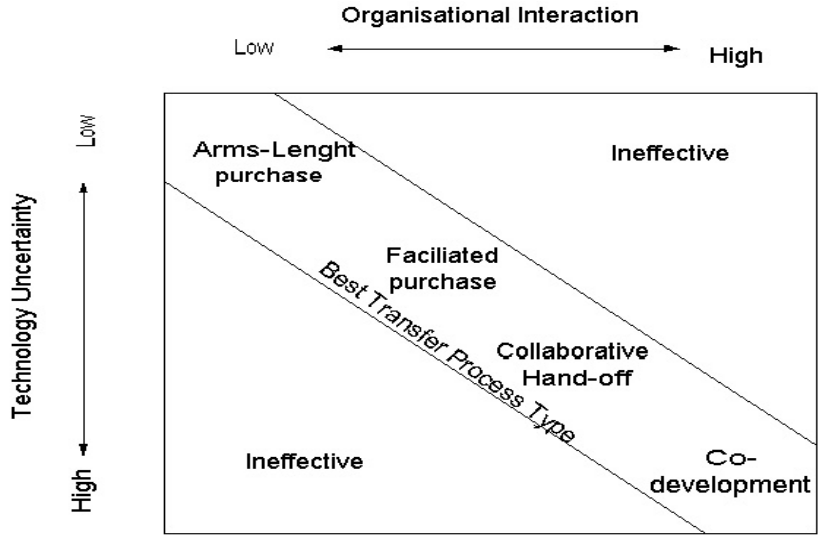


Figure 10 - The Inward Technology Transfer Typology, (Tatikonda & Stock 2000).

Arms-length purchase

[143] Zairi, M. (1999). P.99.
[144] Zairi, M. (1999). p.100.
[145] Tatikonda, M. & Stock, G. (2000). p. 720.
[146] Tatikonda, M. & Stock, G. (2000). p. 720.
[147] Tatikonda, M. & Stock, G. (2000). p. 720.
[148] Tatikonda, M. & Stock, G. (2000). p. 720.

For the recipient, the technology to be transferred has low levels of complexity, novelty and tacitness. The recipient can therefore use the technology as soon as it is received with little or no difficulty. The recipient has all or virtually all the information needed to successfully move and implement this technology.

Facilitated purchase
Complexity, novelty, and tacitness are relatively higher for the technology in this category than in the arms-length purchase transfer. However because of the lack of expertise or experience, the recipient does not know how to immediately utilise the technology. In this transfer process type as well as in an arms-length purchase, the actual movement of the technology in the transfer is likely to be trivial. Organisational interaction is characterised by low to medium levels of communication, co-ordination and co-operation.

The collaborative hands-off
The organisational interaction between the source and the recipient is higher than in the facilitated purchase. The levels of communication and co-operation are greater, and more attention is devoted to co-ordination activities between the source and recipient. Therefore, the collaborative hand-off exhibits medium to high levels of technology uncertainty and organisational interaction and results in relatively higher levels of information processing requirements and capabilities.

Co-development
The relationship between the source and recipient in a co-development transfer will be characterised by a very high degree of communication, co-operation and co-ordination. The boundaries between the source and the recipient are blurred or possibly even eliminated. The source and the recipient work together, largely as one integrated organisation, to move the technology and use it successfully in the recipient organisation.

Matching the Technology Uncertainty and the Organisational Interaction
All technology transfers involve some information processing to conduct the transfer. [149] The degree to which the information processing requirements and capabilities are appropriately matched determines the quality of task outcomes. [150] Poor task outcomes occur when requirements and capabilities are not properly matched. [151] When the organisation does not have enough information processing capacity to accomplish the task, the task is completed below, performance standards, late and /or over budget. [152] When the organisation employs more information processing capacity than is required to accomplish the task, the task is accomplished inefficiently. A given level of information processing requirements should be appropriately matched, i.e. fit to a given level of information processing capacity (or vice versa) in order to achieve effective task outcomes. [153]

[149] Tatikonda, M. & Stock, G. (2000). p. 720.
[150] Tatikonda, M. & Stock, G. (2000). p. 720.
[151] Tatikonda, M. & Stock, G. (2000). p. 720.
[152] Tatikonda, M. & Stock, G. (2000). p. 720.
[153] Tatikonda, M. & Stock, G. (2000). p. 720.

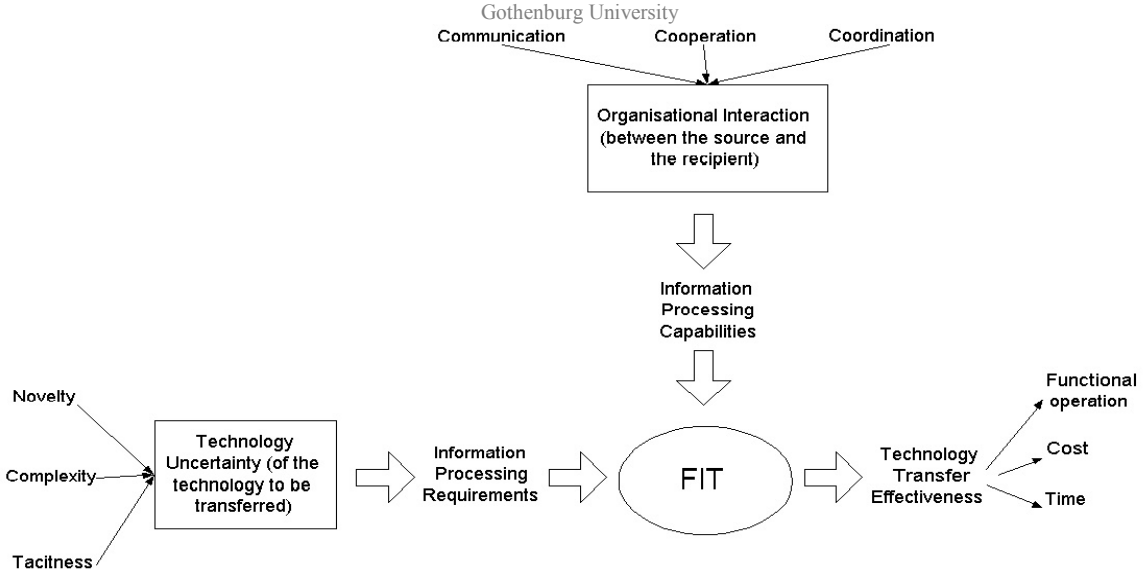


Figure 11 - The technology uncertainty and the organisational interaction determines the effectiveness of the technology transfer, (Tatikonda & Stock 2000).

Three main factors that influence the technology transfer
Many variables influence the technology transfer process. The ITT typology reduces the complexity of the transfer process by synthesising the factors into three general sub-dimensions including the *technology uncertainty*, *organisational interaction* and *transfer effectiveness*. [154] What is meant by each of these dimensions?

Technology uncertainty
In technology transfer, technology uncertainty is the lack of knowledge concerning how to move and implement the technology of interest. The technology uncertainty is the difference between the level of knowledge required by the recipient organisation to acquire and implement the technology and the level of knowledge the recipient actually possesses. There are three main factors that affect the technology uncertainty: the technology novelty, the technology complexity and the technology tacitness.

- Technology novelty refers to the degree of prior experience with the technology and the degree of change in the technology relative to prior technologies. This means that the technology uncertainty is high if the innovation is radical and low if the innovation is incremental. [155]
- Technology complexity refers to the level of interdependence between the components in the technology, the level of interdependence between the technology and the elements external to it and the scope of the technology. [156]
- Tacitness of the technology refers to the tacitness of the knowledge embodied by the technology. [157] Is it possible to codify the knowledge or is it mostly held within individuals?

Organisational interaction
The second dimension considers the relationship between the source and the recipient, which has been classified into three main factors:

[154] Tatikonda, M. & Stock, G. (2000). p. 720.
[155] Tatikonda, M. & Stock, G. (2000). p. 720.
[156] Tatikonda, M. & Stock, G. (2000). p. 720.
[157] Tatikonda, M. & Stock, G. (2000). p. 720.

- Communication includes the methods of communication, magnitude and frequency of communication and the nature of information exchanged. [158]
- Co-ordination refers to the nature of the planned structure and process of interactions and decision-making between the source and the recipient. [159]
- Co-operation refers to the willingness of a partner to co-operate and share knowledge to obtain a common development goal. [160]

Transfer effectiveness
The effectiveness of the technology transfer process is the degree to which the utilisation of the transferred technology fulfils the recipient firm's intended functional objectives considering time, cost and technical performance. [161]

2.2.2 The relation between the stakeholders and the organisational images

The output of SKF Nova is knowledge. Improvement of the capability of SKF Nova to learn, to manage knowledge and to create informal relationships depends to a great extent on the stakeholders involved.

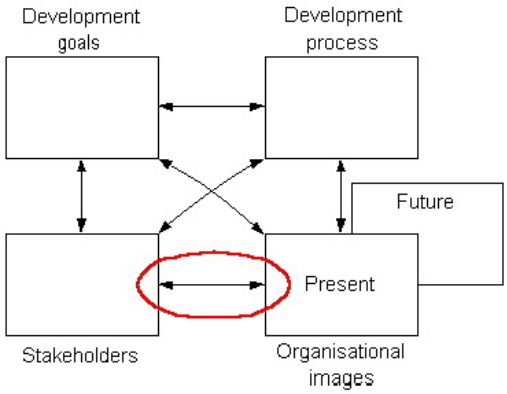


Figure 12 - The relation between the stakeholders and the organisational images of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

The theories selected to improve the relationship between the stakeholders and the organisational images of SKF Nova cover the know-who approach and the library approach to knowledge management. Both of the approaches have already been introduced in the Problem discussion. Lastly a comparison of the two approaches will be made.

Knowledge and Innovation Management (the know-who approach)

The new Knowledge society requires a new approach to innovation management:
The new economics of information and knowledge coupled with accelerating technological complexity and shrinking product lives create intractable dilemmas for companies that rely on internal technological development to meet their Knowledge and Innovation needs.[162] Too many companies today are finding themselves "stuck" and unable to respond quickly enough

[158] Tatikonda, M. & Stock, G. (2000). p. 720.
[159] Tatikonda, M. & Stock, G. (2000). p. 720.
[160] Tatikonda, M. & Stock, G. (2000). p. 720.
[161] Tatikonda, M. & Stock, G. (2000). p. 720.
[162] Harryson, S. (2000).p.5.

to time-paced market shifts.[163] Why? Because they have concentrated on making their pool of knowledge and technology more and more specialised, hoping that this will preserve their competitive edge.[164] Unfortunately, this has actually left many people in marketing, R & D and production short of the cross-functional skills that they need to perform radical innovation. [165] Exploiting given advantages does not seem to be sufficient in a competitive environment that calls increasingly for creating of novelty.[166]

In response to the call for new strategies and approaches to manage both knowledge and innovation, a know-who based approach to Knowledge and Innovation management has been recently developed.[167]

Harryson (2000) argues that the innovation process can no longer be focused on local know-how, but needs to focus more on the global know-who instead.[168] Regardless of the type of industry, companies and their innovation process are becoming increasingly knowledge-based and intellectual assets take the predominant role in defining market value.[169] Accordingly, the shifting sources of global competitive advantage call for new strategies and approaches to manage both knowledge and innovation.[170]

Know-who

The know-who approach advocated by Harryson (2000) stresses the importance of networks with customers, suppliers, competitors and research centres. Rather than developing all specialised knowledge internally, an extensive knowledge exchange save time and development cost. Know-who can be defined as the ability to acquire, transform and apply the know-how.[171]

"*The driving force of Sony's rapid innovation is the conviction that if we loose money we can always recover, but if we lose time we can't. Therefore time has always been a critical issue at Sony. The best way to gain time is to communicate a lot and to gain as many personal networks as possible."*[172]

Organisational networks

Knowledge acquisition is an active process – it requires firms to commit resources to its management.[173] Teece (2000) claims, "Successful companies will always have those with whom they collaborate, be they other firms, individuals or universities". "Networks are thus frequently critical to the knowledge based firm".[174] Innovations tend to result from the combination of interdisciplinary fields of technology that impossibly can be held within one

[163] Harryson, S. (2000).p.5.
[164] Harryson, S. (2000).p.5.
[165] Harryson, S. (2000).p.5.
[166] Harryson, S. (2000).p.5.
[167] Harryson, S. (2000).p.xiii.
[168] Harryson, S. (2000).p.5.
[169] Harryson, S. (2000).p.xiii.
[170] Harryson, S. (2000).p.xiii.
[171] Harryson S, J. (2000).p.ix.
[172] Harryson, S. (2000).p.ix.
[173] Quintas, P. & Lefrere P. & Jones, G. (1997), p. 389.
[174] Teece, D. (2000), p.43.

company.[175] Vast research indicates the emerging trend of internal and external networks for knowledge acquisition.

The know-who based approach combines market-pull and technology-push
The know-who based approach presented by Harryson (2000) presents a unique combination of internal and external networks:

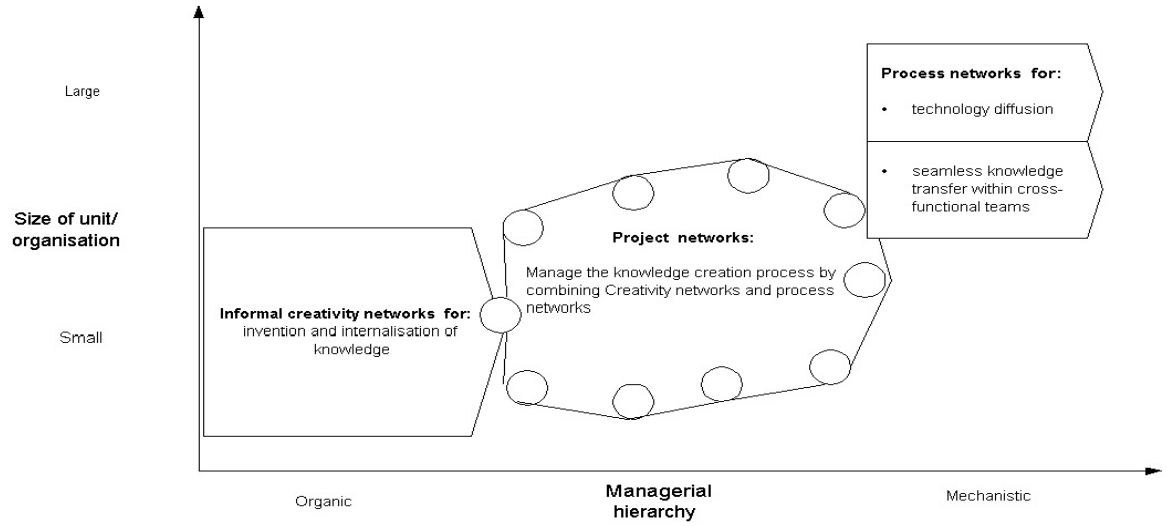


Figure 13 - The three types of networks needed by the know-who based company, Harryson (2000).

The know-who approach advocates that three types of networks are necessary for the know-who based-company. [176]

- Knowledge acquisition from external firms through an informal creativity network. [177] Knowledge considering new technology often represents technology push. [178]
- Knowledge application through cross-functional process networks. [179] The input from the process networks reflects the market pull.
- The project network has a learning, packaging and distributing function. The project network combines technology push and market pull.

Managing the organisational learning process
Much of the knowledge management movement and the concept of networked organisations arose as an attempt to heal the wounds caused by excessive divisionalisation.[180] How can the organisational learning process of a know-who based company be designed? Harryson (2000) has suggested the following process composed by six steps: [181]

1. *Enlarging individual's knowledge* - can be secured through training and job rotation, which increase individuals' capability to relate different experiences to each other.
2. *Sharing tacit knowledge* – appears through three types of networks, the informal creativity network, the project network and the process network. This is a core competency of the know-who based company.

[175] Pyka, A. (2000). p.26.
[176] Harryson, S. (2000).p.15.
[177] Harryson, S. (2000).p.15.
[178] Harryson, S. (2000).p.15.
[179] Harryson, S. (2000).p.15.
[180] Hedlund. (1992).p.112.
[181] Harryson, S. (2000).p.161.

3. *Conceptualisation and crystallisation* take place through the early and intensive preparation and presentation of prototypes, which incorporate and transform tacit knowledge and concepts into tangible models for effective cross-functional communication and joint reflection.
4. *Justification* occurs by presenting the prototypes to top or middle management for strategic input and authority to proceed.
5. *Networking knowledge* – is – just like the sharing of tacit knowledge – not an isolated step in know-who based companies, but an ongoing process that drives the knowledge and innovation machinery as a whole.
6. *Internalising extra corporate knowledge* occurs through technology scanning, followed by emigration of key individuals to identified centres of excellence.[182]

The library approach to knowledge management

Characteristics of an effective Knowledge management programme
To be effective a Knowledge Management programme must have coherence across a number of dimensions including structure, people aspects, culture, processes and technology.[183]

Structure
KM focuses on the development of structures that stimulate re-use and sharing of knowledge and experiences. Examples of such structures are communities of practice, internal and external knowledge networks. Structural aspects further include incentives for employees to share their knowledge or to use knowledge shared by others. [184]

People and culture
People and culture are the most important components since managing knowledge depends on people's willingness to share and reuse knowledge.[185] Developing leaders who foster sharing, build an atmosphere of trust in which sharing is valued can create a sharing culture.[186] If people believe they will benefit from sharing their knowledge, either directly or indirectly, they are more likely to share. Whether people use the knowledge of others depends if they know and trust the source of knowledge. The people aspects further include training, development, recruitment, motivation, retention, organisation, job design, cultural change and the encouragement of creative thinking.[187]

Process aspects
A means to encourage the knowledge sharing of organisations is to establish processes and tools to make knowledge sharing simple.[188]Thierauf (1999) claims that the value of knowledge is not in its collection per se. It is important not to collect and save every bit of information, but to relate what is known to *what needs to be known* to fulfil the objectives and goals of the organisation.[189]

[182] Harryson, S. (2000).p.161.
[183] Quintas, P. & Lefrere P. & Jones, G (1997), p.387.
[184] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[185] KM Working Group of the Federal chief Information Officers Council, 2001, p.1.
[186] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[187] Quintas, P. & Lefrere P. & Jones, G (1997), p.388.
[188] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[189] Thierauf, R. (1999), p.11.

”*In a world where attention is a major scarce resource, information may be an expensive luxury, for it may turn our attention from what is important to what is unimportant.*”[190]

Technology aspects
Emphasis is now shifting away from the computer-centred view toward the communication potential offered by new technologies. Quintas & Lefere & Geoff (1997), claim, ”For the majority of organisations IT approaches can capture only a fraction of their knowledge and intellectual capital.”[191]

Know-how, Know-why and know-what

In order to simultaneously leverage articulated knowledge beyond the boundaries of the firm and prevent the loss of control of strategically critical knowledge, managers must understand what kinds of knowledge are the sources of the firm’s strategic advantage in product competition.[192] Sanchez (1996) further argues that to achieve the greatest leverage of its knowledge, a firm needs to articulate its useful knowledge in ways that let that knowledge be transferred to wherever it can be applied within the organisation or to any other firm who can use that knowledge on behalf of the firm. [193]

Know-how enables a firm to continue performing its current operations. Know-why enables a firm to adapt a product design or to develop a new product design. Know-what understanding requires understanding of what the firm might do with its available competencies or competencies it conceivably could develop.[194]

In dynamic product markets, a firm’s most critical kind of knowledge is likely to be at the know-what and know-why levels, because the firms ability to identify and adapt flexibility to changing technologies and market opportunities are derived from these kind of knowledge.[195]

1. The first step is to determine the relative importance of the firm’s know-how, know-why and know-what kinds of knowledge in maintaining or creating the firm’s distinctive competencies in creating products. [196]

2. The next step in managing the firm’s knowledge to greatest strategic advantage is to leverage the least strategically critically kinds of knowledge of the firm as broadly as possible, while maintaining close control within the firm of the kind of knowledge that is most critical to the firm’s distinctive competencies. [197]

Form of knowledge	*Level of understanding*	*Capability derived from knowledge.*
Know-how	”Practical understanding of how current products work.”	Enables firms to produce and refine current product designs
Know-why	”Theoretical understanding of why	Enables firms to adapt current

[190] Castells, M. (1989).
[191] Quintas, P. & Lefrere P. & Jones, G. (1997), p.388.
[192] Sanchez, R. (1996), p. 136.
[193] Sanchez, R. (1996), p. 136.
[194] Sanchez, R. (1996), p. 136.
[195] Sanchez, R. (1996), p. 136.
[196] Sanchez, R. (1996), p. 136.
[197] Sanchez, R. (1996), p. 136.

	product designs work."	designs or develop defined new products.
Know-what	"Strategic understanding of purposes to which now how and now why may be applied."	Enables a firm to imagine and define feasible new kinds of products.

The library approach versus the know-who approach

The library approach to knowledge management focuses on the development of structures that stimulate re-use and sharing of knowledge and experiences. [198] Re-use of knowledge generally assumes that the knowledge can be codified. Codification of knowledge implies making tacit knowledge that is held within individuals explicit. Nonaka (1994) has developed one theory that considers the process of transforming knowledge from tacit to explicit. It has been previously discussed in the Problem discussion.

Harryson (2000) claims that companies that gain their competitive advantage primarily by sharing and enhancing tacit knowledge for the creation of new and innovative solutions are more likely to gain their competitive advantage from the know-who based approach. [199] This means that the know-who approach is applicable for a company like SKF Nova. Vast research reveals that companies tend to an increasing extent to depend on the competence and knowledge of the employees.[200] Tacit knowledge often comes packaged most efficiently in the form of individuals.[201] The value of "the Human capital" has a greater impact on the competitive advantage of firms than the value of "the Structural capital".

The know-who approach – aims more at leveraging tacit knowledge within and beyond corporate borders than reusing documented knowledge. Tacit knowledge includes scientific expertise, operational know-how, and insights about an industry, business judgement and technological expertise. [202] The know-who approach is based on connecting the right people into human networks. The findings made by Teece (2000) correspond with the know-who approach; he claims that networks are frequently critical to the knowledge-based firm.[203]

The findings made by the KM Working group (2001) stress the importance of personal relationships to share knowledge and information.[204] People in companies seeking innovation

[198] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[199] Harryson Sigvald, J. (2000).p.248.
[200] Ottosson, S. (1999), p. 30.
[201] Hedlund. (1992).p.10.
[202] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[203] Teece, D. (2000), p.43.
[204] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.

need to share information and knowledge that would get lost in document form. [205] This knowledge is difficult to articulate in writing and it is acquired through personal experience.[206] Studies show that people more frequently than not will contact someone they know before searching the corporate database or data warehouse.[207]

[205] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[206] Hansen, M. & Nohria, N. & Thierney, T. Harvard Business Review, March-April 1999.
[207] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.

3 Method

The research method has been derived from the DELTA Meta Architecture[208] and from the Soft Systems Methodology (SSM).[209] Before the method of the study is presented, a short background to DELTA and SSM will be given.

3.1.1 The DELTA Meta Architecture

The ultimate objective of DELTA is the continuous improvement of the enterprise, through improving the manageability of complex development processes.[210] Each enterprise composes a system that transforms an input to an output. According to DELTA, the ability to improve a system necessitates a holistic understanding of four aspects of the enterprise. These aspects compose the fundamental cornerstones of an organisation. [211] DELTA proceeds from the present state of the organisation and relates that to the desired future state. The holistic perspective advocated by DELTA will be used to give a true representation of the reality of SKF Nova. This means that the stakeholders, development goals, development process and organisational images of SKF Nova will be studied. The problems of the current design of SKF Nova represent opportunities to improve the system.

The DELTA framework supports the choice of specific methods and tools to address the various aspects of the firm, rather than being a method in itself.

The word architecture implies principles to create a harmonic design. [212] The architecture includes relationships between individuals, artefacts and between people and artefacts. [213] The focus of DELTA is illustrated in the figure below.

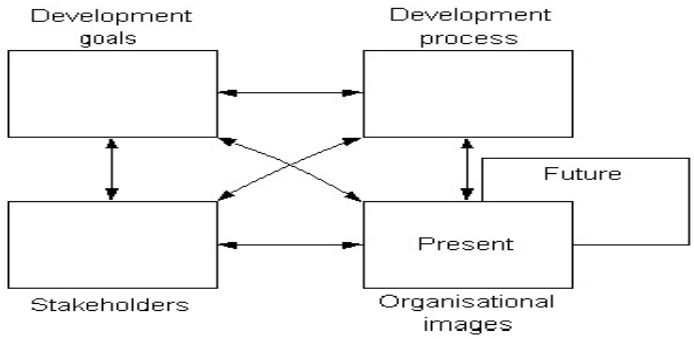


Figure 14 - The holistic perspective taken by DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

3.1.2 Soft Systems Methodology (SSM)

SSM is a process composed by seven activities that was created by Peter Checkland. The stages of SSM can be defined as follows:

[208] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).
[209] Checkland, P. (1981).
[210] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).
[211] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).
[212] Magoulas, T. & Pessi, K. (1998).p.5.
[213] Magoulas, T. & Pessi, K. (1998).p.5.

1. Enter situation considered problematical
2. Express the problem situation
3. Formulate a root definition
4. Build conceptual models of the systems named in the root definition
5. Compare the models with real-world actions
6. Define possible changes that are both desirable and feasible
7. Take action to improve the problem situation[214]

SSM proceeds by inquiry. Learning takes place by initially exploring the perceived opportunities and problems real system. Thereafter system thinking is used to structure the problem domain. System thinking is the intellectual tool to structure information.[215] Modelling is used to create an understanding of the behaviour of the system. The validity of the method is ensured through comparing and adjusting the model with the real-world system. The method is intended to result in a change definition. The last step of the method concerns taking action to improve the functioning of the real world system.

3.1.3 Design of the method

The study has been influenced by the seven activities of SSM. The activities chosen are illustrated in the figure below:

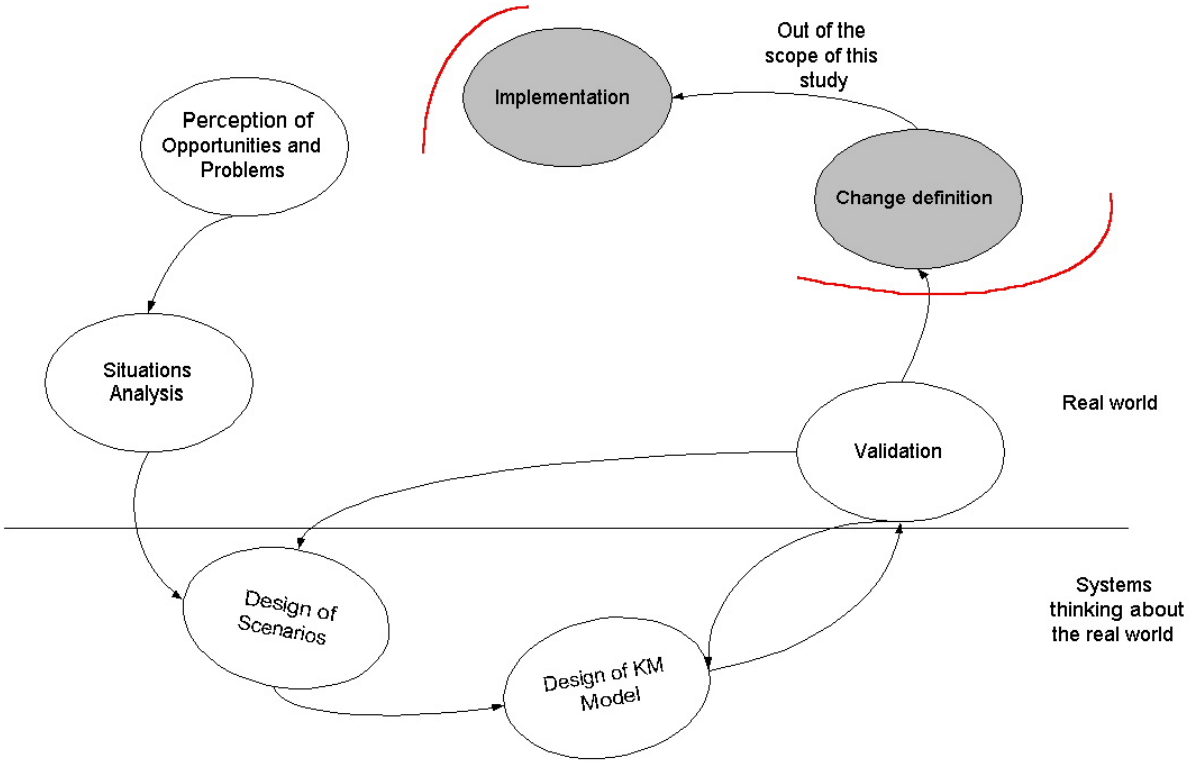


Figure 15 - The activities of the study, (Checkland, 1981).

Perception of opportunities and problems

A perception of the opportunities, problems and critical success factors of SKF Nova was achieved through interviews with four representatives working at SKF Nova. The interviews

[214] Peter, B, Checkland 1981.
[215] Magoulas, T. & Pessi, K. (1998).p.5.

were all taped. In addition five interviews with representatives of three business cases were performed. The business cases all had gone through the innovation process of SKF Nova. Literature studies were performed in parallel with the interviews.

Situations Analysis

One workshop with ten participants was held the 22:nd of October 2001. The participants of the workshop represented the Industrial, the Service, the Automotive division and SKF Nova. The purpose of the workshop was to map the innovation process of the SKF group. A process-modelling tool called RASP was used to perform the mapping. The mapping of the innovation process provided the basis to make the Situations analysis. The structure of the Situations analysis has been inspired by DELTA.

Design of scenarios

During this step, two scenarios representing potential business models of SKF Nova were designed. The Situations analysis combined with the findings of previous research motivated the choice and development of the two potential business scenarios of SKF Nova. Each scenario includes a process and recommendation of appropriate skills required supporting the business model.

Design of Knowledge Management Model

Based on the mapping of the historic system of SKF Nova, the scenarios and extensive literature review, a Knowledge Management model was developed.

Validation

One workshop with nine participants was held the 26:th of November. The original intention was to include the same participants as in the previous workshop. Due to practical difficulties of the participants, three participants were unable to attend the second workshop. Two new participants attended the second workshop.

During the second workshop the two scenarios including their processes and recommended skills were validated. After the second workshop the scenarios were adjusted in accordance to the feedback. The Knowledge Management model was completed and adjusted to comments achieved from two different stakeholders on an interview basis after the workshop.

Change definition

This activity has been excluded from the study. Due to the changed financial situation of SKF Nova, it is no longer relevant to define changes based on historic assumptions. The deliverables instead include a suggestion of two potential new processes and a Knowledge Management model the acquisition of knowledge, internal learning and knowledge application of SKF Nova. This is further explained in the section called Changes in conditions during the study.

Implementation

According to the delimitation of the study, this activity was never intended to be part of the scope of this study.

3.1.4 Critical aspects of the methodological design

A qualitative case study

A qualitative case study approach was chosen to achieve the holistic understanding of the innovation process of SKF Nova and the SKF group recommended by DELTA. A case study does not follow a stereotypical form but relies on the interviewer as a tool or an instrument,

viable to human error and bias. Careful and sensitive interpretation is therefore vital. The method takes into consideration the values, perceptions and the attitudes of the respondents. The major negative aspect of this approach lies in the fact that the personality traits, experience, knowledge, interest and personal opinion of the investigator may influence the investigation and has an impact on the result.

Creation of a shared understanding

The physical report composes only part of the deliverables of the study. The process of moving toward the goal tends to be as valuable as the goal itself. An aim of the workshops has been to create a shared understanding and awareness of the opportunities provided by SKF Nova among the participants.

Complementary methods

SSM is a process model, meaning that it focuses on the characteristics of a certain process, i.e. the physical and information flows involved in the process. DELTA is a substantial model, which implies that it indicates what entities and aspects to consider during the investigation process. The use of a process model and a substantial model has provided complementary support during the modelling of reality.

Changes in conditions during the study

At the initiation of this work, a detailed modelling of the innovation process of the SKF group was made using a process-modelling tool called RASP. The purpose was to identify possible opportunities to improve the exits of SKF Nova. This was relevant considering the historic role of SKF Nova within the SKF group.

The recently introduced market economy of SKF Nova implies a radical change in the relation between SKF Nova and the SKF group. Before the change of financing, SKF Nova was a sub-system of the larger innovation system of the SKF group. From a systems point of view, the system of SKF Nova is currently transforming. This means that the boundaries of the system are changing. The new role within the SKF group is presently being shaped.

Considering the new financial situation, SKF Nova may not benefit as much from solutions based on the historic pre-requisites of SKF Nova. The scope of this study was changed in the middle of the study to focus instead on the potential future opportunities of SKF Nova. The change in scope implied that more effort than what was initially calculated had to be spent on the development of potential future scenarios of SKF Nova. Due to this the step called change definition has been excluded from the study.

4 Empirical data

Two parts compose this chapter, an initial part called Situations analysis and a part called Perception of opportunities and problems. Improvement of the future organisational images of SKF Nova requires an understanding of the stakeholders, the development goals, the development process, the present organisational images and the desired future organisational images of SKF Nova. This will be covered in this chapter.

4.1 Situations analysis

This section is entirely based on empirical information collected during interviews and workshops. Interviews have been made with employees presently working at SKF Nova and with former employees of SKF Nova, representing businesses that have been developed at SKF Nova in the past.

The holistic perspective advocated by DELTA will be used to give a true representation of the reality of the system represented by SKF Nova. The focus of DELTA is on the fundamental cornerstones of an organisation and on the relation between them. [216] DELTA proceeds from the present state of the organisation and relates that to the desired future state. The focus of DELTA is illustrated in the figure below. The stakeholders, development goals, development process and organisational images of SKF Nova will be described next.

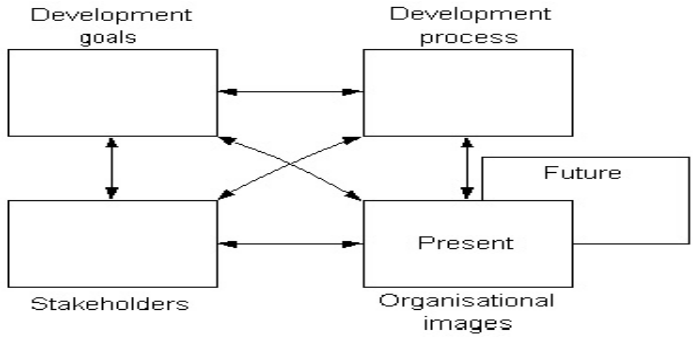


Figure 16 - The holistic perspective taken by DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

4.1.1 Stakeholders

The stakeholders of SKF Nova include the employees of SKF Nova, the divisional customers, some customers represented by external companies and an "innovation network" including representatives of well-known companies and research centres. The stakeholders also include the owners who pay for the activities of SKF Nova. Presently half of the funding of SKF Nova is generated from the SKF group.

[216] Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M. (2001).

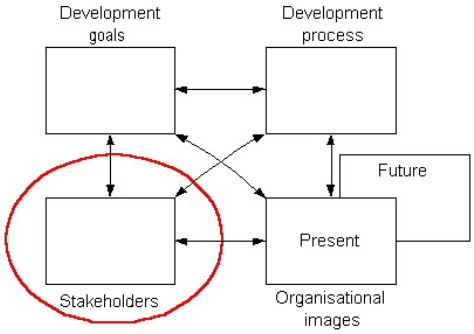


Figure 17 - The stakeholders of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

The actors at SKF Nova
SKF Nova has presently twenty-four employees. The work at SKF Nova is performed as separate projects including approximately two to four people. The project leader of each team is responsible for composing a project team.

The internal customers of SKF Nova
The customers of SKF Nova have traditionally been the divisions of the group. The SKF group has the following divisions: Automotive & Seals, Electrical, Industrial and the Service division. SKF Nova has historically delivered products to the Automotive, Industrial and the Service division.
The division heads make the decision to take the ownership of a project developed by SKF Nova. The employees of the divisions receive the project.

There are two different types of divisions. One type is OEM focused, which means that they sell products that are eventually used as components in the production of other industries. The second type is end-user focused, which means that the products sold are used as spare parts. The Industrial and Electrical Divisions are OEM focused. The Automotive Division serves both OEM and end user markets (vehicle aftermarket). The Service Division is end user focused, selling directly to the users as well as through distributors.

The SKF divisions share a number of key characteristics
While the divisions of the SKF group are clearly very different businesses, they share a number of key characteristics that possibly affect their innovative capacity.[217]

- Low profit margins
- Intense competition
- Increasing customer demands
- Service increasingly a commodity
- Technological discontinuities
- Interdisciplinary efforts needed to develop new technology
- Requirement to:
  - Maintain mainstream business
  - Add value to present business
  - Create radical new business

[217] Workshop 2001-11-26.

Some external customers
Some of the external customers that the employees of SKF Nova co-operate with include Bravikens pappersbruk, Modig and Bosh.[218]

The innovation network
The aim of the network is to discuss and support innovation in large companies. The members include representatives from SCA, Ericsson Business Innovation, Volvo cars, the SKF divisions and Chalmers.[219]

4.1.2 Development goals

The development goals of a company define the immediate goals needed to reach the vision and the business objectives. The vision and business objectives of SKF Nova are determined by the role of SKF Nova within the larger system of the SKF group. The vision of the SKF group is: [220]

"To be recognised as the world leader in bearings, seals and related products. We will achieve this by being the best company in the industry in: providing customer value, developing our employees, and creating shareholder value" [221]

The purpose of the innovation process of the SKF group is:[222]

" To generate profit for the SKF group and the customers of the group and to create new profitable businesses."

The development goals of SKF Nova are currently under transformation, due to the changed financial situation. The adjustment concerns how SKF Nova shall become a divisional resource.

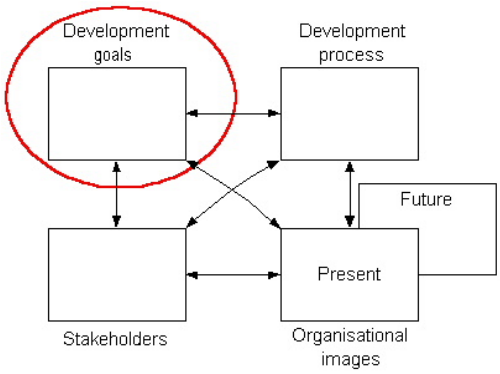


Figure 18 – The development goals of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

Improvement of the exits
One development goal of SKF Nova is to improve the exits. This study was initiated before the role of SKF Nova was changed. Considering the new financial situation, SKF Nova may not benefit as much from solutions entirely based on the historic pre-requisites of SKF Nova. This scope of this study has been changed and business scenarios have been developed to take the potential future role of SKF Nova within the SKF group into consideration.

[218] Interview 2001-12-20.
[219] Interview 2001-12-20.
[220] http://spider.skf.net/SKF/SPIDER/Release1.nsf/html/vision.html
[221] http://spider.skf.net/SKF/SPIDER/Release1.nsf/html/vision.html
[222] Workshop 2001-10-22.

Future expansion of core competencies
The planned future expansion of the core competencies of SKF Nova concern intelligent process monitoring / control and tools for selling knowledge.

Unique image
Another development goal is to clarify the image of SKF Nova. The project to clarify the image of SKF Nova is called ProNova. This study also intends to provide input to and stimulate the creation of new development goals. The vision and business objectives of SKF Nova are presented below.

The business objectives of SKF Nova
The vision of SKF Nova is:

"To be recognised as the leader in technology based new business development in the SKF Group" [223]

SKF Nova's missions are:[224]

- To generate technology based business growth in the SKF Group by taking care of promising ideas and bringing them to projects in a business plan.
- To support the SKF Business Divisions with evaluations of technology based new business opportunities.
- To identify and develop well educated people to become entrepreneurs in SKF.

4.1.3 Development process

The development process is the process of constantly refining the business process of a company. There is no explicitly defined development process of SKF Nova at the moment. The business process has evolved over time as more experiences have been gained. This study outlines a knowledge management model that represents a suggestion of a potential development process of SKF Nova. The business process of SKF Nova will be presented in the next section.

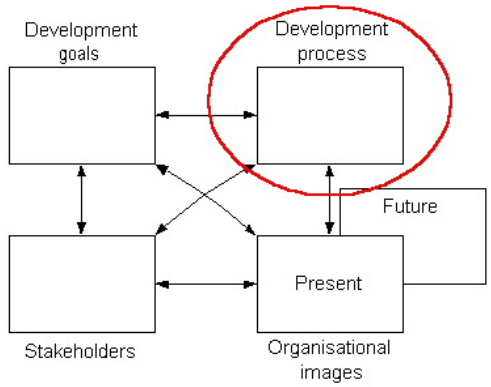


Figure 19 – The development process of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

[223] http://www.nova.skf.com/aboutnova/index.htm
[224] http://www.nova.skf.com/aboutnova/index.htm

4.1.4 Present organisational images

SKF Nova represents a small system that performs innovation within the larger system of the SKF group. The development goals and the development process of SKF Nova are affected by the role that SKF Nova has within the SKF group.

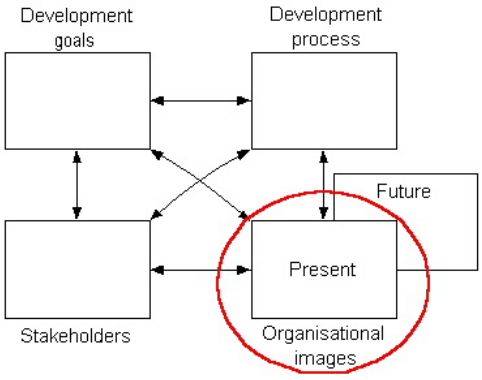


Figure 20 – The present organisational images of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

The role of SKF Nova within the SKF group can be illustrated by the input, transformation process and the output of the system represented by SKF Nova. All systems receive an input from some kind of supplier, transform the input and produce an output. The input, output, suppliers and market of the system represented by SKF Nova are illustrated in the figure below. This figure has been made in co-operation with the respondents.[225]

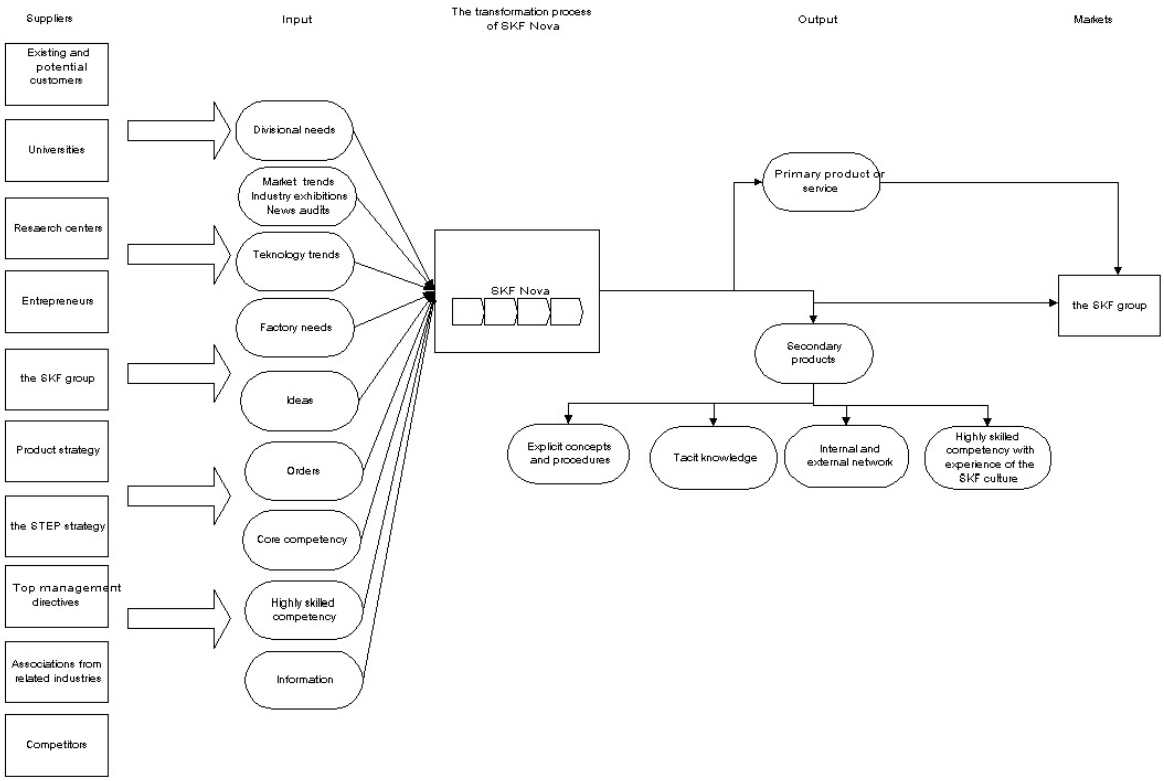


Figure 21 - The suppliers, the input, the output and the markets of the system represented SKF Nova, (Hanna Janzon, 2001).

[225] Workshop 2001-10-22.

Innovation is performed in several places of the group: the divisions, factories and ERC[226] are some examples. To understand the role of SKF Nova within the SKF group, it is important to also understand the general product development process of the SKF group and how the business process of SKF Nova differs from this process. This study reveals that the innovation process of the SKF group should start and end when the salesman visits a customer. [227]The general product development process of the SKF group is defined below.

The general product development process of the SKF Group
The general product development process of the SKF Group is divided into five developmental phases. The phases are in order:

- Idea phase
- Specification phase
- Realisation phase
- Implementation
- Follow-up[228]

Each phase includes specific processes and is intended to generate a predefined outcome. The name of the phases, the activities included and the different milestones can vary somewhat between the different functions of the SKF organisation.[229] The Industrial Division has been using the above process, whereas the innovation process of SKF Nova traditionally has differed from the structure above. The main difference between the innovation process of SKF Nova and the above stated process is that the business process of SKF Nova put greater emphasis on the early development of ideas and projects. The presently used business process and the management of ideas and projects of SKF Nova will be presented next.

The business process of SKF Nova
SKF Nova uses a "stage gate process". In order to evolve from one stage to the next, the projects have to pass a pre-defined milestone, i.e. business gate. A "GO" decision has to be taken by a business committee. The chairman of this committee is the Managing Director of SKF Nova. Depending on the size and scope of the project, representatives from the divisional owners can be part of the business committee

The business process of SKF Nova is divided into three general phases. These phases are in order: Idea phase, Viability Study and Business Development. An exit can take place at the end of each step.

The Idea phase
The Idea Group of SKF Nova performs the Idea phase. This phase is separated from the other phases. The main activities performed during the Idea phase is Idea gathering and Idea screening. The deliverable of this phase is called an Idea Assessment Form. Many of the ideas entering the idea phase do not lead to further studies at SKF Nova. Instead the ideas are passed to one of the SKF Divisions. Idea evaluations are not prioritised activities at SKF Nova since the ideas do not usually have an owner. Before a further study can be initiated at SKF Nova, it is desirable to find an owner among the divisions.

[226] ERC represents the center of advanced research of the SKF group.
[227] Workshop 2001-12-17.
[228] Technical Development Manual of the SKF Group
[229] Interview 2001-11-05.

Viability Study
One idea out of twenty ideas of the Idea phase generates a Viability study at SKF Nova. The Viability study phase includes two major activities: Idea evaluation and Business plan. The Idea evaluation includes an external and internal analysis. The external analysis includes an analysis of the industrial structure, industry and market trends, potential customers and competitors. The internal analysis concerns the aspects of strategic fitness in the SKF Group and potential synergies. The deliverable of the Idea evaluation is a recommendation.

One out of fifty Idea evaluations evolve to the next activity of the viability study phase that concerns the development of a Business plan. It should be noted that this business plan is preliminary. A business plan is a document that should be constantly refined during the entire innovation process.

Business Development
The business development phase includes two main processes: product and market development. The outcome of this phase is always a report. It can be an advantage to make a prototype. A less abstract outcome than a report tends to raise the interest of the potential divisional owners.

The table illustrates the phases, activities and deliverables of the innovation process of SKF Nova.

Phase	*Process*	*Deliverables*
Idea phase	Idea gathering Idea screening	Idea Assessment Form
Viability study	Idea evaluation	Idea recommendation
	Business plan creation	Preliminary business plan
Business development	Product development Market development	Report

Management of ideas and projects at SKF Nova
The different projects of SKF Nova are stored in the PIM database. The project leader is responsible for the registration into PIM. The employees of SKF Nova have access to all projects stored in PIM. The employees of the divisions can read the names of the ongoing projects of SKF Nova.

Project overview
PIM gives an overview of the projects of SKF Nova. The projects are classified into different Portfolios, depending on its topic. A Portfolio represents a key area of SKF Nova. Projects in a certain portfolio can be further classified in Umbrellas.[230] The projects can be listed in different views: by chairman, team members, customer, development process, last update, phase, portfolio, project manager, project type, site, status, team members, technology area and umbrella. The aim is to store all data concerning a project in a "Control document" in PIM that has to be updated on a regular basis. As a project evolves into subsequent phases, the documents produced to satisfy the different milestones should be added.

[230] Secondary information, presented by Per Malmberg.

Division of projects in PIM
The projects of SKF Nova are divided into four different kinds of processes, depending on the characteristics of the projects. The different types are: Customer specific Development Process, General Product Development Process, Knowledge and technology Development Process and Manufacturing Process Development Process.

4.1.5 Future organisational images

In a big corporation like the SKF group different stakeholders tend to different images of the future. There tend to exist many alternative future organisational images. The role of SKF Nova is now changing. At the same time the divisions of the SKF group strive to become more innovative in order to reach the vision the SKF group. The four key drivers to meet the vision of the group are composed by profit, quality, innovation and speed.[231]

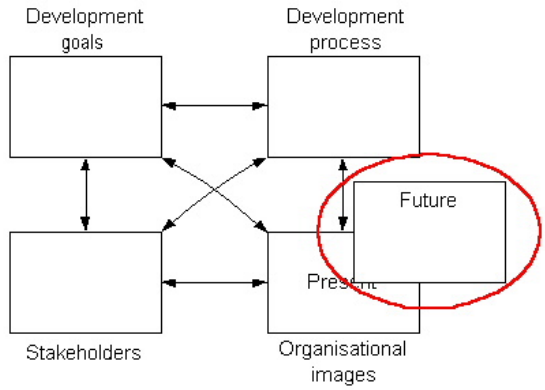


Figure 22 - The future organisational images of DELTA, (Enquist, H. & Magoulas, T. & Bergenstjerna, M. & Holmquist, M., 2001).

The new situation of SKF Nova implies a radical change in the relation to the SKF group. SKF Nova needs to evolve from behaving as a relatively independent business incubator, to offering its services to the SKF divisions. The present challenge of SKF Nova is to become a valuable resource for the SKF divisions. Two statements considering the future role of SKF Nova are presented below.

- SKF Nova provides value through acting as a business driven technology packager.[232] This means that the company shall have the competency to deliver and transfer technology knowledge to the SKF group.
- An important potential future role of SKF Nova is to work closely with the divisions and take part in their innovation processes.[233] This requires an alignment of the innovation process of SKF Nova with the different innovation processes of the SKF divisions. The NMO process of the Industrial Division represents one process that it could be interesting to adjust the process of SKF Nova to.[234] The NMO process is described next.

[231] http://spider.skf.net/SKF/SPIDER/Release1.nsf/html/vision.html
[232] ProNova presentation 2001-11-23.
[233] Lars Höglund, Managing Director of SKF Nova.
[234] Lars Höglund, Managing Director of SKF Nova.

The New Market offer (NMO) Process
The Industrial Division is currently revising the structure of its innovation process in order to clearly define the different project categories, decision bodies, roles and responsibilities, the phases, the solution process and the required outcome of each phase.[235]

The MNO process is intended to develop New Market offers and includes three phases. These phases are in sequence: Idea phase, Specification phase and Realisation phase. The Idea phase include the activities of idea review and idea evaluation, the Specification phase include a pre-study and a definition of the project. The activities included in the Realisation phase are execution, controlling and follow-up.

Objectives of the NMO-process
The objectives are to achieve speed, quality, acceptance and culture. Decision making irrespective of time and place, cross-functional communication, pre-defined checklists and tools and clearly defined roles and responsibilities will ensure speed. Quality will be obtained by matching the expectations of the project managers and decision-makers. Acceptance will be obtained through involving all relevant functions from the start, improved project communication and openness. The cultural aspect is included through the use of a common language in order to create a corporate memory.[236]

Potential roles and responsibilities of SKF Nova in the NMO process
Representatives of SKF Nova and the Industrial Division have identified two potential roles and three potential responsibilities of the future SKF Nova:

Roles
- To assist with specific technology competence and intelligence
- To make available knowledge concerning relevant technological trends

Responsibilities
- To deliver specific technology competence according to agreement
- To deliver competence concerning methods for analysing the potential of new ideas and technologies according to agreement
- To deliver idea evaluations, viability studies and business plans according to agreement

Some critical aspects considering the future role of SKF Nova

- *SKF Nova may benefit from initially being selective considering customer orders and producing a couple of success stories*

  SKF Nova may benefit from initially not taking on too big projects. [237] To obtain credibility it is crucial first to produce a couple of success stories. [238] The most important thing is to deliver what has been stated in the deal. Refusing a project is better than a failure.[239] The ability to select the appropriate orders will influence the success of SKF Nova.

[235] For a detailed description of the NMO process, please refer to the NMO presentation material made by Patrick Delombre.
[236] New Market Offer presentation, by Patrick Delombre, 2001-10-25.
[237] Workshop 2001-11-26.
[238] Workshop 2001-11-26.
[239] Workshop 2001-11-26.

- *It is important to take advantage of the existing resources when expanding the core competencies*
  The eventual expansion into new core competencies and potential external markets should benefit from the existing competency resources that is composed by experiences of growing new businesses, specific edge competency and a valuable network.[240]
- *SKF Nova may benefit from asking the internal customers before offering consultancy services to external companies*

External customers would generate financial benefits and experiences.[241] The SKF brand would probably favourably influence the possibilities to attract external customers.[242] For example concerning logistics the group has made its services available to external customers.[243]

The question is if the value of knowledge services can be leveraged in the same way as logistics services? According to the participants of the workshops SKF Nova should not sell its services to external parties because this could generate the following difficulties: [244]

– Trustworthiness - The perceived risk of leaking valuable know-how to external firms (i.e. competitors) could reduce the motivation of the recipients within the SKF group to use the services of SKF Nova.

– Potentially being forced to sign agreements of exclusive rights to both internal and external customers.

– Ensure professionalism – potentially having to use a specific process to educate the staff in knowledge protection.

– Potentially having to ensure a bulletproof separation of the employees into an internal and an external part.

- *SKF Nova needs to carefully observe the difference between a consultancy firm and a recruitment firm.*

The development of specific edge competencies is very important to SKF Nova.[245] There is a big difference between selling a specific service and selling man-hours. [246] This could potentially serve to avoid that the competence of SKF Nova becomes as a pool of available competence demanded by the divisions when the workload is heavy. [247]

The table below describes some significant characteristics of a consultancy firm and a recruitment firm.

Consultancy offering	Recruitment firm

[240] Interview 2001-11-02.
[241] Interview 2001-11-02.
[242] Workshop 2001-11-26.
[243] Workshop 2001-11-26.
[244] Workshop 2001-11-26.
[245] Workshop 2001-11-26.
[246] Workshop 2001-11-26.
[247] Workshop 2001-11-26.

Specific core competency	No specific core competency
Unique value adding role	Pool of available resources
Advisory role	An alternative to employment during a limited period of time
Fill gaps of competence	

- *SKF Nova may benefit from filling gaps of competence*
  The way to attract the divisions is to offer unique competence, not found elsewhere within the Group.[248] This requires SKF Nova to focus on understanding and satisfying the customer needs.

- *SKF Nova may benefit from internal promotion*
  SKF Nova may benefit from the creation and maintenance of an exhibition case in the SKF headquarters. [249]

Some suggestions of potential future opportunities of SKF Nova
Some suggestions considering interesting areas of potential future expansion of the core competencies of SKF Nova that have been expressed by the divisional representatives will be presented next. [250]

SKF Nova may develop a new model concerning early concept development
To successfully implement radical innovation the Industrial division needs to change the phase of early concept development. The current level of knowledge re-use is high which makes the development process lean. The disadvantage is reduced creativity and motivation to think "outside the box". There is a need for a new model of early concept development that triggers new ways of treating the concept development.

SKF Nova may act as a facilitator of change providing:

- Concepts concerning the implementation of change
- Coaching and support of project management of innovation
- Coaching and support concerning the implementation of change
- Idea workshops
- Capacity to package knowledge that help sustaining long-term competitive advantage

SKF Nova may act as a people finder
SKF Nova would need to:

- Identify companies with similar offerings
- Establish contacts with individuals
- Provide knowledge and contacts to the divisions

SKF Nova may help the divisions to work increasingly value based
Some SKF divisions still determine the price of the products and services "cost plus". SKF Nova would need to:

[248] Workshop 2001-11-26.
[249] Workshop 2001-11-26.
[250] Workshop 2001-11-26.

- Develop concepts concerning the determination of customer value
- Introduce risk taking and a new way of thinking concerning customer value
- Provide help in implementing a value-based way of working

SKF Nova may develop a method of evaluating bearing use
Knowledge concerning how the bearings are run and why they fail represents valuable knowledge for the SKF group. Having that knowledge it is possible to instruct the customers how to use their bearings in a more effective way. This will increase the perceived value of the customer.

SKF Nova may be the most suitable SKF unit for presenting the SKF Group at universities and research institutes
The mix of business, technology and economy composes a stimulating work environment, which will attract new employees.[251]

SKF Nova may develop concepts to continually educate the salesmen to identify opportunities to innovate
Vast research reveals that curious members of the sales force can add valuable information to the innovation process. SKF Nova can help SKF to better take advantage of this opportunity. One means to get there is to develop a program of "Best Industry Innovation Practice" (BIIP) with one part that is tailor made for the salesmen. SKF Nova would need to:

- Develop a training program for the salesmen
- Regularly hold the program
- Provide a certificate to the salesmen that have participated in the program

[251] Interview 2001-11-19.

4.2 Perception of opportunities and problems

This section is entirely based on empirical information collected during interviews and two workshops. Interviews have been made with employees presently working at SKF Nova and with former employees of SKF Nova, representing businesses that have been developed at SKF Nova in the past.
SKF Nova represents a small system within the SKF group. Therefore the transfers of knowledge from SKF Nova to the SKF group are likely to be affected by the general problems of the innovation process of the SKF group. This part of the study is intended to answer the first of the practical problems of the study that is presented below:

What are the opportunities, problems and critical success factors of the current mapping of the innovation process of SKF Nova and the SKF group?

4.2.1 Perceived problems of the innovation process of the SKF group

- There is not enough cross functional communication
- The Sales force members are not always part of the innovation process
- It is difficult to get an owner of the innovation projects at an early stage
- Teams of different parts of the SKF group make development efforts that are very similar or identical without being aware of each other
- The divisions have difficulties to implement new ideas
- There is a lack of competence concerning idea gathering, screening and selection

Based on the above problems of the innovation process, the following opportunities for SKF Nova to improve the innovation process of the SKF group were identified.

4.2.2 Perceived opportunities of the innovation process of the SKF group

- To clearly define the roles and responsibilities of the decisions making process of the innovation process.
- To create a network that includes the members of the sales force in the innovation process.
- To make sure that the innovation process stimulates an early ownership.
- The negative effects of not sharing knowledge among different functions needs to be made explicit and eliminated from the innovation process.
- To reduce costs by avoiding reinvention of the wheel, a co-ordination of the innovation process is required on a global level.
- The innovations of different functions should be connected to the already existing products at an early stage to increase the amount of knowledge reuse
- To be constantly “in traffic” by learning from external firms
- A new Business Information System tailor made to suit the specific requirements of new businesses is needed.
- The innovation process should be complemented with a systematic process aimed at gathering ideas that are based on the end-user needs.

What are the critical factors of the process of transferring knowledge from SKF Nova to the SKF group according to experiences from the past?

4.2.3 Some critical factors to obtain a successful knowledge transfer

Respondents representing businesses historically developed at SKF Nova have identified the critical factors presented below. These factors were perceived to be critical to obtain a successful knowledge transfer. Considering the future role of SKF Nova, these factors may still represent useful experiences to learn from. It is critical to:

- That the employees of SKF Nova and the potential recipients of the SKF group have a shared understanding of the customer need at an early stage
- To produce the sales support material demanded by the salesmen at an early stage
- To produce the appropriate material demanded by the application engineers
- To possess knowledge how to include the new business in the Business Information System of the SKF group
- To ensure the existence of a corresponding agenda in the receiving division. This gives the ability to mobilise the resources required to implement the new business
- To employ a mix of young and more experienced people and with different educational backgrounds to participate in the projects of SKF Nova.

5 Analysis – Systems thinking

Three parts compose the analysis. The first part considers two potential business scenarios by which SKF Nova can add value to the SKF group. The business scenarios represent different potential future organisational images of SKF Nova.
The second part of the analysis considers the knowledge required to be included in an exit.

The last part of the analysis considers how Knowledge Management can be used to improve the exits of SKF Nova. A knowledge management model has been developed. The knowledge management model also represents a potential future organisational image of SKF Nova. The knowledge management model outlines the behaviour required by SKF Nova to manage the knowledge created using the business scenarios.

5.1 Two potential business scenarios

The first part of the analysis is intended to answer the second of the practical problems of the study that is presented below:

How can SKF Nova add value to the SKF group?

Each scenario implies a certain role of SKF Nova. The roles have been chosen to satisfy the need of the SKF group that was perceived by the respondents. Appropriate processes have been developed to support each scenario. To present the business scenarios the following questions have been established:

- What are the opportunities of SKF Nova to add value to the SKF group based on the problems of the innovation process of the SKF group?
- How can SKF Nova add value to the innovation process of the SKF group?
- Which processes are required to support the value adding of SKF Nova?
- Which skills do these processes require?

5.1.1 A possible opportunity for SKF Nova

"It is not the strongest of the species that survives, nor the most intelligent. It is the one most adaptable to change." (Charles Darwin)

To create two potential business scenarios of SKF Nova, the experiences from previous research, the perceived problems, opportunities and critical factors of the innovation process of the SKF group, and the suggested future roles of SKF Nova, have been combined.[252] The characteristics derived from combining the results of the previous research with the empirical findings of this study indicate opportunities for improvement of the innovative capacity of the SKF group.

Some factors critical to the future success of SKF Nova

[252] (Some likely characteristics of the future winners of the innovation industry have been discussed in the problem discussion. The problems, opportunities and critical factors have been presented in the chapter called Perception of problems and opportunities. The potential future roles of SKF Nova have been discussed in the Situations analysis.)

Based on the empirical findings, the following factors are perceived to be very important to the success of the future SKF Nova and motivate the creation of the two different scenarios. Two characteristics are equally important in both of the scenarios:

- The ability to change and be flexible to adapt to the needs of the divisions
- To increase the cross functional dialogue and co-operation

The five factors below represent the basis of the first scenario that is called Brain shopping:

- The ability to anticipate the customer needs
- The ability to fill gaps of competency
- The ability to learn from external firms
- To get an overview of the innovation process of the SKF group
- To "be in traffic" and thereby create knowledge synergies

The last five factors provide the basis of the second scenario that is called In-house innovation.

- To use cross-functional teams. This can potentially ensure that all the relevant stakeholders will be involved in the creation of the new business.
- To use a "stage gate" process to support the teams
- To create a common understanding of the customer need at an early stage and thereby get an early ownership
- To clearly define the roles and responsibilities of each of the functions involved at an early stage.
- To mobilise the resources necessary to build up the internal organisation of the new business (within the SKF group)

Which of the original problems and critical success factors have inspired the scenarios?
Out of the perceived problems of the SKF group, presented below, all but one has been assessed by either Brain shopping or In-house innovation. The first problem below is assessed by both of the scenarios.

The first scenario is called Brain shopping and it primarily assesses the fourth of the problems below. The second scenario that is called In-house innovation assesses all of the problems identified by the respondents, except for the last one.

- ✓ There is not enough cross functional communication
- ✓ The Sales force members are not always part of the innovation process
- ✓ It is difficult to get an owner of the innovation projects at an early stage
- ✓ Teams of different parts of the SKF group make development efforts that are very similar or identical without being aware of each other
- ✓ The divisions have difficulties to implement new ideas
- There is a lack of competence concerning idea gathering, screening and selection

The critical success factors to obtain a successful knowledge transfer that were presented in the chapter called Perception of opportunities and problems are presented below. The second scenario assesses all but two of these.

- ✓ That the employees of SKF Nova and the potential recipients of the SKF group have a shared understanding of the customer need at an early stage
- ✓ To produce the sales support material demanded by the salesmen at an early stage
- ✓ To produce the appropriate material demanded by the application engineers
- • To possess knowledge how to include the new business in the Business Information System of the SKF group
- ✓ To ensure the existence of a corresponding agenda in the receiving division. This gives the ability to mobilise the resources required to implement the new business
- • To employ a mix of young and more experienced people and with different educational backgrounds to participate in the projects of SKF Nova

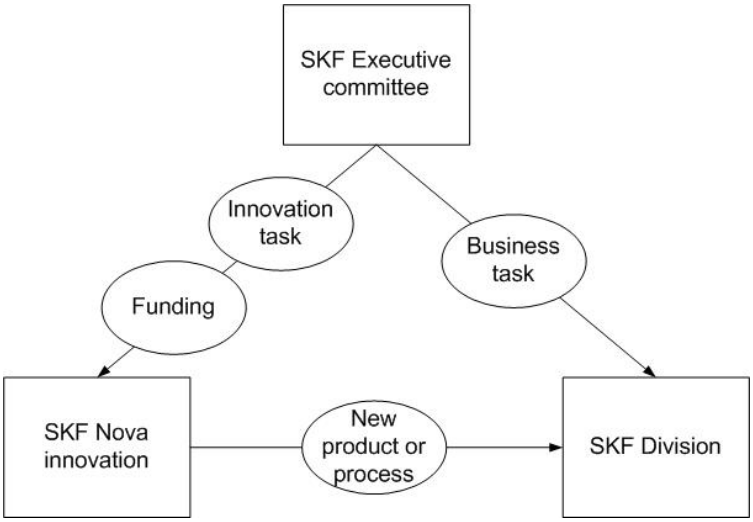
It has been previously mentioned in the chapter called Situations analysis that the present challenge of SKF Nova is to become a valuable resource for the SKF divisions. Two statements considering the future role of SKF Nova has been previously presented:

- Firstly SKF Nova in the future intends to create value through acting as a business driven technology packager.[253] This means that the company shall have the competency to deliver and transfer technology knowledge to the SKF group.
- Secondly that an important potential future role of SKF Nova is to work closely with the divisions and take part in their innovation processes.[254]

The two business scenarios developed below both imply that SKF Nova will work as a business driven technology packer in close co-operation with the divisions.

5.1.2 An overview of the scenarios

The present organisational images of SKF Nova and the role of the company within the SKF group have been discussed in the situations analysis. Before introducing the scenarios a quick overview of the present role of SKF Nova and the potential future roles suggested by the scenarios will be provided. The following three pictures illustrate some main differences between the present role of SKF Nova and the potential future role suggested by the two scenarios.



[253] ProNova presentation 2001-11-23.
[254] Lars Höglund, Managing Director of SKF Nova.

Figure 23 - The historic role of SKF Nova within the SKF group, (Hanna Janzon, 2002).

Before the 26:th of October 2001 SKF Nova obtained financing from the SKF group. SKF Nova delivered products and services to the SKF group.

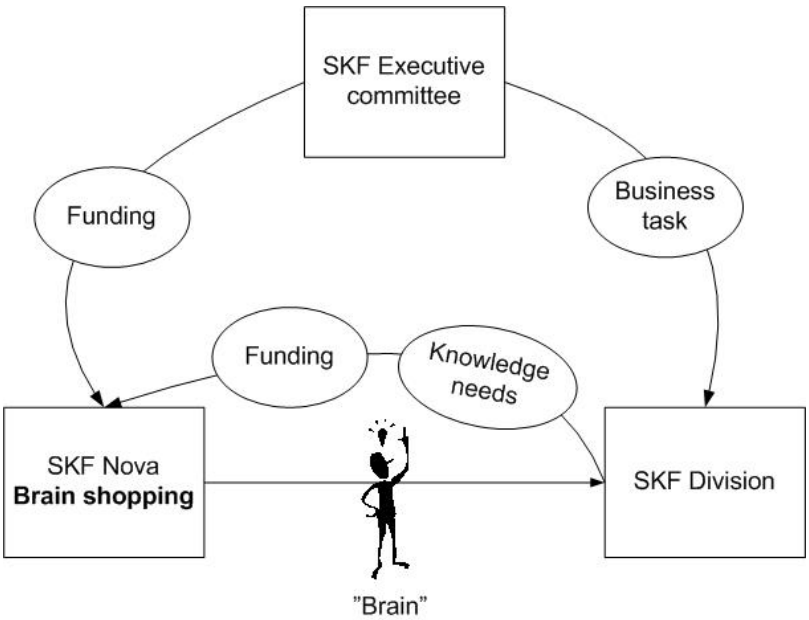


Figure 24 - The new role of SKF Nova suggested by the first business scenario called Brain shopping., (Hanna Janzon, 2002).

Using the first scenario SKF Nova would deliver unique competency to the SKF group and participate in development processes of the divisions. An advantage of this scenario is that the employees of SKF Nova would get an overview of the innovation process of the SKF group, which could potentially reduce the amount of double work within the group.

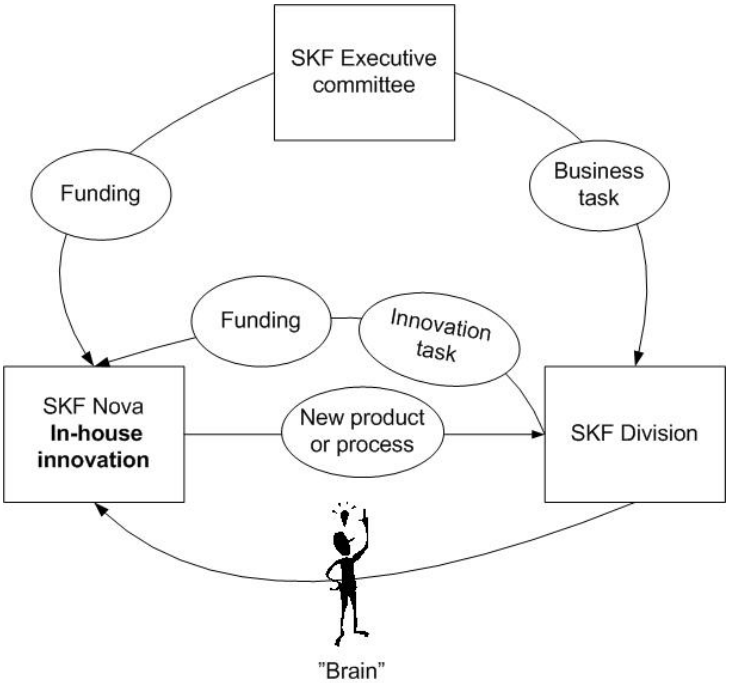


Figure 25 - The new role of SKF Nova suggested by the second business scenario, (Hanna Janzon, 2002).

Using the second scenario SKF Nova would take the responsibility for development of radical innovation projects. The study reveals that cross-functional project teams would be required to successfully transfer the knowledge included in the new product or service to the divisions. The second scenario implies that the potential recipients within the SKF group would participate in the development process of SKF Nova.

5.1.3 Business scenario 1, Brain-shopping

In the business scenario called Brain shopping, SKF Nova acts as a supplier of brains to the divisions. This means that SKF Nova adds value by offering unique competence that works in cross-functional teams with the employees of the divisions. By involving the employees of SKF Nova in the innovation process of the different divisions, an overview of the innovations going on within the SKF group can potentially be obtained. The global understanding of the innovation process can potentially help reducing the amount of double work due to unawareness of the development efforts of different functions of the group.

The customers voice

The business scenario called Brain shopping originates from the following needs expressed by the respondents:

"There is a need for a technology packer that fills the gaps of competency of the divisions by offering complementary competency. The technology packer notices if similar projects are going on in several places within the SKF group and aim at reducing the amount of double work through making the people involved aware of each other. The technology packer is constantly "in traffic", exploring new technology trends in the market place and communicating with external firms. In the long-term, the technology packer will turn into a very important group resource because of its knowledge about most of the ongoing innovation projects within the SKF group. The holistic overview both internally and externally will ensure the creation of knowledge synergies."[255]

Presentation of Brain shopping
The table below presents some characteristics of Brain-shopping.

	Brain shopping
Offering	Leading edge competence in the following areas: Technology intelligence and trends[256] Methods for analysing the potential of new ideas and technologies[257] Competence concerning idea evaluations, viability studies and business plans[258]
Project Owner	Divisional or external
Project responsibility	Divisional or external
Potential	The representatives of the Industrial, the Service and the Automotive division have expressed several different needs that could provide interesting business opportunities for SKF Nova. These have been presented in the Situations analysis. Before taking on external orders, SKF Nova should consider the attitudes of the potential customers within the SKF group.

[255] Workshop 2001-11-26.
[256] These areas have been identified by the Industrial Division and SKF Nova.
[257] These areas have been identified by the Industrial Division and SKF Nova.
[258] These areas have been identified by the Industrial Division and SKF Nova.

Critical success factors of Brain shopping

- The ability to anticipate the customer needs
- The ability to fill gaps of competency by developing edge competency demanded by the divisions
- The ability to learn from external firms
- To get an overview an understanding of the innovation process of the SKF group
- To "be in traffic" and thereby create knowledge synergies
- Internal participation in the development processes of the different divisions

5.1.4 A potential process to support Brain shopping

The figure below illustrates the process graph of Brain-shopping that outline the different activities and the deliverables of each activity.

Figure 26 - The process suggested to support Brain-shopping, (Hanna Janzon 2001).

Activity description

Identification of competence need:

- What competence do the customer presently need?
- What is the expected future need of the customer?

- What is the evolution concerning technology trends in the market place?
- What is the status of the existing competence of SKF Nova?
  An internal identification of the existing competence is appropriate in order to leverage on this competence to the greatest possible extent. A gap analysis considering the difference between the existing competencies and the desired future competencies will highlight the immediate development need.

- Taking the anticipated customer need and the technology trends into consideration, what is the desired future status of the competence of SKF Nova?

- Can we satisfy the need with our existing competence?
- If no: What is the expected cost/ benefit of the desired new competence?
- What is the expected time frame to hire/ educate staff?
- Is an educational effort relevant?
- Is it relevant to acquire additional competence?

Deliverable*:* Directive concerning desired future competence.

Competence acquisition
- Manage relations with divisions
- Manage relations with external network
- If necessary: decision to educate/ acquire new competence
- If necessary: decision to promote the new competence internally/externally

Deliverable: Available competence and/or promotion material

Competence letting
- Make sure that the roles and responsibilities are clearly defined.
- Make a Gantt chart that clearly states the projected length of the involvement in the project
- Package technology according to requirements

Deliverable: Co-operation directive that defines the roles and responsibilities of the different actors and the expected time of the project involvement.

5.1.5 Required skills to perform Brain shopping

"There are three types of companies: those who ask the customer what they want and end up like eternal followers; those who – for some time – manage to force the customers in a direction that they do not want; and those who guide the customers where they want to go before they know themselves where they want to go."[259]

The business scenario of Brain shopping implies that SKF Nova needs to provide edge competency considering new technology to the recipients within the SKF group. What are the skills required to be successful?
- Social competency is a useful ability to quickly access and acquire knowledge about new technology trends composes valuable skills. The more accurately SKF Nova can anticipate the future customer needs the more valuable a resource the company will become to the SKF group.
- The ability to apply the knowledge through cross-functional teamwork is another important "competency" or resource to successfully perform Brain shopping.
- To acquire and apply knowledge it is necessary to develop an informal external network and an internal global cross-functional network.
- Knowledge about the different innovation processes employed by the customers of SKF Nova is useful to understand and successfully participate in the innovation processes of the customers within the SKF group.
- SKF Nova needs edge competency to evaluate the business potential of ideas and the strategic fit of the ideas with the SKF strategy.

5.1.6 Business scenario 2, In-house innovation

In this scenario SKF Nova adds value by developing an idea through one or more stages of an innovation process. An idea can consider maintenance of the mainstream business, adding value to the present business and the creation of radically new businesses of the SKF group. The output from SKF Nova will differ depending on when the knowledge package and the project responsibility is transferred to the division. By reducing the uncertainty of the

[259] Edvardsson, B. & Sandén, M. & Andersson, T. & Waller, B. (2000).p.46.

innovation process while at the same time involving cross-functional teams, the In-house innovation scenario aim at improving the chances of a successful implementation of the new ideas and businesses. The uncertainty is reduced through clearly defining the roles and responsibilities of the different actors in the Project Directive and by adding a two new phases to the innovation process that is called Design of new business and Final knowledge transfer.

The customers voice
The business scenario called In-house innovation originates from the following needs expressed by the respondents:

"There is a need for a technology packer that takes already existing technologies and presents it in new forms or combines different technologies into a new solution. The technology packer does not perform any advanced technical research. The technology packer stimulates the divisions to think in radically new ways and reinvent the wheel. This is done through the successful implementation of technology projects."[260]

The voice of the research
The research presented by this study reveals that the long-term survival of firms to a great extent depends on the ability to successfully perform and implement radical innovations. The exploration of inventive technologies and knowledge appear to require small and organic organisational structures, whereas rapid innovation through effective exploration of that knowledge, in contrast, calls for large and rigid organisations.[261] Through successful management of the knowledge transfer process, effective screening of ideas and the ability to closely co-operate with the recipients of the SKF group, SKF Nova can compose a complementary resource to the group. Out of a long-term perspective, the SKF group may benefit from combining the large and rigid structure with the small and organic structure of SKF Nova to perform both incremental and radical innovation.

Presentation of In-house innovation
The In-house innovation has been derived from combining the empirical findings of this study with previously developed theories and studies of best innovation practice.

The table below presents some characteristics of In-house innovation.

	In-house Innovation
Offering	Leading edge competence concerning the planning and execution of knowledge transfer projects, from idea phase to project implementation.
Project Owner	Divisional or external
Project responsibility	SKF Nova
Potential	Considering the current market situation the potential of this scenario is low at the moment. Before taking on external orders, SKF Nova should consider the attitudes of the potential customers within the SKF group.

Critical success factors of In-house innovation

[260] Workshop 2001-11-26.
[261] Harryson, S. (2000).p.5.

- To use cross-functional teams. An alignment of the innovation process of SKF Nova with the development processes of the customers can potentially ensure that all the relevant stakeholders are involved in the creation of the new business.
- To use a "stage gate" process to support the teams
- To create a common understanding of the customer need at an early stage and thereby get an early ownership
- To clearly define the roles and responsibilities of each of the functions involved at an early stage.
- To ensure the existence of a corresponding agenda in the receiving division. This gives the ability to mobilise the resources required to implement the new business
- To build up the organisation of the new business internally (within the SKF group)

5.1.7 A potential process to support In-house innovation

The figure below illustrates the process graph of In-house innovation that outline the different activities and the deliverables of each activity. It has been previously stated in the Situations analysis that a close co-operation with the divisions may require an alignment of the innovation process of SKF Nova with the different innovation processes of the SKF divisions. To stress the importance of cross-functional co-operation, the process has been aligned with the NMO process of the Industrial division.

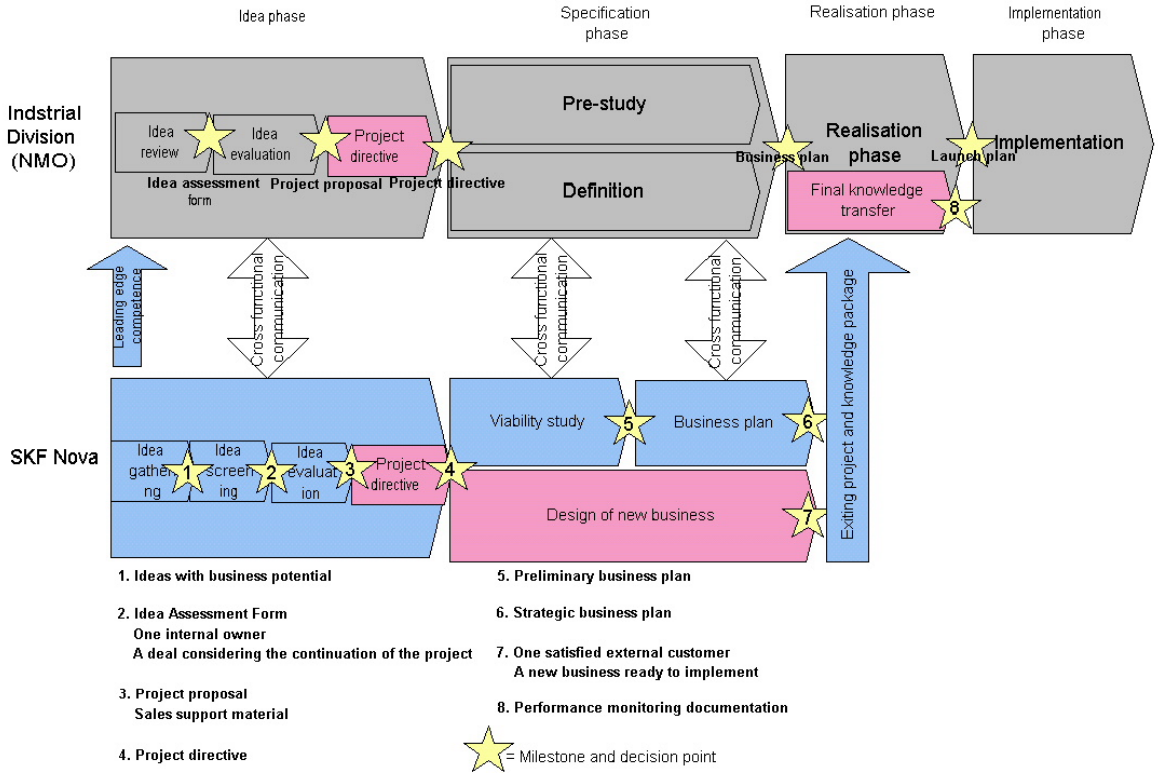


Figure 27 - The process suggested to support In-house innovation, (Hanna Janzon 2001).

The table below clarifies the phases and deliverables of SKF Nova implied by the process to support In-house innovation.

Phase of NMO	SKF Nova phase	Deliverables
Idea phase	Idea gathering Idea screening	Ideas with business potential Idea Assessment Form One internal owner A deal considering the continuation of the project

	Idea evaluation	A project proposal
		Sales support material developed
	Project directive	A project directive
Specification phase	Viability study	A preliminary business plan
	Business plan	Strategic business plan
	Design of new business	One satisfied external customer[262]
		A new business ready to implement
Realisation phase	Final knowledge transfer	Performance monitoring documentation

Critical success factors of the process to support In-house innovation

The role of SKF Nova in the scenario called In-house innovation becomes to define an appropriate process to transfer knowledge from SKF Nova to the division in question. To add value to the division, SKF Nova must ensure that the transfer of the output is successful. The research presented by this study indicates that the most effective way to ensure a successful knowledge transfer is to consider the technological uncertainty of the technology. The greater the technological uncertainty associated with a given technology, the greater the organisational interaction between technology source and recipient that is required for technology transfer success. [263] This means that the relevant activities of the knowledge transfer process depend on the technological uncertainty of the individual innovation project. In summary the following characteristics of an effective innovation process have been previously identified in the Frame of Reference: [264]

- Has a pre-determined structure
- Ensures flexibility in the nature of work within that structure
- Considers the unique characteristics of each idea
  - Maintain mainstream business
  - Add value to present business
  - Create radical new business

- Provides the ability to tailor make the process
- Encourages cross-functional development

This means that the process suggested by this study to support In-house innovation can only serve as a general structure, i.e. a tool box, when tailor making the processes to match the technological uncertainty with the appropriate level of cross-functional co-operation. Ottosson (1999) argues that the use of a highly structured process and checklists risks reducing the creativity of the team members. [265] However a checklist can be a useful means to control that no critical activities have been excluded. [266]

Critical activities of the process to support in-house innovation

The entire innovation process of SKF Nova can be considered a process of transferring knowledge from SKF Nova to the recipients within the SKF group. The actual exit from SKF Nova occurs in different points in time for different projects. The process to support In-house innovation must reduce the risks of failure during the transfer of responsibility between SKF Nova and the divisions.

[262] In the cases where the driver of the idea was”market pull”, there may already exist external customers. Concerning ideas that originate from ”technology push”, the customers have to be actively searched for.
[263] Tatikonda, M. & Stock, G. (2000). p. 720.
[264] Tatikonda, M, V., & Rosentahl, S, R. (2000), p.402.
[265] Ottosson, S. (1999), p. 99.
[266] Ottosson, S. (1999), p. 99.

Some factors perceived to be critical to obtain a successful knowledge transfer have been previously identified in the part of the presentation of the empirical data that is called Perception of opportunities and problems. These activities have historically represented ”weak links of the chain” of the SKF innovation process. The activities identified by the respondents were:

- That the employees of SKF Nova and the potential recipients within the SKF group have a shared understanding of the customer need at an early stage. A common understanding can serve to ensure an early ownership of the project within the SKF group.
- To produce the sales support material demanded by the salesmen at an early stage.
- To produce the appropriate material demanded by the application engineers.
- To ensure the existence of a corresponding agenda in the receiving division. This gives the ability to mobilise the resources required to implement the new business.

Three additional activities have been derived from the results of previous research:
- To clearly define the process, roles and responsibilities of each of the functions involved at an early stage.
- To build up the organisation of the new business internally (within the SKF group).
- To ensure a successful knowledge transfer.

The study reveals that knowledge considering three specific areas is most critical to obtain a successful exit from SKF Nova. A specific activity has been added to the innovation process of SKF Nova to assess each of the critical areas. Returning to the illustration of the process of In-house innovation, three new activities suggested by the study have been made pink. The new activities are called: Project directive, Design of new business and Final knowledge transfer. These phases represent opportunities to improve the original innovation process of SKF Nova indicated by the study. These new activities have been verified and adjusted to the feedback given by the participants of the second workshop. A short presentation of the new activities will be given below. A detailed activity description of these activities can be found in the Appendix. Since the respondents of the study have expressed a strong need for a process that consider the gathering, screening and evaluation of ideas, these activities have been assessed by the study and will accordingly be described in the Appendix.

Project directive
To obtain divisional ownership of the projects it is very important for SKF Nova to be included in the early stages of the innovation process of the divisions. The activity called Project directive serves to identify all the relevant stakeholders of the SKF group and allocate a cross-functional team. Further the Project directive phase serves to identify the appropriate roles, responsibilities and process of transferring knowledge to successfully implement the change in the receiving division. The Industrial Division will use the phase called Project Directive in the New Market Offer Process.[267]

Considering ideas that have been gathered by SKF Nova the Project Directive activity provide an occasion to:
- Ensure the existence of a corresponding agenda in the receiving division. This will give the ability to mobilise the resources required to eventually implement the new business.
- Present the sales support material demanded by the salesmen.
- Present the appropriate material demanded by the application engineers.

[267] Interview 2001-11-09.

An early preparation of the sales support material can potentially increase the credibility of SKF Nova. This can further reduce the uncertainty of the recipients and ensure common expectations on the project outcome.

Design of new business
The activity called Design of new business serves to build up the organisation around the new business within the SKF group. The empirical findings presented in the study reveals that the weakest link of the innovation process concerns the *transfer of knowledge to implement the innovation*. The recommendation made by previous research to improve the success of the knowledge transfer is to include people from different functions. The use of cross-functional teams can ensure the ability to mobilise the resources necessary to implement the new business.

The experiences from historic cases of SKF Nova clearly tell that there exists great opportunities to improve the effectiveness of the knowledge transfer and implementation of the new business. I strongly recommend the use of cross-functional teams that co-operate to build up the new business. The outcome of the activity called Design of new business is a new business entirely prepared for implementation.

Another opportunity for SKF Nova than the Design of new business phase is to improve the transfer process is by using the ITT-typology. The next part of the analysis will consider how SKF Nova can use the ITT-typology to improve the effectiveness of the transfer process.

Final knowledge transfer
To reduce the friction of the knowledge transfer, this study recommends that the final activity of the employees of SKF Nova should occur in the Realisation phase. The most important responsibility of the employees of SKF Nova in the Realisation phase considers the monitoring of the sustained value creation of the new business. The Final knowledge transfer activity is described in more detail in the Appendix.

5.1.8 Required skills to perform In-house innovation
SKF Nova needs the competency to take the responsibility for adding value to an idea through a pre-determined amount of innovation process stages. Two valuable skills, competencies or resources necessary concern:

- The ability to perform both incremental and radical innovation projects.
- The ability to successfully transfer different technology projects to the divisions of the SKF group and potentially in the future to external firms.

Required skills to perform both incremental and radical innovation
The empirical findings of the study indicate that the large and rigid structure of the SKF group is well suited to perform both maintenance of the mainstream business and incremental innovation. The NMO process of the Industrial Division is an example of a highly structured process to support the creation of new market offers. The theoretical findings considering large firms suggest however, that the most successful innovators manage to combine large and rigid structure with flexible and creative structure. The theory suggests that the two structures are mutually exclusive. While creativity and flexibility is required to capture and develop new opportunities, structure is needed to develop, manufacture, market and sell the innovation. The study strongly indicates that the transfer of knowledge between the two parties requires an effective transfer process.

To ensure an effective transfer process to manage both incremental and radical innovation, SKF Nova needs the ability to consider alternative process models and the ability to evaluate and set-up an appropriate process together with the customer. Knowledge about different types of process models is important to SKF Nova. According to Ottoson (1999) the use of a dynamic innovation process places higher requirements on the actors involved in the development process. Competency to evaluate the business potential of the technology and the strategic fit of the technology with the SKF strategy represents a valuable resource.

What motivates the use of different types of innovation processes by SKF Nova?

- Different projects imply different levels of technological uncertainty
- The higher the technological uncertainty, the more organisational interaction is required to achieve a successful project transfer
- Different customers will use different processes
- Different development processes have different purposes
- Different development processes generate different results
- Not "one size fits all"

Required skills to successfully transfer different technology projects
The ITT typology indicates that successful transfer of different technologies may require qualitatively different innovation processes depending on the technological uncertainty associated with the technology to be transferred. [268] (The ITT typology has been described in the Frame of Reference.) A radical innovation implies higher technological uncertainty and thereby requires a higher level of organisational interaction than an incremental innovation. [269] Tatikonda and Stock (2000) claim that there are at least two significant organisational competencies required by the recipient organisation in order to conduct a given transfer type. [270] SKF Nova needs to have both of these competencies:

- The first competency is assessment of the technological uncertainty associated with the technology to be transferred. An inaccurate assessment of the uncertainty associated with the technology to be transferred will result in an improper choice of transfer type. The penalty for the wrong choice is excessive cost (if the uncertainty is judged to be higher than it actually is) or unsuccessful functional implementation (if the uncertainty is judged to be lower than it actually is). [271]

- The second competency is the organisational ability to provide the required level of organisational interaction. If SKF Nova anticipates the need to employ a variety of different process types, then the firm needs to develop skills at each interaction level. Competencies in organisational interaction suggest the need for firms to make appropriate strategic choices. [272] The ability of SKF Nova to make the appropriate strategic choices is supported both by the findings of Tatikonda & Stock (2000) and by the empirical results of this study. According to Tatikonda & Stock (2000), there are potential benefits from

[268] Tatikonda, M. & Stock, G. (2000). p. 720.
[269] Tatikonda, M. & Stock, G. (2000). p. 720.
[270] Tatikonda, M. & Stock, G. (2000). p. 720.
[271] Tatikonda, M. & Stock, G. (2000). p. 720.
[272] Tatikonda, M. & Stock, G. (2000). p. 720.

choosing to transfer the types of technologies that are most compatible with the organisational interaction skills present in the recipient organisation. [273]

5.1.9 Concluding reflections about the scenarios

Two potential means for SKF Nova to add value to the SKF group
The two scenarios presented above represent two different means for SKF Nova to add value to the SKF group. The scenarios have been developed to support the needs related to innovation of the SKF group, perceived by the respondents.

The scenarios out of a long-term and a short-term perspective
The present market situation implies restricted budgets and restricted motivation of the divisions to perform radical innovation. This makes Brain shopping the presently most relevant scenario for SKF Nova. The Brain shopping scenario is an answer to the immediate development needs of the potential customers within the SKF group. It is further an answer to the need of getting closer to the divisions and adjusting to their demands.

The research presented by this study reveals that the long-term survival of firms to a great extent depends on the ability to successfully perform and implement radical innovation. The research further reveals that the exploration of inventive technologies and knowledge appear to require small and organic organisational structures, whereas rapid innovation through effective exploration of that knowledge, in contrast, calls for large and rigid organisations.[274] Through successful management of the knowledge transfer process, effective screening of ideas and the ability to closely co-operate with the recipients of the SKF group, SKF Nova can compose a complementary resource for the group. Out of a long-term perspective, the SKF group may benefit from the use of also the In-house innovation business scenario. The process to support in-house innovation includes the flexibility needed to tailor make the process of knowledge transfer. The business scenario called In-house innovation provides SKF Nova with the pre-requisites necessary to perform both incremental and radical innovation.

I claim that a long-term competitive advantage of SKF Nova must be based on skills that make SKF Nova unique within the SKF group. The empirical findings of the study indicate that the large and rigid structure of the SKF group is well suited to perform both maintenance of the mainstream business and incremental innovation. The NMO process of the Industrial Division is an example of a highly structured process to support the creation of new market offers. Out of a long-term perspective I find the survival of SKF Nova most unrealistic if only using the business model implied by Brain-shopping. The services offered would to a high extent consider incremental innovation, which does not consider a unique capability within the SKF group.

SWOT-analysis considering both scenarios
The table below presents a SWOT analysis that considers SKF Nova using both Brain-shopping and In-house innovation.

SWOT-analysis	
Strengths	An entrepreneurial culture in the sense that the climate is characterised by openness to

[273] Tatikonda, M. & Stock, G. (2000). p. 720.
[274] Harryson, S. (2000).p.5.

	new ideas and creative solutions. A small and organic organisational structure with the speed and flexibility needed for the exploration of inventive technologies and knowledge. Previous experience from working with innovation projects. A well-established external network. Existing experience and leading edge competencies in the areas of idea management and business analysis and planning. The mix of business, technology and economy composes a stimulating work environment, which can increase the motivation of the employees and attract new competence.
Weaknesses	No previous experience of working as a consultancy firm.
Opportunities	To eventually become an important resource of the SKF group with: A base of knowledge and experience considering the different innovation projects of different parts of the SKF group. An extensive external and internal network
Threats	Internal competition Taking on external orders could seriously damage the internal credibility of SKF Nova. Risk of loosing internal trustworthiness if SKF Nova does not observe the difference between a consultancy firm and a recruitment firm.

Some potential benefits of the two business scenarios

- An increasing tie to the divisions over time thanks to the close corporation within cross-functional teams.
- Increasing "internal market share" (within the SKF group) due to improved communication and corporation.
- An increasing ability to understand the technology trends in the market place and the need of the customers within the SKF group.

Both of the scenarios imply transfer of knowledge

Both the scenarios imply knowledge creation. In the Brain-shopping scenario, the employees of SKF Nova participate in the innovation projects of the divisions by contributing with unique knowledge. In the In-house innovation scenario the level of cross-functional co-operation is determined by the technological uncertainty. Both scenarios include knowledge transfers in both directions between the divisions and SKF Nova.

The knowledge transfer implied by Brain-shopping

In the Brain-shopping scenario it is critical to anticipate the needs of the divisions. This requires close communication and co-operation between the parties involved. The Brain-shopping scenario further requires transfer of knowledge from external sources to SKF Nova. This knowledge is eventually to be transferred to the divisions.

The knowledge transfer implied by In-house-innovation

The business scenario called In-house innovation implies that SKF Nova sets up an appropriate process to successfully transfer knowledge to the SKF group. The process to support this scenario is dynamic in the sense that it provides the possibility to take the unique features of each innovation into consideration. The use of a cross-functional team during the knowledge transfer provides one means to improve the transfer. A new activity of the innovation process called "Design of new business" has been suggested. The ITT-typology represents another option for SKF Nova to improve the effectiveness of the transfer process, i.e. exit when using the innovation process that was suggested to support the business scenario that is called In-house innovation. The next part of this chapter considers the knowledge that must be included in an exit to make the knowledge transfer successful.

5.2 A definition of the boundaries and variety of the innovation process

This part of the analysis is intended to answer the third of the practical problems of the study that is presented below:

What knowledge must be included in a successful exit?

An understanding of the different requirements posed by incremental and radical innovations
A shared understanding of the different requirements posed by incremental and radical innovations could potentially ensure common expectations of SKF Nova and the customers within the SKF group considering the knowledge to be included in an exit. The knowledge that must be included in an exit can be considered out of the perspective of incremental innovation and out of the perspective of radical innovation. The knowledge that must be included in an exit varies between the two perspectives. If the exact same innovation process is used to perform all innovations it is possible to clearly specify the exact documents to be produced at each milestone. The theoretical findings presented in this study indicate that considering incremental innovation the most efficient way to innovate is to use one "standardised" innovation process. However the research presented by this study indicates that the most effective way to perform radical innovation is to tailor-make the innovation process depending on the specific characteristics of each individual innovation project.

5.2.1 The knowledge that must be included in a successful exit

The results from the previous research indicate that the more radical innovation, the more flexibility in the innovation process is required. However considering maintenance of mainstream business and incremental innovation it is possible to use a pre-defined and highly structured innovation process. In the first part of the analysis it has been argued that to be a unique resource to the SKF group and to gain a long-term competitive advantage, SKF Nova must posses the ability to perform both radical and incremental innovation.

Incremental innovation requires structure
An exit represents a transfer of knowledge and responsibility from the smaller SKF Nova system to the larger system of the SKF group. Out of a perspective of incremental innovation, the amount of knowledge included in the transfer depends on the stage of the innovation process that the transfer, i.e. exit from SKF Nova takes place. The earlier the exit from SKF Nova, the more work will remain to be done by the divisions. The figure below illustrates the knowledge that is added during the different phases of the innovation process suggested by the business scenario called In-house innovation. The documents required in the different phases of the innovation process is described in detail in the part called Detailed Process description in the Appendix. By clearly defining the output of each development phase, SKF Nova can reduce the uncertainty of the divisions. This study indicates reducing the uncertainty of the divisions considering the implementation of new technologies, as an activity critical to SKF Nova.

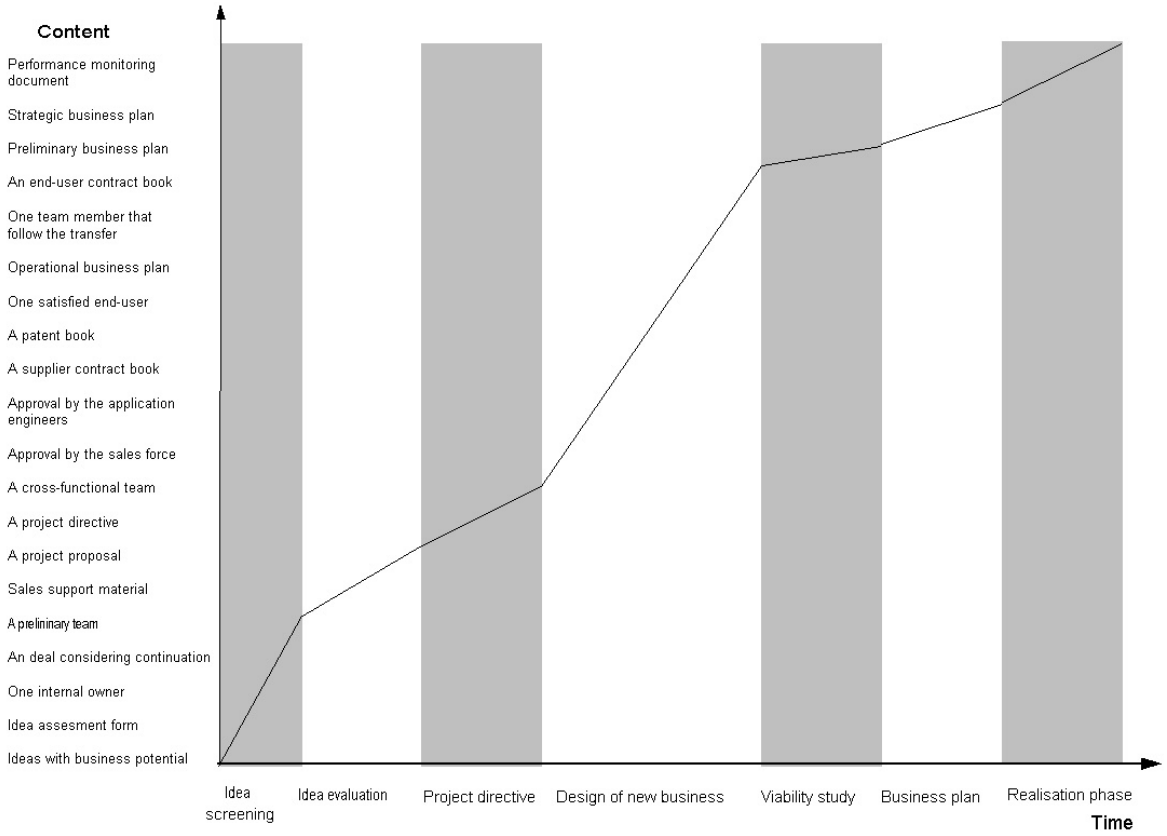


Figure 28 - The knowledge adding of the innovation process, (Hanna Janzon 2001).

Radical innovation requires creativity

The research presented by the study indicates that creativity is essential to successfully perform innovation. Creativity requires the flexibility to consider the unique characteristics of each business idea. To meet the requirements of creativity and flexibility, the innovation process must match the unique circumstances of each innovation project. The more radical the innovation, the more flexibility is required from the innovation process. The conclusion to draw from these insights is that it is neither meaningful, nor possible to make one general standard definition including all the relevant knowledge to make all exits perfect. On the contrary, the key to make each exit successful is to identify and take into consideration the unique circumstances of each knowledge transfer. The findings of the study indicate that one of the most important aspects to consider for each innovation is the uncertainty associated with the technology. The more radical the idea is, the more uncertainty is implied which in turn implies an increased need of close cross-functional co-operation.

The start and end of the innovation process

A shared understanding of the start and end of the innovation process could potentially ensure common expectations of SKF Nova and the customers within the SKF group considering the knowledge to be included in an exit.

The findings of the study reveal that the innovation process of the SKF group should start and end when the salesman visits a customer. [275] This indicates that the innovation process of the SKF group is entirely driven by market pull. According to the results of the previously discussed findings of Ottosson (1990), radical innovation originates from technology push while meeting explicit customer requirements lead to incremental innovation. Ottosson (1990)

[275] Workshop 2001-12-17.

suggests that to perform also radical innovation, studies performed in the user's environment provide one means to combine market pull and technology push.

At this moment the sales force of the SKF group is not always part of the innovation process. [276] The use of a cross-functional innovation process could eventually involve the members of the sales force in the innovation process. A cross-functional innovation process will imply increasing inter organisational co-operation. The more co-operations, the greater is the need of an effective handling of knowledge and information.

A long term perspective
The long-term survival of firms to a great extent depends on the ability to successfully perform and implement radical innovations. The large and rigid structure of the SKF group is well suited to perform both maintenance of the mainstream business and incremental innovation. The NMO process created by the Industrial Division is an example of a highly structured process to support the creation of new market offers. The literature suggests that to perform radical innovation a combination of the large and rigid structure and an organic and creative structure is required. The transfer of knowledge between the two structures requires an effective transfer process. Through successful management of the knowledge transfer process SKF Nova can compose a complementary resource to the group to perform both incremental and radical innovation. A strategy to successfully manage the combination of the two structures must support the transfer of knowledge between SKF Nova and the regular operations of the SKF group. The Knowledge Management model suggested by this study represents such a strategy.

The ability to closely co-operate with the recipients of the SKF group is important to ensure a successful knowledge transfer.
The next section will consider how SKF Nova by assessing the technological uncertainty of each individual innovation project can find the appropriate level of cross-functional co-operation during the activity called Design of new business.

5.2.2 Improvement of the transfer process

The ITT typology described in the Frame of Reference, aims at improving the effectiveness of the technology transfer. [277] The ITT typology aims at improving the effectiveness of the individual transfer project instead of trying to improve the effectiveness of the entire innovation process. Tatikonda & Stock (2000) mean that there are strong arguments to use different innovation processes for different types of innovations:

- Each transfer project has a unique set of objectives because the specific functional, cost and time objectives vary across transfer projects.
- The relative importance of achieving the functional objective, cost or timeliness will also vary across transfer projects. For example, a firm in one transfer instance may prioritise speediness of the transfer and so de-emphasise the importance of cost containment.
- The technological uncertainty varies considering different technologies.
- The general proposition of the ITT typology is that the greater the technological uncertainty associated with a given technology, the greater the organisational interaction between technology source and recipient that is required for technology transfer success.

[276] Workshop 2001-12-17.
[277] Tatikonda, M. & Stock, G. (2000). p. 720.

Using the ITT typology to select an appropriate transfer process

The ITT typology identifies along the diagonal the best choice of technology transfer process type by matching the technology uncertainty of the technology to be transferred and the organisational interaction between the technology source and recipient. [278] There are four transfer process types (arrayed along the diagonal): arms-length purchase, facilitated purchase, collaborative hand-off, and co-development. [279] Each transfer process type represents the best match, or fit, between technology uncertainty and organisational interaction. [280]

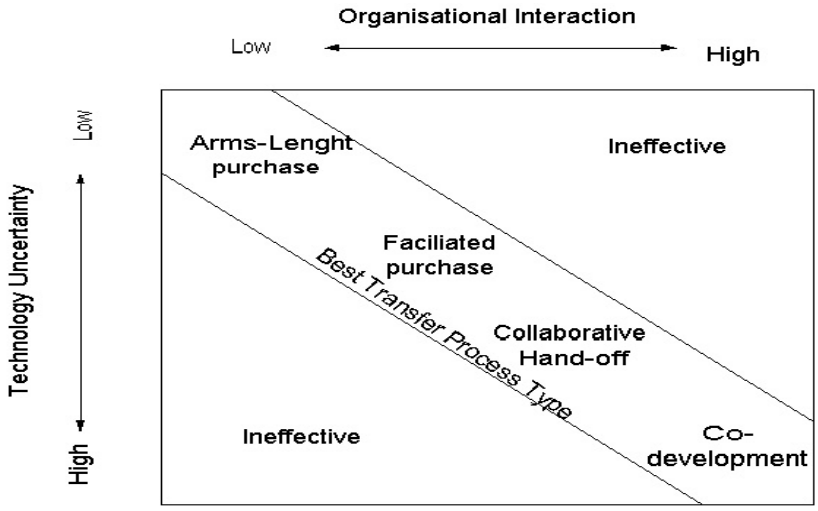


Figure 29 - The different types of technology transfer processes proposed by the Inward Technology Transfer Typology, (Tatikonda & Stock 2000).

Two occasions where SKF Nova can use the ITT-typology

- *SKF Nova can use the ITT-typology to select an appropriate transfer process*
  By assessing the technological uncertainty of each individual project, the aim of the ITT-typology is to find the best match, or fit, between technology uncertainty and organisational interaction. [281] The novelty, tacitness and the complexity of the technology determine the technology uncertainty. This has been described in more detail in the Frame of Reference. The general proposition of the ITT typology is that the greater the technological uncertainty associated with a given technology, the greater the organisational interaction between technology source and recipient that is required for technology transfer success. [282]

- *SKF Nova can use the ITT-typology to evaluate whether it is possible to mobilise the resources required to build up the new business within the SKF group*
  The theoretical findings suggest that the weakest link of the innovation concern the implementation of the new business. The activity called Design of new business have been added to the innovation process in order to bring about a cross-functional team that with unified forces have the ability to mobilise the resources to build up the new business

[278] Tatikonda, M. & Stock, G. (2000). p. 720.
[279] Tatikonda, M. & Stock, G. (2000). p. 720.
[280] Tatikonda, M. & Stock, G. (2000). p. 720.
[281] Tatikonda, M. & Stock, G. (2000). p. 720.
[282] Tatikonda, M. & Stock, G. (2000). p. 720.

within the SKF organisation. According to the previous experiences of SKF Nova, there have been cases when the teams from SKF Nova have been trying to make this race alone. This has been extremely though for the team members and it has caused tension and frustration among the actors involved. In the future the ITT-typology provides one means for the employees of SKF Nova to evaluate the possibility to obtain the required level of cross-functional co-operation at a very early stage. If some of the important actors are not willing to participate to the extent that is required, considering the technological uncertainty of the project, I strongly recommend that SKF Nova should close the project.

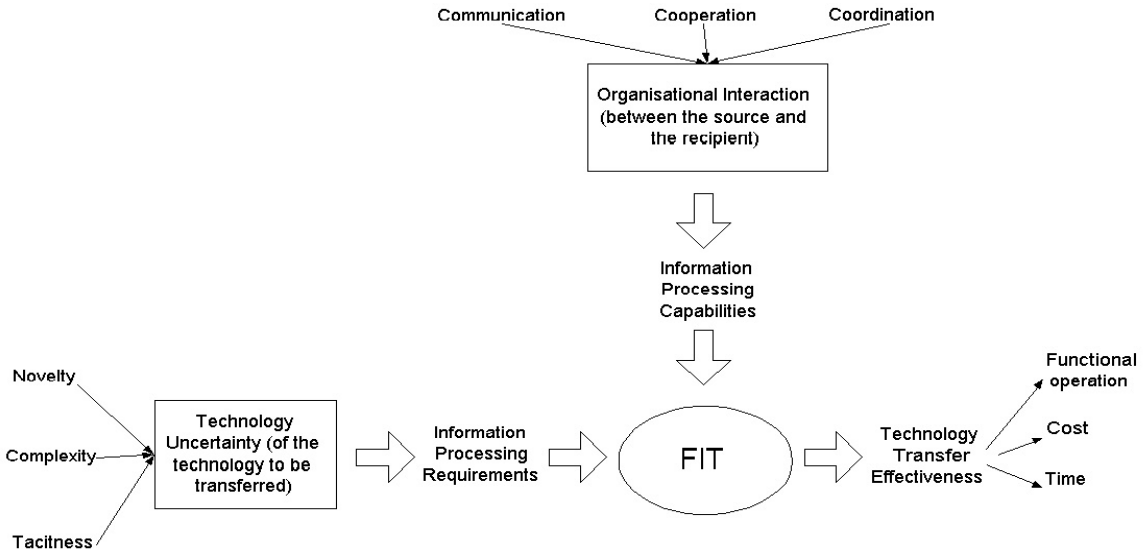


Figure 30 -The technology uncertainty and the organisational interaction determine the effectiveness of the technology transfer, (Tatikonda & Stock 2000).

The start and end of the transfer process according to the ITT typology

Tatikonda & Stock (2000) define the starting point of the *technology transfer process* to be the point in time immediately after the recipient's decision to acquire a given technology. The technology transfer process ends by the actual utilisation of the technology by the recipient organisation. [283]

Tatikonda & Stock (2000) mean that the transfer process involves the actual *implementation* of the technology in a production process or its incorporation into a new product. The technology transfer process consists of the inter organisational activities employed to achieve both movement of technology across the organisational boundary from the source to the recipient and its utilisation by the recipient to achieve some specified functional objectives.

Motives to use the ITT-typology

- Effective acquisition and utilisation of new technology from an outside or source can contribute greatly to the operational success of a firm.
- Acquiring and assimilating new product and process technologies is often quite difficult. [284] It can lead to substantial delays and cost over-runs. [285]
- Technology transfer into the firm is a challenging and often recurring operational problem. [286]

[283] Tatikonda, M. & Stock, G. (2000). p. 720.
[284] Tatikonda, M. & Stock, G. (2000). p. 720.
[285] Tatikonda, M. & Stock, G. (2000). p. 720.

- There is a need for more interfaces with external organisations to source technologies as fewer product and process technologies are developed or produced internally. [287] Supply chain management philosophies suggest that some firms need practical skills in technology transfer if they wish to routinely achieve functionally effective, low-cost, time-efficient transfers. [288]

For these reasons, in many firms technology transfer is no longer an occasional activity, which can be managed in an ad-hoc fashion: rather, it is a recurring process, which requires purposeful management supported by a well-developed portfolio of organisational skills. [289]

SKF Nova can potentially benefit from using the ITT typology
SKF Nova has historically performed projects that have involved a high degree of technological uncertainty. There exist vast empirical and theoretical evidence revealing that the most critical link of the innovation process concerns the project transfer. The different project transfer processes proposed by Tatikonda & Stock (2000) concern the implementation of change. Since one of the problems of the SKF divisions concern the implementation of change and the ITT typology serves to reduce the uncertainty implied in the transfer of new technology, SKF Nova can potentially benefit from using the ITT typology.

A potential transfer process of SKF Nova
Assuming that SKF Nova in the future will use the Knowledge Management model proposed by this study, the role of SKF Nova becomes to transfer knowledge concerning new technologies into the divisions. (The Knowledge Management model will be introduced in the next chapter). Tatikonda & Stock (2000) define the effectiveness of the technology transfer process to be "*the degree to which the utilisation of the transferred technology fulfils the recipient firm's intended functional objectives within cost and time targets.*"

This means that the project transfer process of SKF Nova could potentially involve the actual *implementation* of the technology in a production process or its incorporation into a new product. The knowledge and technology transfer process of SKF Nova could potentially consist of both the a) *movement of technology* across the organisational boundary from the source to the recipient and b) its *utilisation* by the recipient to achieve some specified functional objectives.

The process of moving technology from SKF Nova to the recipients of the SKF group corresponds to the functioning of the traditional innovation process with the product exit. To include also the utilisation of the technology, the transfer process must also ensure that there exits a process of building up the new business within the SKF organisation that goes on in parallel with the traditional product innovation. This means that the ITT typology supports including the new phases called "Project directive" and "New business creation" in the process to support the business scenario called In-house innovation. The Project directive enables the identification of all the relevant stakeholders of the SKF group and the allocation of a cross-functional team. Further the Project directive phase serves to identify the appropriate roles, responsibilities and process of transferring knowledge to successfully implement the change in the receiving division. By involving all the relevant stakeholders, the

[286] Tatikonda, M. & Stock, G. (2000). p. 720.
[287] Tatikonda, M. & Stock, G. (2000). p. 720.
[288] Tatikonda, M. & Stock, G. (2000). p. 720.
[289] Tatikonda, M. & Stock, G. (2000). p. 720.

ability to mobilise the resources necessary to build up the new business within the SKF group can potentially be ensured.

5.2.3 Concluding reflections about the exits from SKF Nova

The knowledge that has to be included in a successful exit
Out of a perspective of incremental innovation it is possible to claim that the knowledge that must be included in an exit from SKF Nova depends on the phase in which the exit takes place. However out of a perspective of radical innovation it is neither meaningful, nor possible to make one general standard definition including all the relevant knowledge to make all exits perfect. On the contrary, the key to make each exit successful is to identify and take into consideration the unique circumstances of each knowledge transfer. The findings of the study indicate that one of the most important aspects to consider for each innovation is the uncertainty associated with the technology. The more radical the idea is, the more uncertainty is implied which in turn implies an increased need of close cross-functional co-operation.
The ITT-typology represents one way for SKF Nova to improve the effectiveness of the exits when using the innovation process suggested by the business scenario that is called In-house innovation.
The conclusion to draw from this is that the exits from SKF Nova can be improved by considering the degree of radicalness of the innovation and adjusting the innovation process accordingly.

Improving the exits by creating a shared activity
The findings of previous research suggest that both the structure of large organisations and the flexibility and creativity of a small organisation are essential to succeed with innovation. The empirical findings of the study indicate that the divisions of the SKF group have difficult to implement change, i.e. new ideas. The theoretical findings indicate that the implementation phase is the weakest link of the innovation process. Instead of exiting the arena before or during the implementation, this study suggests that the more radical the idea is, the more co-operation is required to successfully implement the new business. The conclusion to draw from this is that the exits from SKF Nova can be improved by creating a common activity of the innovation process where all the actors can meet. The phase called Design of new business provides such an activity.

Improving the exits by reducing the uncertainty through using the ITT-typology
Innovation is about change. The more change that is envisioned, the more uncertainty will be involved in the innovation process. Large corporations benefit from high levels of standardisation in its regular operation. The research reveals that it is often difficult to combine the structure needed by the regular operation with the flexibility required to manage innovation.
The ITT-typology suggests that companies need to set-up an appropriate transfer process depending on the technological uncertainty associated with the new technology. The general proposition of the ITT-typology is that the greater the technological uncertainty associated with a given technology, the greater the organisational interaction between technology source and recipient that is required for technology transfer success. According to the ITT-typology the knowledge transfer has not been successful until the new technology is used by the receiving organisation. This study reveals that the divisions of the SKF group have difficulties to implement new ideas. The-ITT typology provides a means for SKF Nova to foresee the difficulty that can be expected to implement each specific innovation project. The more change implied by the new technology, the more radical the innovation, the more difficult the

implementation of the technology can be expected to be. The more complicated the implementation is expected to be; the more cross-functional corporation is required during the entire transfer process. This means that the knowledge and technology transfer process of SKF Nova could potentially consist of both the a) *movement of technology* across the organisational boundary from the source to the recipient and b) its *utilisation* by the recipient to achieve some specified functional objectives. The success of the exit is not ensured until the new knowledge is actually implemented and utilised according to the original objectives stated at the initialisation of the innovation project.
There are specifically three situations where the SKF Group could potentially benefit from using the ITT typology in the future:

- Transfers of knowledge and technology from external networks into SKF Nova
- Transfers of knowledge and technology from SKF Nova to the divisions
- Transfers of knowledge and technology from the divisions through external customers

5.3 The Right competence at the right time – A knowledge management model

Strategic KM emphasises the long-term work of creating and sustaining an information environment based on KM. Teece (2000), argues that knowing how to select, interpret, and integrate information into a usable body of knowledge is a far more valuable individual and organisational skill than simply being able to give the answer to a discrete question or a series of questions.[290]

Why do firms manage knowledge? There are many arguments, one of the more fundamental is that the sustainable competitive advantage of business firms flows from the creation, ownership, protection and use of difficult to imitate commercial and industrial knowledge assets.[291]

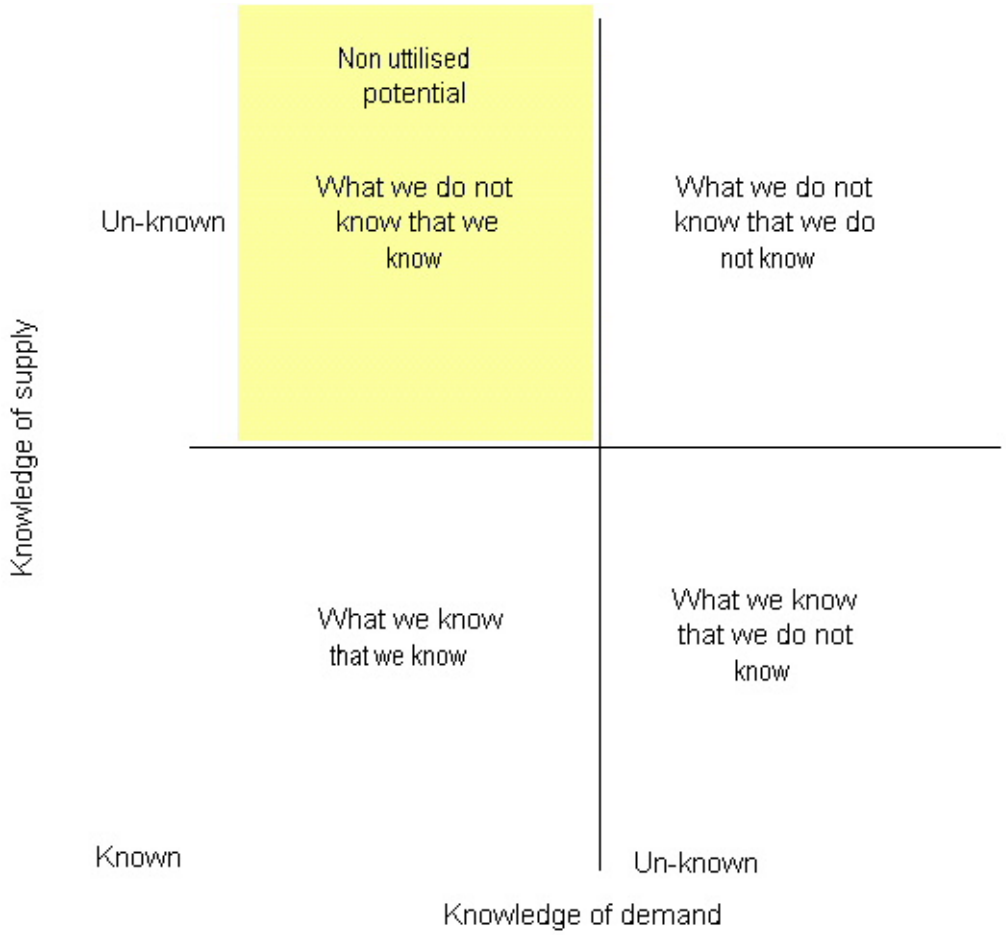


Figure 31 – The Johari window, (Luft 1969).[292]

An interesting scope of KM is the knowledge that exists within a firm without anyone's notice. Knowledge Management addresses the non-utilised knowledge potential of firms. This knowledge can be used to improve the current and future functioning of the business. It is

[290] Teece, D, J. (2000), p.40.
[291] Teece, D, J. (2000), p.35.
[292] Luft,, J. (1969). "Of Human Interaction," Palo Alto, CA:National Press, 177 pages.

relevant to relate what is known and not known to *what needs to be known* to fulfil the objectives and goals of the firm. The value of knowledge is not in its collection per se. [293]

5.3.1 Introduction to the model

The Knowledge Management model is intended to support the individuals of SKF Nova in their daily work, thereby improving the chances of successful exits. A detailed analysis has been performed to identify the relevant knowledge to manage at SKF Nova. This chapter is intended to answer the last of the practical problems of the study that is presented below:

How can SKF Nova use Knowledge Management to improve the transfer of knowledge throughout the innovation process to increase the number of successful exits?

5.3.2 Analysis of the Knowledge Management needs

Describe the system

System thinking is the intellectual tool to structure information.[294] A systems engineer views the real world as a system. In Greek the meaning of the word system is ”to be and act together”.[295] All systems can be modelled. Since different people have different perceptions of the same reality, it is essential that the model builder describe his perception of the system. All aspects of the system that could be relevant for the purpose of the modelling should be included.

SKF Nova represents a system. The innovation process of the SKF group can be viewed a system as well. Before the change of financing, SKF Nova was a sub-system of the larger innovation system of the SKF group. From a systems point of view, the system of SKF Nova is currently transforming. This means that the boundaries of the system are changing. The new role within the SKF group is presently being developed.

To improve the functioning of a system the boundaries of it initially have to be determined. Thereafter a detailed mapping of the functioning of the system is required. This includes an investigation of the input, the output and the internal transformation processes of the system. An effective Information system (IS) must reflect the real world system. Improvement of the information environment implies change, and no type of change is socially neutral or ad hoc. [296] Organisations and information systems are mutually independent. Consequently, any changes in the enterprise presuppose corresponding changes in its information systems. Any change in information systems presupposes corresponding changes in the enterprise, its processes and the behaviour of its personnel.[297]

To give a true representation of the reality of the system a Meta perspective is initially required. [298] When the general picture is clear, the system can be further abstracted into sub-systems. At the initiation of this work, a detailed modelling of the innovation process of the SKF group was made. The purpose was to identify possible opportunities to improve the exits of SKF Nova. This was relevant considering the old situation of SKF Nova. SKF Nova was then a part of the larger system represented by the innovation process of the SKF group.

[293] Thierauf, R, J.(1999), p.5.
[294] Magoulas, T. & Pessi, K. (1998).p.5.
[295] Magoulas, T. & Pessi, K. (1998).p.5.
[296] Magoulas, T. & Pessi, K. (1998).p.5.
[297] Enquist, H, Magoulas, T, Bergenstjerna, M, Holmquist, M. (2001).
[298] Enquist, H, Magoulas, T, Bergenstjerna, M, Holmquist, M. (2001).

To take also the potential new situation of SKF Nova into consideration, the scope of this work was changed. Two scenarios, appropriate processes and the skills required to support the scenarios has been outlined with the purpose of giving a detailed description of the potential future system of SKF Nova.

The Knowledge Management model of SKF Nova needs to support the future functioning of SKF Nova. The scenarios include processes to solve or reduce the previously identified problems of the innovation process of the SKF group. By supporting the scenarios, the Knowledge Management model will help reduce the negative impact of the problems on the exits of SKF Nova.

5.3.3 Identification of problems and their relations

Based on the modelling of the innovation process of the SKF group it is possible to identify adequate problems of the system. The problems represent opportunities to improve the system. Which problems the modeller chooses to model from his observation will depend on his or her previous experience, personal qualities and background. By making a graph that illustrates how the problems are related to each other it is possible to identify causality. From that it is possible to trace which problems are initial and which are terminal. The terminal problems have a heavy impact on the system.[299] By solving the problems that are higher up in the hierarchy the terminal problems may also be solved. The problem graph starts at the top with initial problems looking for followers until it ends at the bottom with the terminal problems.

Even if SKF Nova from a systems perspective is a system currently changing, the context within which it exists is still the same. This means that the problems identified by the respondents of the study cannot be expected to disappear only due to the change of financing. The potential Knowledge Management model of SKF Nova needs to assess the following problems that has previously been presented in the chapter called Perception of problems and opportunities:

- There is not enough cross functional communication
- The Sales force members are not always part of the innovation process
- It is difficult to get an owner of the innovation projects at an early stage
- Teams of different parts of the SKF group make development efforts that are very similar or identical without being aware of each other
- The divisions have difficulties to implement new ideas

The graph below illustrates one possible interpretation considering how these problems are related to each other. All the problems in the graph represent factors that affect the innovation process of SKF Nova.

[299] Lind, B. (1997), p.136.

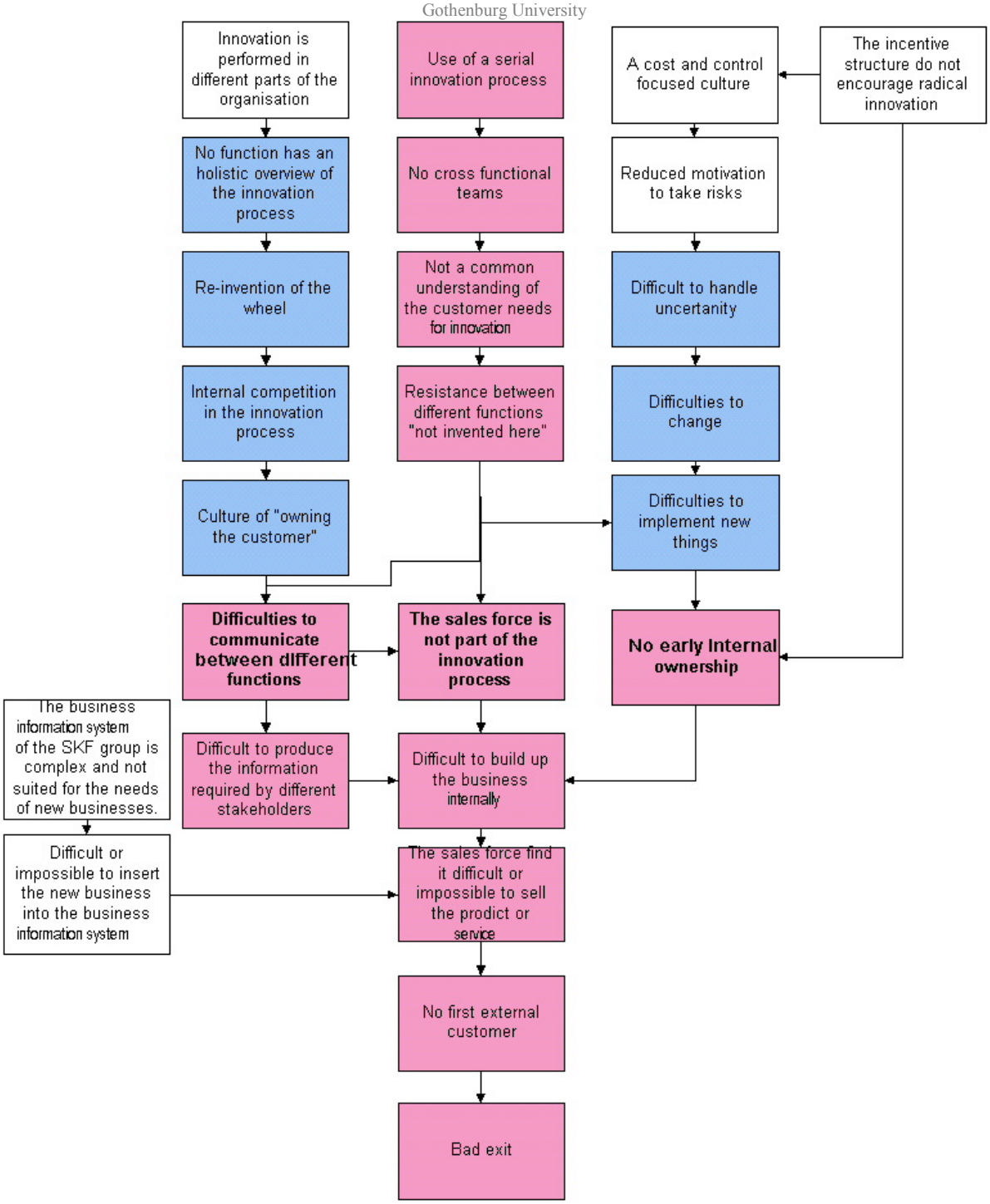


Figure 32 - Analysis of the causal relationships of the perceived problems of the innovation process of the SKF group, (Hanna Janzon 2001).

This study indicates three main problems. Starting from the left of the problem graph, the main problems identified by the respondents are:

- Teams of different parts of the SKF group make development efforts that are very similar or identical without being aware of each other[300]
- There is not enough cross functional communication[301]

[300] Workshop 2001-11-26.
[301] Workshop 2001-11-26.

- The divisions have difficulties to implement new ideas[302]

According to the problem graph the statement that the Sales force members are not always part of the innovation process and that the divisions have difficulties to implement new ideas are merely symptoms. This means that these problems are caused by the three main problems and that solving the three main problems can solve them.

The scenario called Brain shopping represents an attempt to solve the first of the three problems above. By involving the employees of SKF Nova in the innovation process of the different divisions, an overview of the innovations going on within the group would be obtained. This knowledge could potentially help to reduce the amount of double work due to unawareness of the development efforts of different functions of the group.

The scenario called In-house innovation, previously accounted for, addresses the two latter problems above. By reducing the uncertainty of the innovation process while at the same time involving cross-functional teams, the In-house innovation scenario aim at improving the chances of a successful implementation of new ideas. The uncertainty is reduced through clearly defining the roles and responsibilities of the different actors in the Project Directive and by adding a new phase to the innovation process that is called Design of the new business.

The knowledge management model to be developed will assess all of the three problems by supporting the two business scenarios.

5.3.4 Potential improvements through Knowledge Management

Using the problem graph above as a starting point it is relevant to identify the problems that could potentially be solved or improved by improving the supply of knowledge and information. In this context the information environment refer to the part of the environment that affects and can be supported by the use of KM. The boundaries of an information environment do not have to be equal to the boundaries of the organisation.[303] Identifiable parts called information domaines compose an information environment.[304] The informational domains within the relevant information environment can belong to one or several organisations.

The white rectangles of the problem graph represent problems that cannot be changed by SKF Nova. These are structural and cultural problems related to the culture and incentive structure of the bigger SKF system. These problems will not be taken into consideration in this work. The blue rectangles represent problems that might be possible for SKF Nova to indirectly affect with a KM model. This even if the blue rectangles fall within the boundaries of the information domain of the SKF group. The blue rectangles can be considered a potential opportunity of SKF Nova. The pink rectangles represent problems of the information domain of SKF Nova. SKF Nova can affect these.

[302] Workshop 2001-11-26.
[303] Magoulas, T. & Pessi, K. (1998).p.5
[304] Magoulas, T. & Pessi, K. (1998).p.5

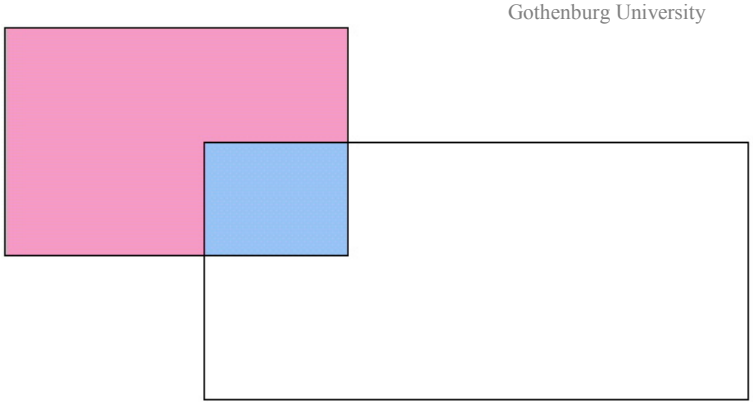


Figure 33 - The information environment of the SKF group and the information environment of SKF Nova, (Hanna Janzon 2001).

5.3.5 Analysis of the information system architecture

An Architecture represents the organisational structure of a practically and attractively organised social environment.[305] The word Architecture (in Greek: arci = principles and techture = appropriate design) implies principles to create a harmonic design. The architecture includes relationships between individuals, artefacts and between people and artefacts. Both the word system and the word architecture refer to holistic relationships between complex phenomena.[306]

The information system architecture represents "the sum of the total of all information related flows, structures, functions and so on, both manual and automated, which are in place and/ or required to support the relationships between the entities that make up the business".[307] The input, output, suppliers and market of the system represented by SKF Nova have been previously presented in the Situations Analysis.

[305] Magoulas, T. & Pessi, K. (1998).p.5.
[306] Magoulas, T. & Pessi, K. (1998).p.5.
[307] Zachman. (1978).p.9.

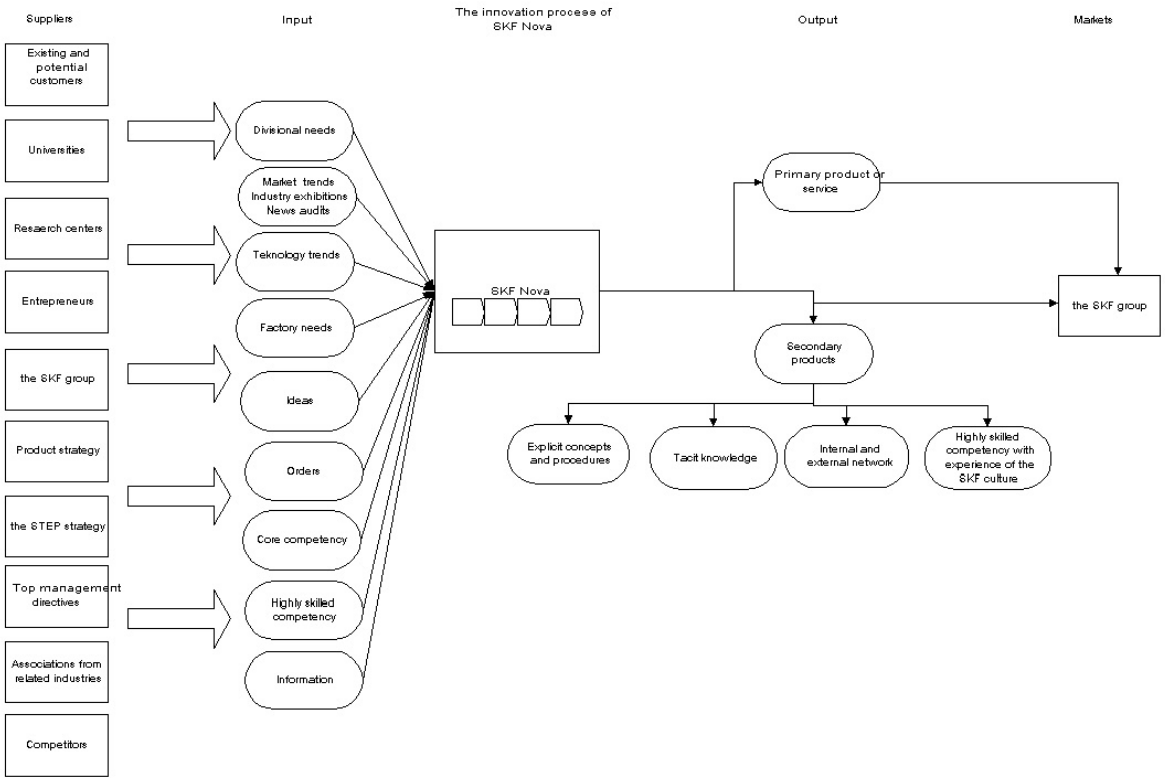


Figure 34 - The existing information system architecture of SKF Nova, (Hanna Janzon 2001).

SKF Nova receives information from both internal and external sources. The information can concern customer needs, ideas from different sources market and/or technology trends. The information is transformed within SKF Nova. Primary or secondary products or services compose the output. The primary products are delivered to the SKF group or are offered directly to the external market. The secondary products will never be offered to the external market. Knowledge, concepts, internal and external networks and new promising employees compose this output. The primary products are interesting out of a knowledge management perspective. The Knowledge management model of SKF Nova must consider the most effective organisation of the knowledge acquisition, accumulation and application of SKF Nova.

5.3.6 Relevant Knowledge Management approaches for SKF Nova

The Knowledge Management approaches that have been used to develop the potential model of SKF Nova will be presented below.

Characteristics of an effective Knowledge management programme
To be effective a KM programme must have coherence across a number of dimensions including people and culture aspects, structure, processes and information and communications technology (ICT).[308]

Management of knowledge
From the perspective of an organisation, knowledge manifests itself in many forms beyond human knowledge. [309]Always originating within people, it flows into all other aspects of the

[308] Quintas, P. & Lefrere P. & Jones, G (1997), p.387.
[309] Wiig, K,M.(1993).p.155.

organisation ranging from its structure, culture, work practices, technology, to its products and services.[310] The described flow of knowledge from the people to the artefacts of an organisation implies a transformation of knowledge from tacit to explicit. What KM essentially does for an organisation is making that transformation increasingly structured while ensuring that the appropriate knowledge flows to the appropriate place in the organisation. KM is the optimal organisation of the process that transforms personal ideas and experience into generally applicable concepts. [311]

KM can be defined as ”the process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets and to develop new opportunities.”[312]

What is needed to identify knowledge?
Wiik (1993) argues that the use of effective methods is necessary provide commonly accepted and well understood descriptions of the knowledge involved and to give insightful representations of the situations that need to be managed.[313]

One means to identify knowledge presented by Sanchez (1996) classifies the knowledge of firms into know-how, know-why and know-what. The following table describes the three levels of knowledge.

Form of knowledge	*Level of understanding*	*Capability derived from knowledge.*
Know-how	”Practical understanding of how current products work.”	Enables firms to produce and refine current product designs
Know-why	”Theoretical understanding of why product designs work.”	Enables firms to adapt current designs or develop refined new products.
Know-what	”Strategic understanding of purposes to which now-how and now-why may be applied.”	Enables a firm to imagine and define feasible new kinds of products.

Know-how
Know-how is the knowledge used to perform the daily work.[314]It is the ability to solve problems efficiently based on accumulated knowledge, experience and skills. Know-how can be obtained from a number of sources, from training, education and when one colleague instructs another how things work and are to be done. Know-how is developed when we figure out how things work and how we need to deal with them.

Know-why
Know-why provides general modules and organised understanding of and theoretical backgrounds for, the situations and conditions that we deal with, particularly the complex ones. [315] Knowledge on this level consists of the rules, facts, and explicit concepts that we use

[310] Wiig, K,M.(1993).p.155.
[311] Quintas, P. & Lefrere P. & Jones, G (1997), p.387.
[312] Quintas, P. & Lefrere P. & Jones, G (1997), p.385.
[313] Wiig, K,M.(1993).p.162.
[314] Wiig, K,M.(1993).p.136.
[315] Wiig, K,M.(1993).p.136.

consciously when we reason and make decisions as part of the daily work. [316] This type of knowledge provides us with methodologies and guides us with principles for how we handle situations. We use know-why knowledge as a background and reference knowledge for in-dept analyses of all kinds of problem solving situations. It can be obtained from self-study or education.

Know-what

This type of knowledge guides our thinking and motivation, helps us to generate our goals and ideas, and provides us with insights that enable us to observe situations from several perspectives. [317] This type of knowledge can also be called idealistic knowledge. The idealistic knowledge is used for two purposes a) to direct our motivation and action toward a goal b) to change our mind concerning a particular situation. This knowledge can be obtained from for example discussions with knowledgeable individuals and benchmarking. It is important that the goals and objectives of the firm guide everyone's actions.

Management of know-how, know-what and know-why

According to Sanchez, the first step in managing the firm's knowledge to greatest strategic advantage is to determine the relative importance of the firm's know-how, know-what and know-why kinds of knowledge in maintaining or creating the firm's distinctive competencies in creating products. [318]The next step is to leverage the least strategically critically kinds of knowledge of the firm as broadly as possible, while maintaining close control within the firm of the kind of knowledge that is most critical to the firm's distinctive competencies. [319]

The most recent research on KM suggests that considering innovation the most important knowledge to manage is the know-who type of knowledge.

The know-who approach to knowledge management

Regardless of the type of industry, companies and their innovation process are becoming increasingly knowledge-based for each day that passes by, and intellectual assets take the predominant role in defining market value.[320] Accordingly, the shifting sources of global competitive advantage call for new strategies and approaches to manage both knowledge and innovation.[321] In response to this, a know-who based approach to Knowledge and Innovation management has been recently developed. The know-who approach stresses the importance of networks with customers, suppliers, competitors and research centres. Rather than developing all specialised knowledge internally, an extensive knowledge exchange save time and development cost. Know-who can be defined as the ability to acquire, transform and apply the know-how.[322]

Measurement of knowledge

Another important aspect of KM is measurement of the knowledge assets. (Management includes the dimensions of monitoring and control.) Knowledge assets can refer to both productive knowledge and customer knowledge.[323] According to Steward (1999) Intellectual

[316] Wiig, K,M.(1993).p.136.
[317] Wiig, K,M.(1993).p.136.
[318] Sanchez, R. (1996), p. 136.
[319] Sanchez, R. (1996), p. 136.
[320] Harryson S, J. (2000).p.xiii.
[321] Harryson S, J. (2000).p.xiii.
[322] Harryson S, J. (2000).p.ix.
[323] Teece, D, J. (2000), p.42.

capital includes three possible classifications of knowledge assets: human capital, structural capital and customer capital.[324]

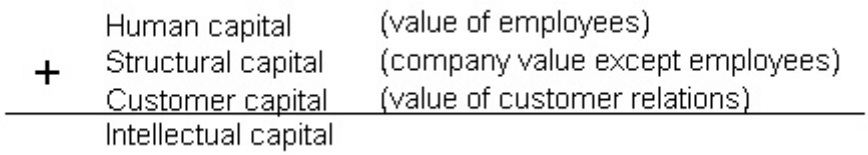


Figure 35 - Intellectual capital is composed by human capital, structural capital and customer capital, (Steward 1999).

5.3.7 Improvement of the information systems architecture imply change

It was stated above that the information system architecture represents "the sum of the total of all information related flows, structures, functions and so on, both manual and automated, which are in place and/ or required to support the relationships between the entities that make up the business".[325] Improvement of the information system architecture thereby implies improvements of the business process of a firm.

An important requirement posed is that the Knowledge Management model must reflect the reality. Improvement of the information environment implies change because firms and their information systems are mutually independent. Consequently, any changes in the organisation of the work of the firm presuppose corresponding changes in its information systems. Any change in information systems presupposes corresponding changes in the enterprise, its processes and the behaviour of its personnel.[326]

5.3.8 A Knowledge Management model to support SKF Nova

The model presented below intends to outline an effective process to acquire, accumulate and apply the knowledge created by the employees of SKF Nova. The model represents a suggestion of a potential development process of SKF Nova.

The model is intended to improve the transfer of knowledge between SKF Nova and the potential recipients within the SKF group and between SKF Nova and external firms. The model has been influenced by the different knowledge management theories discussed above.

SKF Nova is a company that gains its competitive advantage primarily by sharing and enhancing tacit knowledge for the creation of new and innovative solutions. The know-who approach to knowledge Management provides an important basis of the model. The close relation between Knowledge Management and innovation suggested by the know-who approach indicates that the Knowledge Management model of SKF Nova can be used to improve the exits from SKF Nova. The knowledge management model below will affect the transfer of knowledge between SKF Nova and three different networks:

[324] Steward (1999)
[325] Zachman. (1978).p.9.
[326] Enquist, H, Magoulas, T, Bergenstjerna, M, Holmquist, M. (2001).

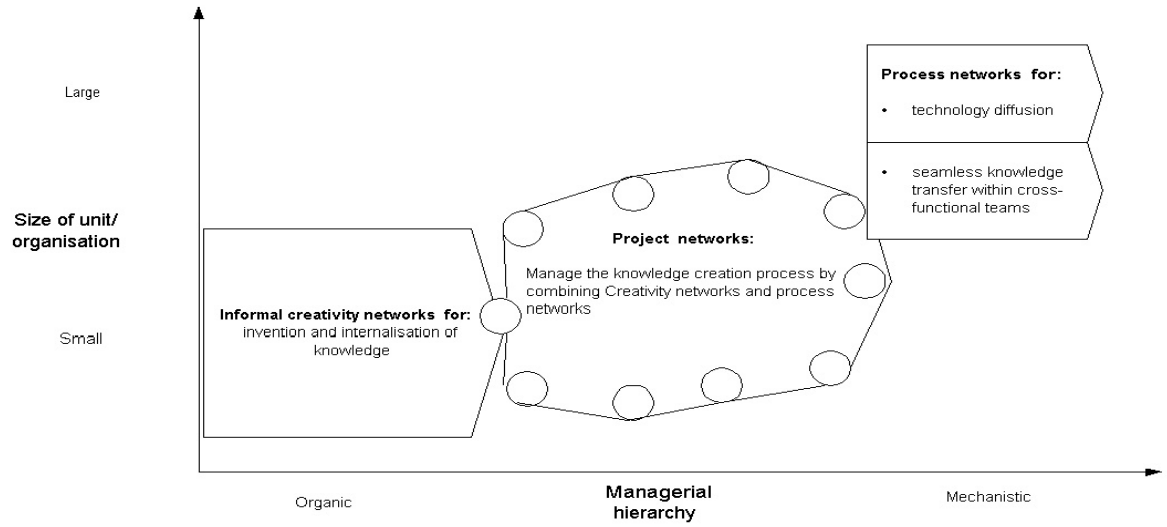


Figure 36 - The three types of networks needed by the know-who based company, (Harryson 2000).

- Knowledge acquisition from external firms through an informal creativity network. [327] Knowledge considering new technology often represents technology push. [328]
- Knowledge application through cross-functional process networks. [329] The input from the process networks reflects the market pull.
- The project network represents the learning function. In the project network. The knowledge acquired from the informal creativity network is accumulated. The knowledge is applied in the process networks. Knowledge from the process networks that represents perceived needs is collected and brought back to the project network. This means that the project network combines technology push and market pull. In the knowledge management model below, SKF Nova takes the role of the project network. Looking at the figure above, it is clear that SKF Nova acting as a project network would produce value to the SKF group through making the transfer of knowledge between the large and structured organisation and the smaller organisation smoother.

[327] Harryson, S. (2000).p.15.
[328] Harryson, S. (2000).p.15.
[329] Harryson, S. (2000).p.15.

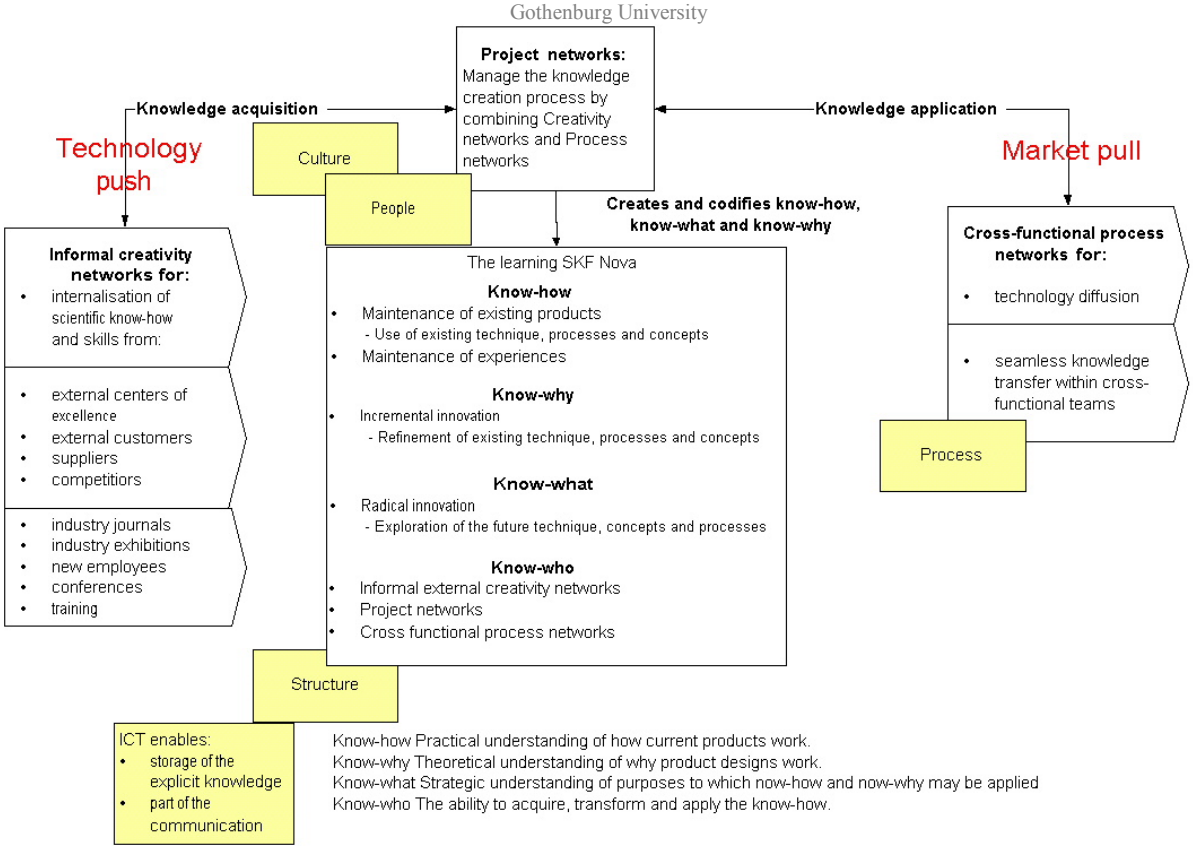


Figure 37 - The Knowledge Management model of SKF Nova suggested by the study, (Hanna Janzon 2001).

Explanation of the model
Initially the different parts of the model need to be introduced.

The Learning SKF Nova
The big square in the middle represents the knowledge base of SKF Nova. Part of the know-how, know-why, know-what, know-who can be transformed from tacit to explicit know-how. Explicit knowledge can be codified and thereby owned by SKF Nova. The discussion below will reveal that much of the knowledge of SKF Nova is tacit in nature and can never be codified. This knowledge belongs to the human capital of SKF Nova. The explicit know-how, know-what and know-why that is codified makes up the structural capital of SKF Nova. The know-who will mostly be tacit in nature. The extent of the know-who that can be codified makes up the network capital of SKF Nova.

The Project networks
The project networks represent the organisational learning mechanism of SKF Nova. The employees of SKF Nova work in teams. The individuals will acquire knowledge from mainly two sources: from the informal creativity networks and from the internal process network. To the extent it is possible this knowledge will be transformed from tacit to explicit and codified into the knowledge base. It is very important that the tacit knowledge is shared between the different employees of SKF Nova to the greatest extent possible.

The informal creativity networks
The informal creativity network is the primary source of technology understanding of SKF Nova. The network includes external companies, for example potential customers, suppliers, competitors, and partners. The employees of SKF Nova will also gather technology

knowledge from conferences and industry journals. To a great extent the knowledge from the informal creativity networks will consist of know-who.

The process networks
The knowledge acquired from the informal creativity networks is applied through participation in the innovation process of the SKF divisions. Since the knowledge of SKF Nova to such a large extent is tacit in nature the knowledge must be transferred through human knowledge shuttles. The employees of SKF Nova transfer the knowledge through participation in cross-functional innovation process teams. This participation will give the team members of SKF Nova an understanding of the divisional needs. This is understanding is transferred back to SKF Nova, some of it is shared and some of it is codified and added to the accumulated experience in the knowledge base at SKF Nova.

The know-who approach represents an opportunity for SKF Nova
The know-who approach to KM is based on connecting the right people into human networks. Harryson (2000) argues that project networks effectively should connect the external creativity network and the internal innovation process network. [330] This serves to mobilise the internal and external networks.[331] What does this mean for SKF Nova?
The problem graph reveals three main opportunities for SKF Nova to improve the exits are:

- To get a holistic overview of the innovation process of the SKF group.
- To participate in the cross-functional development process of the different divisions.
- To reduce the uncertainty related to innovation perceived by the divisions.

(These opportunities corresponds to the three main problems previously discussed:
- Teams of different parts of the SKF group make development efforts that are very similar or identical without being aware of each other[332]
- There is not enough cross functional communication[333]
- The divisions have difficulties to implement new ideas[334])

I suggest that using a know-who based approach to knowledge management represent an opportunity for SKF Nova to solve these problems. This could be done by acquiring, managing and diffusing knowledge between two types of networks:

Firstly SKF Nova could potentially acquire knowledge from what Harryson calls ”an informal creativity network” involving external companies such as external customers, suppliers, competitors and centres of excellence. This way SKF Nova would acquire know-how, know-what and know-why.

Secondly the acquired knowledge can potentially be classified and transformed at SKF Nova into know-how, know-what, know-what and know-who. SKF Nova would function as a project network. The project network is necessary for the organisational learning to take place as suggested by Nonaka (1994). The central theme of Nonaka’s theory has been previously discussed in the Problem discussion. According to Nonaka, the learning resides on a dynamic

[330] Harryson, S. (2000).p.170.
[331] Harryson, S. (2000).p.170.
[332] Workshop 2001-11-26.
[333] Workshop 2001-11-26.
[334] Workshop 2001-11-26.

interaction between four different modes of knowledge conversion.[335] These modes are socialisation, externalisation, combination and internalisation. [336] According to Nonaka organisational knowledge creation happens when all four modes of conversion are explicitly managed to form a continual cycle, shaped by a series of shifts of the modes.[337] Nonaka has identified specific key triggers to induce these shifts. These shifts are presented below:

- *Socialisation* usually starts with the building of a field of interaction, which facilitates the sharing of member's experiences and perspectives.
- *Externalisation* is triggered by successive rounds of dialogue in which metaphors can be used to enable team members to articulate their own perspectives, and thereby reveal hidden tacit knowledge that is otherwise hard to communicate.
- *Combination* is facilitated by co-ordination between team members, divisions and business units.
- *Internalisation* is triggered by the iterative processes of trial and error and learning by doing, by which concepts are articulated and developed in concrete forms.

Thirdly SKF Nova can potentially apply the acquired know-how by participating in the divisional cross-functional innovation process network. From the process network SKF Nova would at the same time acquire an understanding of the divisional customer need. Harryson calls the management of the combined knowledge from the external network and the internal process network for a project network. SKF Nova would function as a project network according to Harrysons description.

SKF Nova can exploit the opportunities suggested in the problem graph by managing an informal creativity network and an internal cross-functional process network

1. The problem graph reveals that participation in a potential future cross-functional development process of the divisions would ensure a common understanding of the divisional need at an early stage. This would in turn reduce the internal resistance between different functions. This would improve the possibilities of mobilising the necessary resources to build up the business within the SKF group. This study indicates the preparation of the new business within the SKF group to be a critical success factor to obtain a successful exit.

2. Participation in different development processes of different divisions would potentially give SKF Nova an overview of many of the innovation projects of the SKF group. According to the problem graph this could reduce the level of re-invention of the wheel and the internal competition. This would lead to an improved communication and improved abilities to build up the business internally. This study indicates the preparation of the new business within the SKF group to be a critical success factor to obtain a successful exit.

3. The external network, i.e. the informal creativity network would give SKF Nova an insight of external trends. The internal process network would provide SKF Nova with an understanding of the divisional need. The project network of SKF Nova would provide a possibility to process; refine, transform and store the knowledge and experience generated

[335] Nonaka, I. (1994).p.20.
[336] Nonaka, I. (1994).p.20.
[337] Nonaka, I. (1994).p.20.

from the informal creativity and the internal cross-functional process network. The combination of the three types of knowledge – from the external sources, from the internal sources and from the knowledge and experiences stored over time, would give the employees of SKF Nova the ability to make associations. This could potentially serve to reduce the uncertainty of the divisions. According to the problem graph, a reduction of uncertainty lead to increased ability to change. This in turn would improve the ability of the divisions to change. According to the graph this would make the divisions more inclined to take the ownership of innovation process. This would improve the possibilities of mobilising the necessary resources to build up the business internally. This study indicates the preparation of the new business within the SKF group to be a critical success factor to obtain a successful exit.

Summary of the functioning of the Knowledge Management model
In summary the know-who based approach implies that SKF Nova manages knowledge in an internal project network. The employees of SKF Nova would through a process of organisational learning transform part of the tacit knowledge of individuals to explicit knowledge that can be stored. The knowledge would be acquired through extra corporate networking with suppliers, partners, lead customers and competitors. The knowledge would be diffused to the SKF group through networking within the SKF group. The know-who approach takes into consideration that the knowledge concerning innovations very often is tacit in nature. Tacit knowledge includes scientific expertise, operational know-how, and insights about an industry, business judgement and technological expertise. [338] The tacit knowledge is transferred to the SKF divisions through human know-how shuttles. The know-who approach implies constant learning that occurs before, during and after the participation in the cross-functional development process.

Important aspects of the model
Some KM aspects of specific importance to SKF Nova will be explained in the next section. The aspects consider the five dimensions above-mentioned, (people, culture, structure, processes and technology). The people aspects cover investment in human capital, personal development, what to learn and training in internal knowledge. The structural aspects consider the structural and the network capital of SKF Nova. The process aspect cover a potential learning process proposed by Harryson and relates this to the requirements of KM posed by each scenario.

People aspects – development of the human capital
People and culture are the most important components since managing knowledge depends on people's willingness to share and reuse knowledge.[339] The employees of a learning organisation have three principal responsibilities: to acquire, accumulate, share and apply knowledge.
What are the requirements out of a KM perspective, concerning the selection and development of the human capital selected at SKF Nova?

Investment in human capital
There needs to be a balance of young and more experienced employees working at SKF Nova. This has been discussed in the Perception of Problems and opportunities of SKF Nova. Having too many inexperienced employees could make the SKF Nova less trustworthy in the

[338] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[339] KM Working Group of the Federal chief Information Officers Council, 2001, p.1.

eyes of the rest of the SKF group. To further improve the internal credibility of SKF Nova a mix of different competencies is required.

Personal development
The individuals of a learning organisation must be interested in constantly learning new things, unlearning "old behaviour", share knowledge and experience and devote time to help others learn.[340] Constant reflection and use of creative thinking to present suggestions concerning the improvement of the work situation is very important since it represents creation of know-what and possibly know-why. The know-who approach stresses the value of personal relationships. Joint training programs represents yet an option to increase the personal networks.

What to learn
What knowledge apart from technology is needed to package knowledge? The analysis of the historic SKF Nova suggests that the company would benefit from developing explicit concepts and processes. Increased structuring of the work practices of SKF Nova could potentially reduce the occurrences of lost patent possibilities, give increased cost focus and to some extent reduce the flexibility in the way of working at SKF Nova. This would reduce the perceived lack of steering and control perceived by the internal customers. This would further improve the credibility of SKF Nova in the eyes of the internal customers which would reduce the risk of the "not invented here syndrome" to occur.

Flexibility in terms taking into consideration the specific characteristics of each unique business idea and technology is extremely important for SKF Nova. This type of knowledge cannot be re-used. Concepts on the contrary would provide mental guidelines for the employees who could help them structure the information and knowledge in their minds. Concepts could serve to reduce the complexity of difficult problems. Concepts could further serve to reduce the level of uncertainty. This study indicates that reduced uncertainty would affect the willingness of the internal customers to take risks and increase their motivation to implement new things. SKF Nova could potentially gain competitive advantage by re-using concepts and methodologies, which could serve as general templates. Re-use of general templates would save money, time and improve the internal credibility of SKF Nova. These concepts could be of two types:

- Concepts concerning the internal work practices and processes of SKF Nova
- Concepts concerning the implementation of new work practices in the division to reflect changes in product design due to radical innovation

Training in internal knowledge
Harryson (2000) claims that the organisational dilemma of innovation is that the creation and exploration of inventive technologies and knowledge appear to require small and organic organisational structures, whereas rapid innovation through effective exploration of that knowledge, in contrast, calls for large and rigid organisations. For innovation to happen, both small organic organisations and a large hierarchic unit are typically required. The relationship between the SKF group and SKF Nova reflects the opportunities of the organisational dilemma of innovation. To make the transfer of knowledge between SKF Nova and the recipients of the SKF group easier, this study indicates that the employees of SKF Nova needs schooling in the business information system of the SKF group.

[340] Mayo, A. & Lank, E. (1994).p.259.

Sharing culture
What makes up a sharing culture? According to the KM working group (2001), the development of leaders who foster sharing and building an atmosphere of trust in which sharing is valued can create a sharing culture.[341] A learning organisation is based on a general attitude that knowledge as such is not power. On the contrary, sharing knowledge should give power in a learning organisation.

Structural aspects – development of structural and network capital
What is the relevant know-how, know-what, know-why and know-who of SKF Nova to create, codify and diffuse? To what extent is it relevant for SKF Nova to codify and reuse knowledge? The structural aspects include the development of what Steward (1999) refers to as structural and customer capital.[342] The customer capital according to Steward's definition implies the value of the customer relationships. This will here instead be referred to as network capital as it includes the value of the external informal creativity network, the value of the internal cross-functional process network and the value of the project network of SKF Nova.

In the table below a suggestion how the knowledge of SKF Nova could potentially be classified is given.

Level of understanding	*Capability of SKF Nova*
Know-how	Knowledge how to perform incremental and radical innovation. Knowledge how to package knowledge.
Know-why	Knowledge of what makes an innovation process work. Understanding of different types of innovation processes. Understanding how to manage the knowledge of the project network of SKF Nova.
Know-what	Understanding of what innovation work will be like in the future. Ability to anticipate customer demand.
Know-who	The ability to make associations based on personal networks when combining the knowledge obtained from the creativity network, the project network and the process network.

SKF Nova may benefit from balancing structural and network capital
Structural capital refers to concepts, methodologies and processes that are codified and can be owned by the company. Some advantages of using pre-defined work procedures and general templates have been claimed above. This study indicates that it is relevant for SKF Nova to a certain extent to codify the know-how and know-why that considers general work procedures and templates. Considering experiences obtained during previous innovation projects, these can be codified and accumulated in a knowledge bank.

The knowledge obtained from the external informal creativity networks can be transformed from tacit to explicit to some extent. Tacit knowledge includes scientific expertise, operational know-how, and insights about an industry, business judgement and technological expertise. [343] The transformation occurs through an organisational learning process. One

[341] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[342] Steward (1999)
[343] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.

potential process for organisational learning will be discussed in the next section. The resulting explicit knowledge can be codified. However much of this knowledge will remain tacit in nature and will remain within the individuals. The previous arguments are supported by the findings of the KM working group (2001) suggesting that people in companies seeking innovation need to share information and knowledge that would get lost in document form. [344] This knowledge is difficult to articulate in writing and it is acquired through personal experience.[345]

Network capital refers to the knowledge about who to approach for advice and knowledge concerning a specific field. This knowledge is partly owned by the organisation, but most of this value is closely related to the value of the human capital.

Process aspects

This section will consider some essential components of a potential learning process proposed by the know-who approach to KM. This learning process will be related to the KM requirements posed by the two processes proposed in the scenarios.

A process for organisational learning
The proposed KM model suggests the learning process of SKF Nova to take place within the project network. This means that the learning process of SKF Nova can be managed through the project network by combining the Process network and the informal creativity network.

The organisational learning process designed by Harrison (2000) that has been previously presented in the Frame of Reference could inspire a potential future learning process of SKF Nova. [346]

- *Enlarging individual's knowledge* - can be secured through training and job rotation, which increase individuals' capability to relate different experiences to each other.
- *Sharing tacit knowledge* – appears through three types of networks, the informal creativity network, the project network and the process network. This is a core competency of the know-who based company.
- *Conceptualisation and crystallisation* take place through the early and intensive preparation and presentation of prototypes, which incorporate and transform tacit knowledge and concepts into tangible models for effective cross-functional communication and joint reflection.
- *Justification* occurs by presenting the prototypes to top or middle management for strategic input and authority to proceed.
- *Networking knowledge* – is – just like the sharing of tacit knowledge – not an isolated step in know-who based companies, but an ongoing process that drives the knowledge and innovation machinery as a whole.
- *Internalising extra corporate knowledge* occurs through technology scanning, followed by emigration of key individuals to identified centres of excellence.[347]

Relevant Knowledge Management activities to support each scenario

[344] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[345] M, T. Hansen & N, Nohria & T, Thierney, What's your strategy for managing knowledge? Harvard Business Review, March-April 1999.
[346] Harryson Sigvald, J. (2000).p.161.
[347] Harryson Sigvald, J. (2000).p.161.

The following KM activities are relevant for both scenarios:

- Manage relations with the informal creativity network, project network and process network. This activity corresponds to the sharing of tacit knowledge of the organisational learning process defined above.
- Follow-up the performance of the employees of SKF Nova. This activity is important to follow up the enlarging of the individual's knowledge. Enlarging of the individual's knowledge is an ongoing process at SKF Nova.
- Sharing of project experiences at SKF Nova. This activity is very important in order to transform knowledge from tacit to explicit at SKF Nova. Also, this represents an important means to exchange tacit knowledge between the individuals of SKF Nova.

Knowledge Management required to support Brain shopping
KM assumes continuous learning. This necessitates regular follow up of the knowledge increase resulting from the business process. The problem graph outlined above suggests that one of the problems of the innovation process of the SKF group is a lacking overview of the different innovation projects going on in different places of the group. The Knowledge Management to support Brain shopping needs accumulate the experience considering different innovation projects that is gained over time by the employees of SKF Nova. Eventually this can give an overview of the innovation efforts of the SKF group.

Some issues related to the learning of SKF Nova implied by Brain shopping that it could be interesting to follow-up are suggested below:

A follow-up phase to support Brain-shopping
- How much has the shared explicit knowledge of SKF Nova increased during a specific time period?
- Do we manage to anticipate the need of the internal customers?
- Have we been forced to re-adjust our original competence development plans to satisfy the needs of the internal customers?
- To what extent are we involved in incremental versus radical innovation?
- What type of knowledge do we use (explicit or tacit)?
- To what extent is it possible to codify and share knowledge?
- To what extent do we re-use general processes, concepts, methodologies, templates and procedures?

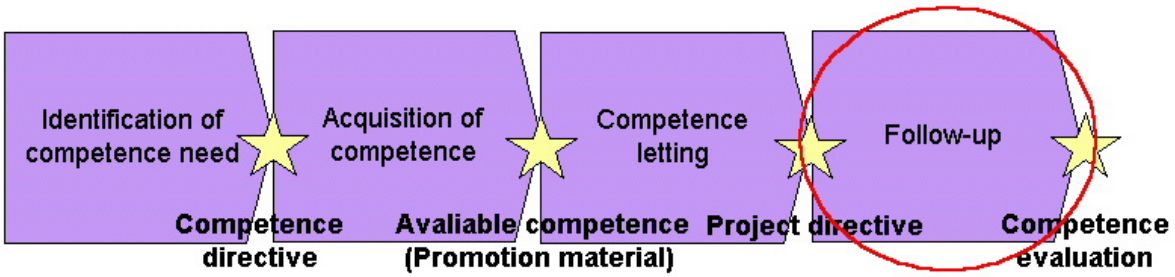


Figure 38 - Knowledge Management required to support Brain shopping, (Hanna Janzon 2001).

This study stresses the importance of especially three of the phases of the innovation process. These phases are the Project directive, the Design of new business and the Final knowledge transfer.

Project directive
The problem graph outlined in the beginning of this part indicates that the development of a common understanding of the customer need at an early stage reduces the risk of the ”not invented here syndrome”. This further impacts the ability to build up the business within the SKF group, which in turn affects the chances of a successful exit. Harryson (2000) argues that linkages to external sources will not generate innovation on their own.[348] Regardless of whether an innovation is acquired or internally generated, connections, i.e. networks, at the corporate level are necessary to disseminate it across divisions. [349] Also unless market needs are carefully considered, commercialisation may not succeed. [350]

To become involved in the cross-functional innovation processes of the divisions SKF Nova needs to be very active in the very early stages of the innovation process. This means both to generate ideas and promote the competence of SKF Nova internally and to heavily focus on understanding the needs of the internal customers.

Design of new business
The problem graph indicates the importance of building up the new business internally. This KM model uses the internal network to identify the relevant people that have the power necessary to mobilise the internal resources required. The importance and value of the cross-functional innovation process of SKF Nova is once more obvious.

According to Harysson (2000), large firms often suffer from three different communication gaps:
- One between the idea generator and those who can mobilise the resources that are necessary to realise the idea.
- A second when top management fails to communicate a clear mission of the corporate activities to subordinates.
- The physical separation and differences in jargon between the different functions of for example marketing, sales, product development and manufacturing.[351]

The appropriate management of the know-who knowledge can avoid these communication gaps.

Final knowledge transfer
The problem graph indicates the SKF divisions have difficulties to implement new things. The ITT typology previously discussed provides an important opportunity for SKF Nova to manage specifically two different types of knowledge transfers:

- Technology project transfers from external networks into SKF Nova.
- Technology project transfers from SKF Nova to the divisions.

A follow-up phase to support In-house innovation
The purpose of this phase is to follow up the success of the innovation projects. The post transfer review phase provides the ability to learn from experiences gained during the process.

[348] Hedlund. (1992).p.112.
[349] Hedlund. (1992).p.112.
[350] Hedlund. (1992).p.112.
[351] Hedlund. (1992).p.112.

Some examples of factors that could potentially be measured are given and explicitly stored for regular monitoring.

- No. project submissions per period of time
- Project completion rate per period of time
- Work in progress
- Time to market
- Project cost in relation to perceived customer value
- No. patents issued by the idea
- No. incremental versus radical innovation projects

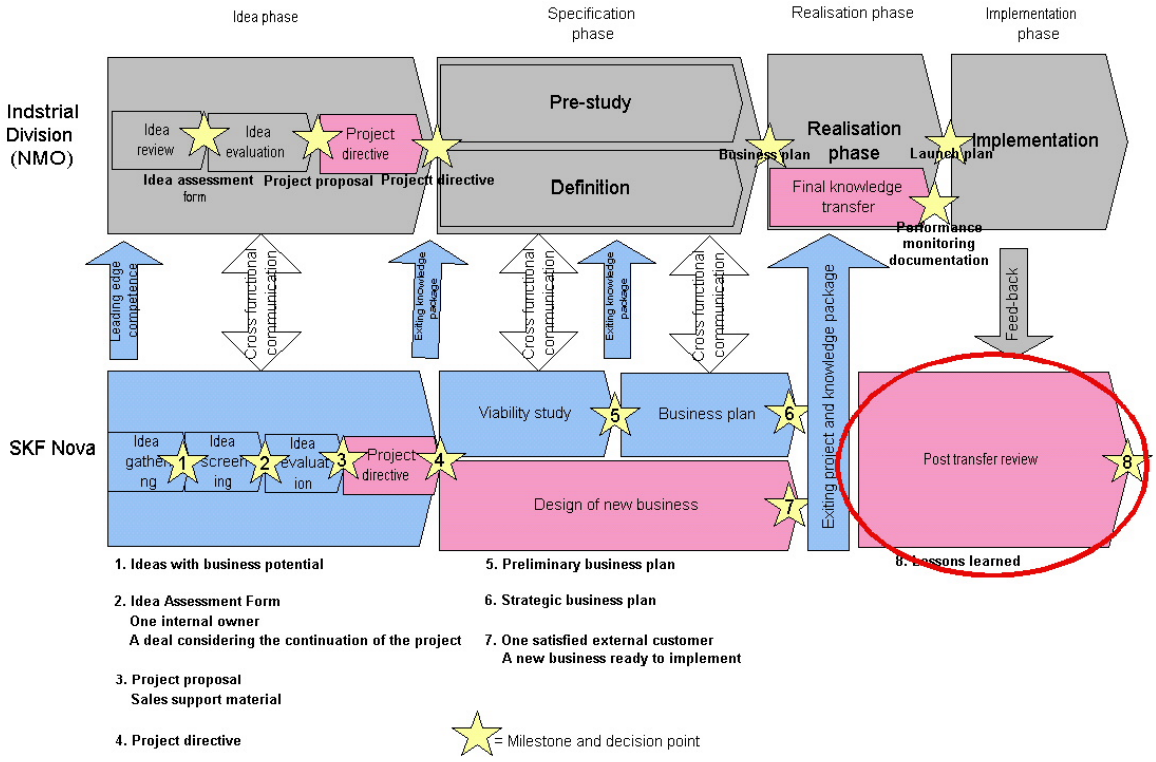


Figure 39 - Knowledge Management required to support In-house innovation, (Hanna Janzon 2001).

Information and communication technology (ICT) aspects

This section will shortly cover some relevant IT aspects considering traditional KM and the know-who approach to KM. Lastly a short note on the value of technology will be made.

It needs to be stated that ICT is not more than an enabler of communication and data storage. It is the business process of SKF Nova that needs to guide a potential investment in a KM system, not the information technology.

Harryson (2000) claims that the know-who approach to KM require KM systems that both manage to build human knowledge networks by interconnecting the right people and promoting high quality dialogue for genuine knowledge creation, and capture and codify the results for rapid reuse by a broader and more media based network of documents with links to

their creators. [352] The above discussion is supported by Quintas, Lefere and Geoff (1997), claiming that the emphasis is now shifting away from the computer-cantered view toward the communication potential offered by new technologies. [353]
"For the majority of organisations IT approaches can capture only a fraction of their knowledge and intellectual capital."[354]

Teece (2000) claims "Information technology can assist KM, but knowledge management involves much more than the astute use of IT tools.[355] Several studies show that people more frequently than not will contact someone they know before searching the corporate database or data warehouse.[356]

The value of technology
Technology produces value when it increases the accessibility of knowledge, reduces the time and effort of employees to record and keep it current and facilitates interaction with citizens, customers, suppliers, partners and each other. [357] Technology's role in KM is important but should represent no more than 40 percent of the spending on KM.[358]

5.3.9 Concluding reflections about the Knowledge Management model

How knowledge Management can be used by SKF Nova to improve the exits
SKF Nova can use knowledge management to improve the transfer of knowledge throughout the innovation process and thereby improve the number of successful exits. The know-who approach suggests the use of three different types of networks to acquire, accumulate and finally apply new knowledge in the regular operation of large organisations. A future Knowledge Management strategy of SKF Nova must support the transfer of knowledge between SKF Nova and the regular operations of the SKF group. The Knowledge Management model suggested by this study represents such a strategy. The model represents a suggestion of a potential development process of SKF Nova.

I claim that the know-who approach to Knowledge Management suggested by the model do have potential to improve the exits, i.e. the transfers of knowledge of SKF Nova for three reasons:

- The process networks of the KM model further support the close corporation with the recipients within the SKF group suggested by both of the proposed business scenarios. The cross-functional co-operation will give the employees SKF Nova the opportunity to develop a strong network that is necessary to understand the need of the internal customers and thereby improving the ability of SKF Nova to anticipate the future customer demand.
- The informal creativity networks of the KM model support the close corporation with a network of external firms, suggested by the business scenario called Brain-shopping. The informal creativity networks provide the members of SKF Nova with important contacts that can be of great value to the divisions. One potential future role of SKF Nova, suggested by the respondents, was to act as a "people finder", since it is difficult for the

[352] Harryson, S. (2000).p.249.
[353] Quintas, P. & Lefrere P. & Jones, G (1997), p.388.
[354] Quintas, P. & Lefrere P. & Jones, G (1997), p.388.
[355] Teece, D, J. (2000), p.35.
[356] KM Working Group of the Federal chief Information Officers Council, 2001, p.11.
[357] KM Working Group of the Federal chief Information Officers Council, (2001), p.17.
[358] KM Working Group of the Federal chief Information Officers Council, (2001), p.17.

recipients of the SKF group to constantly gather this type of knowledge. This has been discussed in the Situational Analysis.

- The project network at SKF Nova combines the input from an informal creativity network with external firms, with input from a process network with the recipients within the SKF group. This means that SKF Nova would combine input representing technology push from the external firms, with input representing market pull from the recipient within the SKF group. The input from these two networks can be actively managed, refined and accumulated by the project network at SKF Nova. The combination of market pull and technology push will enable SKF Nova to package knowledge that considers both radical and incremental innovation.

The ITT typology can be used to determine the appropriate level of co-operation considering the transfers of knowledge from the informal creativity networks to SKF Nova and from SKF Nova to the recipients within the SKF group.

6 Validation

6.1 Validation of the scenarios and the Knowledge Management model

The scenarios have been verified and adjusted in accordance with the feedback obtained during the second workshop that was held the 26:th of November. The Knowledge Management model was completed and adjusted to comments achieved from two different stakeholders on an interview basis after the workshop.

6.2 Comparison of theory and practice

This part presents a comparison of the perceived opportunities to improve the innovation process of the SKF group with the existing theory considering the management of knowledge and innovation. The comparison considers the organisational images of SKF Nova that has been assessed by the study from both a theoretical and an empirical perspective.

Secondly the theoretical results and the empirical situation of the SKF group will be compared considering some critical aspects to successfully perform innovation. The comparison will cover the following aspects: the organisational dilemma of innovation, the ability to classify knowledge and critical characteristics of an effective innovation process.

6.2.1 Some valuable skills to perform innovation

The following opportunities to improve the innovation process of the SKF group were perceived by the respondents of the study. These have been presented in the chapter called Perception of opportunities and problems and assessed in the analysis.

- There is not enough cross functional communication
- The Sales force members are not always part of the innovation process
- It is difficult to get an owner of the innovation projects at an early stage
- Teams of different parts of the SKF group make development efforts that are very similar or identical without being aware of each other
- The divisions have difficulties to implement new ideas
- There is a lack of competence concerning idea gathering, screening and selection

Some general characteristics that can be expected from the future winners of the "innovation industry" according to the theory have been previously presented in the Frame of Reference.

- To use cross functional teams
- Clear goals and innovation strategies that are shared by the employees of different functions
- The ability to change
- The ability to benefit from a creative culture
- The ability to closely co-operate with customers
- The ability to anticipate future customer needs
- The ability to constantly learn from external firms
- The use of a stage gate process to support the project teams

It is interesting to note that all the opportunities perceived by the respondents of the study correspond with the general characteristics required to effectively manage innovation claimed by the recent research.

The facts that there is not enough cross functional communication, that the Sales force members are not always part of the innovation process and that it is difficult to get an owner of the innovation projects at an early stage may represent a call by the respondents for cross functional development teams. The fact that teams of different parts of the SKF group make development efforts that are very similar or identical without being aware of each other can be a call for clear goals and innovation strategies that are shared by the employees of different functions. The fact that the SKF divisions have difficulties to implement new ideas can be a call for improving the ability of the divisions to change.

6.2.2 The organisational dilemma of innovation

The study reveals that the exits from SKF Nova have traditionally been influenced by the culture of the SKF group. The production of the SKF group is heavily rationalised and trimmed to deliver mass-customised products in large quantities. SKF Nova has provided the advantages of flexibility, entrepreneurial spirit and the ability to quickly adjust to change. The culture of the SKF group is influenced by the rigid structure required by the traditional operations. The difficulties of successfully combining the requirements of the regular operations and the creative chaos needed to innovate are strongly supported in theory.

Harryson (2000) argues that the creation and exploration of inventive technologies and knowledge appear to require small and organic organisational structures, whereas rapid innovation through effective exploration of that knowledge, in contrast, calls for large and rigid organisations.[359] Companies trying to achieve both creative invention and rapid innovation are most likely to be caught in this dilemma.[360] Accordingly for innovation to happen, both small organic organisations and a large hierarchic unit are typically required. [361] This calls for a management approach that converges the two shaded opposite ideal positions illustrated in the figure, without moving into the undesired positions of massive (exaggerated) chaos or decentralised bureaucracy. [362]

[359] Harryson, S. (2000).p.5.
[360] Harryson, S. (2000).p.5.
[361] Harryson, S. (2000).p.5.
[362] Harryson, S. (2000).p.5.

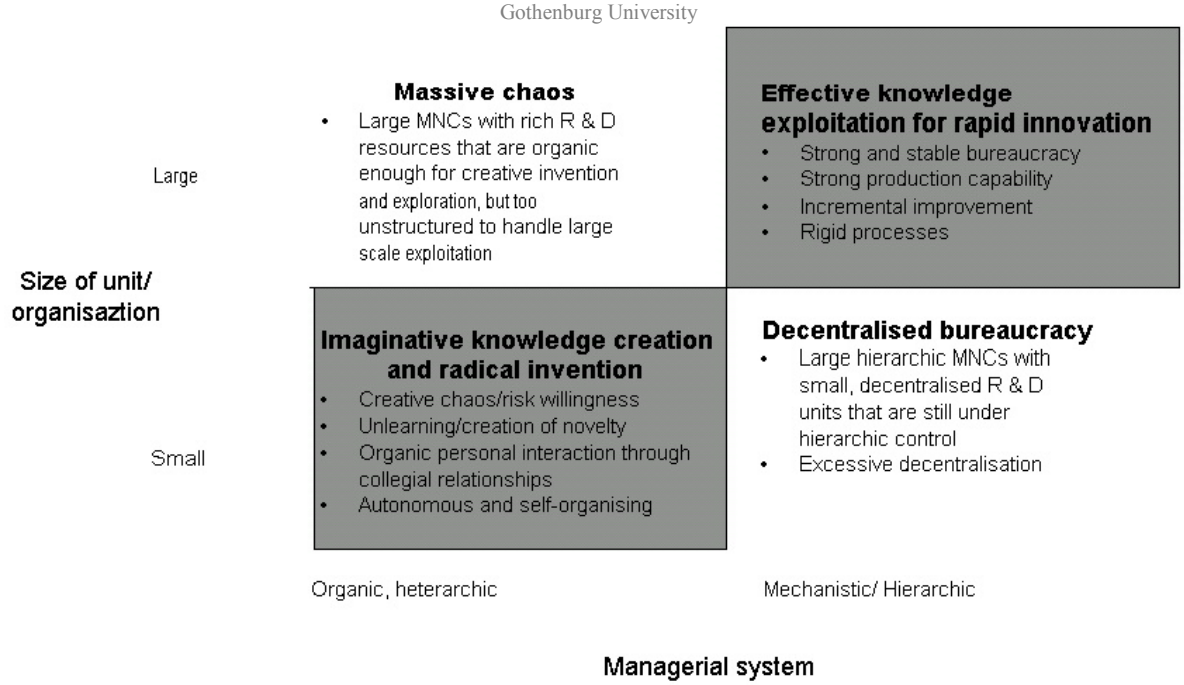


Figure 40 - The organisational dilemma of innovation, (Harryson 2000).

The results of the previous research suggest that new approaches and strategies need to be developed in order to meet the new requirements posed by firms. These requirements consider models that combine the support of knowledge and innovation management. The majority of the existing research represents the opinion that it is impossible or very difficult to perform radical innovation in the regular line organisation of large firms. This argument supports the existence and demand for a separate company like SKF Nova to support the innovation of large firms.

The challenge that remains considers the management of the knowledge transfer between SKF Nova and the regular operations of the SKF group. The history of the SKF group supports the theory of the organisational dilemma of innovation. The dilemma exists because of the separation of SKF Nova from the rest of the SKF group. However, the separation is the pre-requisite to ensure the innovative capability of SKF Nova that is needed by the SKF group.

A strategy to successfully manage the combination of the two cultures must support the transfer of knowledge between SKF Nova and the regular operations of the SKF group. The Knowledge Management model suggested by this study represents such a strategy.

6.2.3 The ability to classify knowledge

The theory suggests that knowledge considering how to classify different types of knowledge ensure the ability to leverage on the least critical dimensions of knowledge and to successfully manage the knowledge that composes the competitive advantage of the firm. One means to identify knowledge presented by Sanchez (1996) classifies the knowledge of firms into know-how, know-why and know-what. Harryson (2000) further introduces the dimension of know-who. According to Sanchez, firms will benefit from re-using its least strategically important knowledge.

The empirical findings of the study reveal that SKF Nova has not previously used to explicitly classify its knowledge. The findings of this study indicate that SKF Nova would benefit from

a combination of the know-who approach and the library approach to knowledge management. Re-use of explicit concepts and processes could potentially improve both the quality and the speed of the work. Further re-use of templates and documented experiences would facilitate for new employees of SKF Nova.
The know-who approach provide one means for large firms to control the driving forces of innovation by combining an external creativity network representing technology push with an internal cross-functional network representing market pull. The Knowledge Management model suggested by the study indicates that SKF Nova can manage its acquisition, learning and application of knowledge by using the know-who approach.

6.2.4 Critical characteristics of an effective innovation process

According to the findings of the previous research it is possible to identify some features that characterise an effective innovation process. An effective innovation process in this context implies a process that can handle both radical and incremental innovation. The following characteristics of an effective innovation process have been identified by the study:

- Has a pre-determined structure
- Ensures flexibility in the nature of work within that structure
- Considers the unique characteristics of each idea
  – Maintain mainstream business
  – Add value to present business
  – Create radical new business

- Provides the ability to tailor make the process
- Encourages cross-functional development

The empirical findings of the study suggest that the general innovation process of the SKF group do not consider all of these features. The general process of the SKF group has a pre-determined structure. It does not consider the unique characteristics of each idea, nor does it provide a high degree of flexibility or encourage cross-functional development.

The NMO process that is presently being developed by the Industrial Division does encourage cross-functional development. The NMO process is still highly structured, which may make it less suitable for radical innovation. Another feature of the NMO process is that it is initialised by market pull. The theory strongly suggests that the driving forces of radical innovation are both market pull and technology push. This indicates that the NMO process is suitable for incremental innovation since radical innovation tends to be initialised from a combination of market pull and technology push.

7 Conclusion

This chapter composes three parts. The first part presents the conclusions. The second part considers recommendations to improve the effectiveness of SKF Nova, based on the findings. The third part presents some suggestions for further research based on insights of shortcomings of the existing research.

7.1 Conclusions considering the exits of SKF Nova

The conclusion is structured in a way to provide a clear answer to all of the research questions.

Which are the opportunities, problems and critical success factors of the current mapping of the innovation process of SKF Nova and the SKF group?
The study reveals seven main problems of the general innovation process of the SKF group, perceived by representatives of the Automotive, Service and the Industrial division. Based on these problems, nine opportunities to improve the innovation process of the SKF group have been identified. Based on lessons learned from the past, the study indicates six factors critical to the success of an exit. Three major areas where the divisions ask for the services of SKF Nova consider the successful implementation of new ideas, i.e. change, to participate in the cross-functional development processes of the SKF group and the ability to avoid re-invention of the wheel through global participation in different innovation projects all over the firm.

In addition to the concrete needs mentioned above, several potential future offerings of SKF Nova demanded by the respondents have been presented in the chapter called Situations analysis. The conclusion is that there is a large divisional demand for the services of SKF Nova within the SKF group.

How can SKF Nova add value to the SKF group?
The study reveals that to represent a valuable resource to the divisions in the future, SKF Nova must adapt to the needs perceived by the potential customers within the SKF group. The study concludes that networking with external firms, social competence, global cross-functional experience and the ability to perform both incremental and radical innovation become increasingly important for SKF Nova to win the race. These findings indicate that the demand for the services of SKF Nova considers unique, i.e. complementary competency not elsewhere found within the SKF group.

The present market situation implies restricted budgets and restricted motivation of the SKF divisions to perform radical innovation. This situation indicates that the present need of the potential customers within the SKF group primarily considers incremental innovation. However the research presented by this study reveals that the long-term survival of firms to a great extent depend on the ability to successfully perform and implement radical innovation. Out of a long-term perspective, the SKF Nova and the SKF group may benefit from the use of also a business model to handle both radical and incremental innovation.

The empirical findings of the study indicate that the large and rigid structure of the SKF group is well suited to perform both maintenance of the mainstream business and incremental innovation. The NMO process of the Industrial Division is an example of a highly structured process to support the creation of new market offers. The theoretical findings considering

large firms suggest however, that the most successful innovators manage to combine rigid structure with a flexible and creative structure. The theory suggests that the two structures are mutually exclusive. While creativity and flexibility is required to capture and develop new opportunities, structure is needed to develop, manufacture, market and sell the innovation. The study strongly indicates that the transfer of knowledge between the two parties requires an effective transfer process.

What knowledge must be included in a successful exit?
The research presented by the study indicates that creativity is essential to successfully perform innovation. Creativity requires the flexibility to consider the unique characteristics of each business idea. To meet the requirements of creativity and flexibility, the innovation process must match the unique circumstances of each innovation project. The more radical the innovation, the more flexibility is required from the innovation process. The transfer process is a crucial part of the innovation process of SKF Nova. The conclusion to draw from these insights is that it is neither meaningful, nor possible to make one general standard definition of all the relevant knowledge to make all exits perfect. On the contrary, the key to make each exit successful is to identify and take into consideration the unique circumstances of each knowledge transfer. The findings of the study indicate that one of the most important aspects to consider for each innovation is the uncertainty associated with the technology. The more radical the idea is, the more uncertainty is implied which in turn implies an increased need of close cross-functional co-operation. The conclusion to draw from this is that the exits from SKF Nova can be improved by considering the degree of radicalness of the innovation and adjusting the innovation process accordingly.

The empirical findings of the study indicate that the divisions of the SKF group have difficult to implement change, i.e. new ideas. The theoretical findings indicate that the implementation phase is the weakest link of the innovation process. Instead of exiting the arena before or during the implementation, this study suggests that the more radical the idea is, the more co-operation is required to successfully implement the new business. The conclusion drawn is that the exits from SKF Nova can be improved by creating a common activity of the innovation process where all the actors can meet. The activity added to the innovation process of SKF Nova, that is called “Design of new business” provide such an activity.

To further improve the management of the knowledge transfer process and effectively screen ideas the study suggests the use of a tool called the ITT-typology. The ITT-typology advocates that companies need to set-up an appropriate transfer process depending on the technological uncertainty associated with the new technology.

How can SKF Nova use Knowledge Management to improve the transfer of knowledge throughout the innovation process to increase the number of successful exits?
The study concludes that independently of the form of innovation SKF Nova will perform in the future, a critical success factor will consider the ability to present the knowledge the company possesses and the way that SKF Nova can contribute to the profit of the SKF group. Since SKF Nova is a knowledge-based organisation, an effective management of knowledge is required.

The study further concludes that SKF Nova can use Knowledge Management to improve the transfer of knowledge throughout the innovation process and can thereby improve the number of successful exits. The Knowledge Management model developed for SKF Nova implies control of the two fundamental drivers of innovation represented by market pull and

technology push. The model represents a suggestion of a potential development process of SKF Nova by outlining three specific practices that can be deployed by SKF Nova to accelerate innovation performance:

- Knowledge acquisition- networking with external centres of excellence and from informal networks with customers, suppliers and competitors for acquisition of scientific know-how and skills.

- Knowledge application by participating in the cross-functional development processes of the recipients within the SKF group. The cross-functional co-operation will give the employees SKF Nova the opportunity to develop a strong network that is necessary to understand the need of the internal customers and thereby improving the ability of SKF Nova to anticipate the future customer demand.

- Active management, refinement and accumulation of the knowledge acquired from the external and the internal networks. The combination of market pull and technology push will enable SKF Nova to package knowledge that considers both radical and incremental innovation.

Summary of the conclusions
In summary these conclusions indicate that SKF Nova can improve the exits to the SKF group by especially three means:

- Through the use of a business model that supports incremental innovation and a business model that supports radical innovation. The two scenarios developed by the study represent two such options.

- Through successful management of the knowledge transfer process. The study concludes that the use of a cross-functional team during the weakest link of the innovation process, i.e. the knowledge transfer, provides one means to manage the knowledge transfer. A new activity of the innovation process called “Design of new business” is suggested to improve the exits. The ITT-typology represents another means to manage the knowledge and technology transfer.

- Through a strategy that manages and supports the combination of the structure required by the regular operations of the SKF group and the flexibility required to be innovative. The Knowledge Management model suggested by the study represents such a strategy.

7.2 Recommendations

This part of the chapter presents recommendations based on the study that can potentially improve the effectiveness of the operations of SKF Nova. These recommendations are based on two arguments fundamental to SKF Nova:

- Independently of the form of innovation SKF Nova will perform in the future, a critical success factor considers the ability to present the knowledge the company possesses and the way that SKF Nova can contribute to the profit of the SKF group.

- Since SKF Nova is a knowledge-based organisation, an effective management of knowledge is required.

To focus on combining Knowledge and Innovation management

1. SKF Nova may benefit from acquiring, accumulating and applying knowledge through combining the three types of networks suggested by the Knowledge Management model of the study. The combined control of market pull and market push provided by the model can potentially serve to improve the credibility of SKF Nova.

2. SKF Nova may benefit from using the Knowledge Management model to develop a strategy considering the future development of edge competencies of SKF Nova. It is essential for SKF Nova that the competency complements the competency of the SKF group.

3. SKF Nova may benefit from the development of concepts that can be re-used in different projects. The concepts, i.e. templates that are relevant depend on what services that SKF Nova will perform in the future. The templates would provide some structure and improve the efficiency and quality of the work at SKF Nova.

To have a clear vision

4. SKF Nova may benefit from clearly defining the future business of SKF Nova, the solution process and the required skills to support the business. It is important for the employees of SKF Nova to have a common goal to strive for. The business scenarios suggested by this study can potentially provide useful inspiration and insights in this work.

To be customer oriented

5. SKF Nova may benefit from adapting to and focusing on satisfying the present and future needs of the potential recipients within the SKF group. The present market situation implies a focus on incremental innovation as suggested by the business scenario called Brain shopping. In the future the need of the potential customers within the group can potentially evolve into also supporting radical innovations, as suggested by the business scenario called In-house innovation.

6. SKF Nova may benefit from careful consideration of the several suggestions of potential future offerings stated by the respondents of the study.

To always prioritise cross-functional projects

7. SKF Nova may benefit from always prioritising working in cross-functional projects that involves close co-operation with team members from the potential recipients within the SKF group. A close co-operation with the internal customers serves to ensure the existence of a common agenda.

8. SKF Nova may benefit from the use of a cross-functional team during the weakest link of the innovation process, i.e. the knowledge transfer. The new activity of the innovation process called "Design of new business" provides one means to manage the knowledge transfer.

To always focus on creating a shared understanding and shared expectations

9. SKF Nova may benefit from always clearly defining the roles and responsibilities of the different functions at an early stage in the project. This ensures that the different stakeholders involved have a shared understanding and shared expectations on the outcome of the project.

10. SKF Nova may benefit from prioritising the creation of sales support material at a very early stage of all projects. This ensures that the different stakeholders involved have a shared understanding and shared expectations on the outcome of the project.

To use the ITT- typology to create success stories based on successful exits

11. SKF Nova may benefit from using the ITT-typology to screen ideas. This would imply early consideration of the capacity existing within the SKF group to mobilise the resources necessary to build up the business. An early consideration of the internal capacity can potentially ensure a successful exit from SKF Nova.

12. SKF Nova may benefit from using the ITT-typology to select an appropriate transfer process depending on the technological uncertainty associated with the technology. This can potentially serve to ensure a successful exit from SKF Nova. The study conclude that there are specifically three situations where the SKF Group could potentially benefit from the ITT typology in the future:

- Transfers of knowledge and technology from external networks into SKF Nova
- Transfers of knowledge and technology from SKF Nova to the divisions
- Transfers of knowledge and technology from the divisions through external customers

To be a unique resource

13. SKF Nova may benefit from acquiring and maintaining edge competence considering idea gathering, screening and selection. Knowledge in these areas has potential to make SKF Nova a resource with unique competence within the SKF group. The study reveals that there is a lack of competence concerning idea gathering, screening and selection within the SKF group.

To focus on refinement of the image of SKF Nova and selling SKF Nova to the SKF group

14. The new financing of SKF Nova enhances the need of organising some kind of a Sales function at SKF Nova. A selling goal and a way of regular measurement of the selling efforts and of the selling results must be defined. Since the survival of SKF Nova is dependent on the ability to define and sell its services this is an extremely important aspect. It is important that the responsibility of selling SKF Nova is explicitly allocated. It

must to be everybody's responsibility to sell projects to the SKF group. At the same time it may be most efficient to have one or a couple of persons responsible for the coordination and follow-up of the selling efforts. Further the responsibility for anticipation of the future competence needs and development of the promotion material of SKF Nova needs to be allocated.

15. SKF Nova may benefit from the creation and maintenance of an exhibition case in the SKF headquarters. Presentations, workshops and the Internet provide additional important means to promote SKF Nova.

7.3 Suggestions for further research

The findings of this study indicate that SKF Nova would benefit from a combination of the know-who approach and the library approach to knowledge management. Re-use of explicit concepts and processes could potentially improve both the quality and the speed of the work. Further re-use of templates and documented experiences would facilitate the work for new employees. Empirical research is necessary to analyse whether the library approach and the know-who approach to Knowledge Management represent two clearly opposed approaches, or whether the library approach and the know-who approach are or will be converging.

Vast theoretical evidence claim that large companies to have difficulties do combine the large and rigid structure necessary to obtain economies of scale with the flexibility needed to effectively perform innovation. An interesting field of study would be to explore the different possibilities to organise innovation and to determine whether some structures are more efficient than the others are. Are there other possibilities to organise innovation than having a greenhouse that performs innovations clearly separated from the rest of the organisation versus performing innovation in the regular line organisation?

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Göran Lindsten, Manager Ceramic Bearings
Jonas Nilsagård, VP, CPAC Systems
Viktoria Wikström, Manager Coated Bearings

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Sven Göthberg, Manager GAM Trucks Scandinavia, Automotive Division
Hans-Erik Maack, Manager New Business Development, Norway, Industrial Division
Helmut Salsland, Manager Service, Scandinavia, Service Division

Patrick Delombre, Marketing Project Manager, Industrial Division
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Johanna Björkner, Business analyst, SKF Nova
Daniel Edberg, M.Sc., Business analyst, SKF Nova
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Vello Klaassen, Deputy Managing Director, SKF Nova
Per Malmberg, Project Manager, SKF Nova
Veronika Rundkvist, Idea Management, SKF Nova
David Simonsson, M.sc., Manager Idea Management, SKF Nova

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9 Appendix

9.1 Detailed description of the process to support In-house innovation

This part of the study intends to present a detailed description of the process developed to support the business scenario called In-house innovation. The activities described below shall not be considered to be imperatives. It has been previously claimed that creativity is needed to perform innovation. Creativity requires the capacity to consider the unique characteristics of each business idea. The process outlined below shall only be used to give general guidelines and must be tailored to match the unique circumstances of each project. One of the most important aspects to consider for each project is the uncertainty associated with the technology. The more radical the idea is the more uncertainty is implied which implies an increased need of close cross-functional co-operation.

My recommendation is to use the detailed process below as a checklist to control that no essential activity has been left out. Most of the activities included in this description already compose part of the existing innovation process of SKF Nova. The activities described below assume that SKF Nova in the future will use the Knowledge Management model suggested by the study.

9.1.1 Activities to be described

The study reveals that knowledge considering three specific areas is most critical to obtain a successful exit from SKF Nova. A specific activity has been added to the innovation process of SKF Nova to assess each of the critical areas. The new activities are called: Project directive, Design of new business and Final knowledge transfer. A detailed activity description considering the new activities will be performed below. Since the respondents of the study have expressed a strong need for a process that consider the gathering, screening and evaluation of ideas, these activities have been assessed by the study and will accordingly be described below.

9.1.2 Idea phase

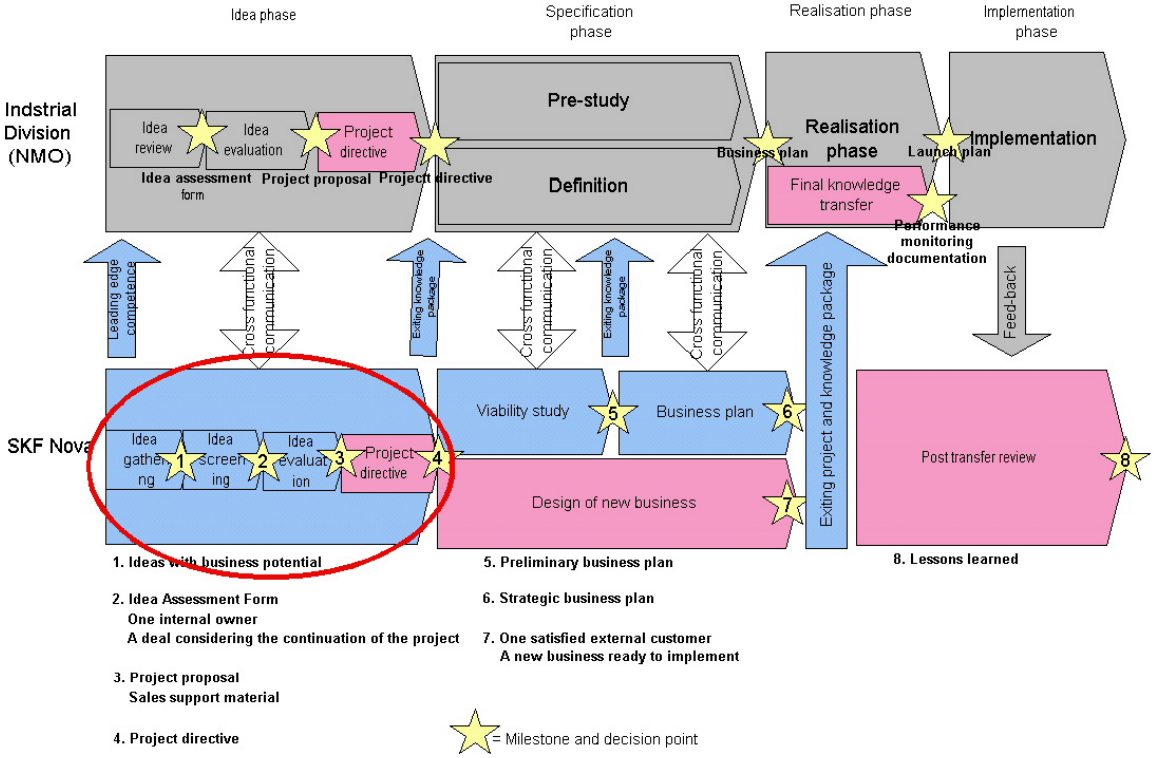

Figure 41 - The activities of the Idea phase, (Hanna Janzon 2001).

The table presents the purpose of each activity of the idea phase.

Activity	Purpose of the activity
Idea gathering	*To generate ideas with business potential and to ensure a common understanding of the customer need*[363]
Idea screening	*To make sure that the ideas gathered are:* *In response to competitive requirements* *Capable of delivering customer needs and technically feasible* *Consistent with strategic objectives of the SKF group* *To find an internal owner* *To make a deal considering the continuation of the project*
Idea evaluation	*To examine and refine the potential business opportunity and technical capabilities* *To determine the appropriate transfer process (required level of cross-functional co-operation) based on the uncertainty associated with the technology* *To determine whether it is possible to mobilise the internal resources required to implement the new business within the SKF group* *To prepare and present the sales support material at an early stage*
Project directive	*To allocate clear roles and responsibilities* *To allocate clear roles and responsibilities* *To set up an appropriate innovation process together with the customer* *To create a project directive*

Idea gathering

The purpose of the activity is to generate ideas with business potential and to ensure a common understanding of the customer need[364]

- Present the ProNova material to potential customers within the SKF group
- Continuously adjust the promotion material to reflect the development of SKF Nova to give a realistic and trustworthy picture of the way of working

[363] The term customer here refers to the potential recipient within the SKF group.
[364] The term customer here refers to the potential recipient within the SKF group.

- Generate ideas with business potential from the network within the SKF group
- Generate ideas from the external creativity network

Deliverable: Ideas with business potential

Idea screening
The purpose of the activity is to:

- Make sure that the ideas gathered are:
  - In response to competitive requirements
  - Capable of delivering customer needs and technically feasible
  - Consistent with strategic objectives of the SKF group
- Find an internal owner
- Make a deal considering the continuation of the project

Make sure that the idea is in response to competitive requirements
- Describe the existing reality of the potential end-users of the product
  - Is there presently a solution to the end-user need?
  - Describe how this works

Make sure that the idea is capable of delivering customer needs and is technically feasible
- Describe the potential future solution
  - Estimate the perceived end-user value of the idea
  - Proposed tool: Monroe's value definition[365]
  - Determine the customer satisfaction targets

  - Do the perceived customer value exceed the cost of the technology?
  - Check the technical feasibility

- Motivate why the future solution is better than the old solution from a customer perspective.
  - Why do a potential customer prefer the future solution?

- Contact relevant representatives of the sales force to get their input considering the potential of the idea

- Do the idea concern incremental product development or radical innovation?
- Proposed tool: A market technology assessment tool[366]

Make sure that the ideas are consistent with the strategic objectives of the SKF group
Innovation represents value adding if it contributes to the long-term competitive advantage of the SKF group. Do the idea has potential to contribute to the long-term competitive advantage of the SKF group?

- Evaluate if the idea fit the SKF strategy. The fit with the SKF strategy and the possibility to succeed with the proposed solution is better if the answer to the questions below is yes.[367]

[365] Please refer to: "Toolbox for SKF Nova".
[366] Please refer to: "Toolbox for SKF Nova".

  - Do we know the customer?
  - Do we control the unique technology?
  - Do we possess knowledge concerning the aspects of production?
  - Proposed tool: the Hax analysis.[368]

- Fill in an idea assessment form

Find an internal owner
- Present the idea assessment form and the rest of the material gathered to potential internal owners
- Make sure that there is a clear commitment from an internal owner before entering the next phase
- Accommodate a preliminary team responsible for the idea evaluation

Make a deal that consider the continuation of the project
Some important aspects to consider in the deal have been identified below:

- Statement of ownership
- Clearly defined roles and responsibilities for delivering the idea evaluation
- A clear definition of the purpose and expected output of the project
- An identification of relevant contact persons and communication requirements during the idea evaluation
- A Gantt chart covering until the next gate
- An approximation of the potential future profit that can be expected from the project
- An approximation of the realistic price that SKF Nova can charge based on the value perceived by the internal customers

Deliverable: an Idea assessment form issued, one internal customer, a deal considering the continuation of the project

Idea evaluation
The purpose of the activity is to:
- Examine and refine the potential business opportunity and technical capabilities
- Determine the appropriate transfer process (required level of cross-functional co-operation) based on the uncertainty associated with the technology
- Determine whether it is possible to mobilise the internal resources required to implement the new business within the SKF group
- Prepare and present the sales support material at an early stage

Examination and refinement of the potential business idea
- Explore the external business prerequisites of the idea
  Proposed tool: Porter's Five Forces Model[369]

- Explore the internal prerequisites of the idea

[367] Interview 2001-11-02.
[368] Please refer to: "Toolbox for SKF Nova".
[369] Please refer to: "Toolbox for SKF Nova".

- Identify the business needs and opportunities to market and deliver consumer requirements
- Evaluate whether the resources and capabilities required by the idea match the competencies of SKF Nova
  Proposed tool: Slywotzky/Morrison's dimensions of business design[370]

Determination of the appropriate transfer process

- Define the requirements posed by the new business considering the appropriate distribution channel and sales channel to be used.

- Determine the appropriate level of co-operation to successfully transfer the knowledge based on the technology uncertainty associated with the technology. This can be done through using the ITT-typology.

Determination whether it is possible to mobilise the required resources

- Compare the requirements posed by the new business with the existing organisation
- Determine the most efficient organisation of the new business
- Make an evaluation of the possibility to mobilise the resources required by the new business
- Verify the evaluation with the potential recipients within the SKF group to ensure a common understanding

Preparation and presentation of the sales support material

- Categorise the type of launch and its degree of impact in the market place
- Consider IPR and regulations
- Prepare the sales support material. The material should motivate the potential product from a customer perspective and an SKF perspective considering
  – End user need
  – Technical feasibility
  – Competitive requirements
  – Alternative products
  – Estimation of the expected customer value
  – Estimation of the expected total sales value
- Present the sales support material to the members of the sales force

- Make a project proposal based on the material produced

Deliverable: a Project proposal, Sales support material

Project directive

The purpose of the activity is to:

- Allocate clear roles and responsibilities
- Set up an appropriate innovation process together with the customer
- Create a project directive

Allocation of roles and responsibilities

[370] Please refer to: "Toolbox for SKF Nova".

- Validate and verify the project proposal with the customers within the SKF group
- Identify and allocate appropriate cross-functional actors
- Accommodate a cross functional project team

Creation of an appropriate innovation process

- Select and set-up the innovation process together with the customer based on the transfer process identified above
- Allocate clear roles and responsibilities for delivering the project
- Identify relevant decision body (based on the estimated sales value)

Creation of a project directive

Some important aspects to include in the project directive are:

- A statement of ownership
- An identification of the relevant decision body (based on the perceived future value of the project)

- A clear definition of the expected deliverables of the project
- A clear allocation of the roles and responsibilities for delivering the project
- A clear definition of the stage of exit from SKF Nova
- A clear definition of the roles and responsibilities of the transfer process including an identification of the relevant recipients

- A clear description of the innovation process chosen, the milestones and all activities to be performed

- An identification of the expected communication requirements during the project

- A Gantt chart
- An approximation of the realistic price that SKF Nova can charge based on the value perceived by the internal customers

Deliverable: a Project directive

Zairi (1999) suggests further deliverables of the idea phase.[371]

9.1.3 Specification phase

The detailed description below will only consider the new activity that has been suggested by this study to improve the innovation process of SKF Nova. The new activity of the specification phase is called Design of new business.

[371] Please refer to: "Toolbox for SKF Nova".

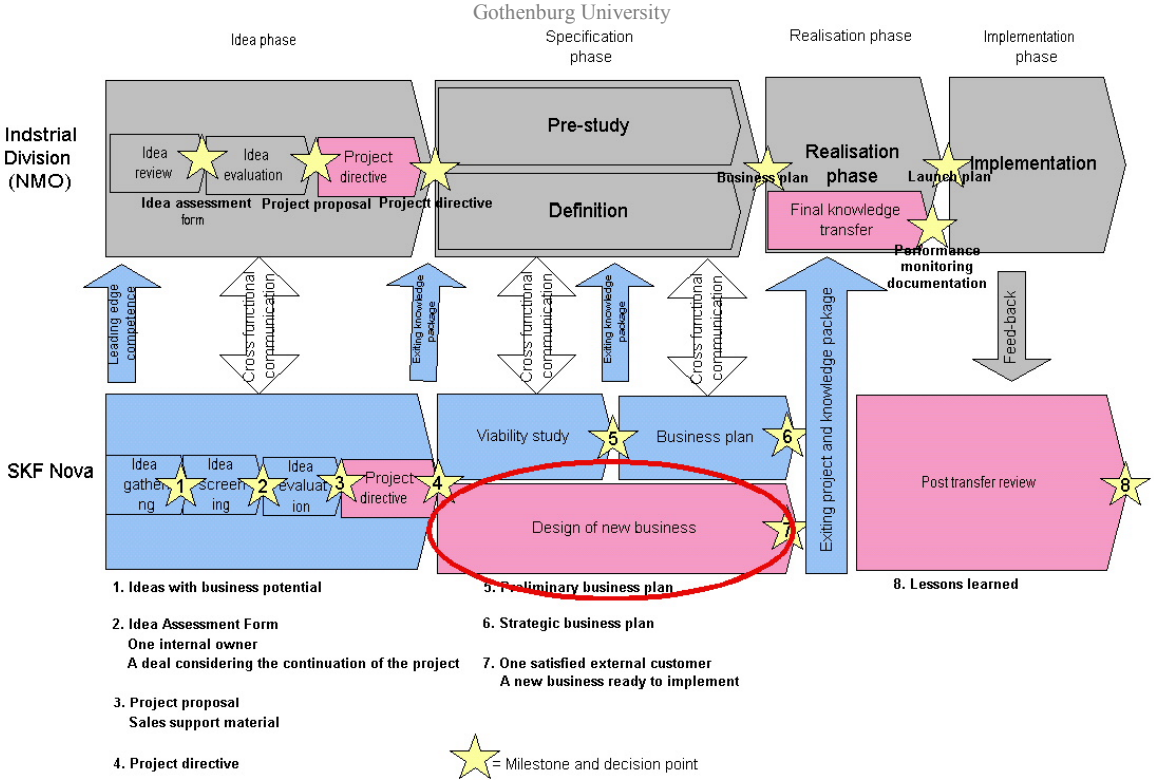

Figure 42 – The new activity called Design of new business, (Hanna Janzon 2001).

The table presents the purpose of each activity of the specification phase.

Activity	Purpose of the activity
Design of new business	To mobilise the resources required supporting the creation and eventual implementation of the new business within the regular operations of the SKF group. To find a first external customer[372]
Viability study	To further develop the idea by checking technical feasibility, setting performance targets in terms of quality, cost and delivery.
Strategic business plan	To complete the business case.

Design of new business

The purpose of the activity is to mobilise the resources required to support the creation and eventual implementation of the new business within the regular operations of the SKF group.

Mobilisation of the required resources

The empirical findings of the study reveal that successful innovators do use a cross-functional innovation process to achieve the most effective combination of resources from different functions. The capabilities of SKF Nova are valuable in order to combine the input from the external creativity network and the internal cross-functional project network. The findings of this study suggest that the most successful way to mobilise the resources required by a new business include the involvement of cross-functional actors. The activity called Design of new business includes several suggestions of relevant aspects to be done by a cross-functional team. The cross-functional team serves to reduce the uncertainty of the eventual implementation of the new business in the receiving division.

- Plan the resources, facilities, tooling and skills needed to build up the business

[372] In the cases where the driver of the idea was" market pull", there may already exist external customers. Concerning ideas that originate from "technology push", the customers have to be actively searched for.

- Assess the manufacturing requirements and suitability of existing technologies
- Assess the business needs and opportunities to market and deliver consumer requirements

- Initiate contact with application engineers
- Provide the information demanded by the application engineers

- Sign contracts with suppliers
- Consider IPR and regulations
- Finalise the creation of the material to educate the sales force
- Finalise the creation of the sales support material

- Determine the appropriate roles and responsibilities in the Realisation phase
- Prepare documentation for the recipients within the SKF group
- Insert the product into the business information system of the SKF group
- Prepare relevant documentation needed by the end-user

- Develop a prototype
- Make a test plan
- Verify the test plan with various stakeholders

- Educate the sales force
- Communicate extensively with stakeholders (division, knowledge provider, end-user)

Finding a first external customer
- Present the prototype together with a member of the sales force to end-users
- Use a controller to present the financial business case to external customers

- Sign a contract with at least one external customer
- Prepare a contract book including the contract(s)

Deliverable: A new business ready to implement a first external customer
Zairi (1999) suggests further deliverables of the specification phase.[373]

9.1.4 Realisation phase

The main activities of the realisation phase are not included in responsibilities of SKF Nova. The purpose of the participation of SKF Nova in this phase is instead to ensure a successful knowledge transfer. The recipients within the SKF group are responsible for the main activities of the realisation phase.

The main activities of the realisation phase consider the realisation of the strategic and the operational business plan. The phase also includes the activities required to optimise design using all necessary indicators including those related to quality, cost and delivery. This realisation phase further includes the demonstration of product design stability through iterative pilot tests to check the readiness of the manufacturing process.

[373] Please refer to: "Toolbox for SKF Nova".

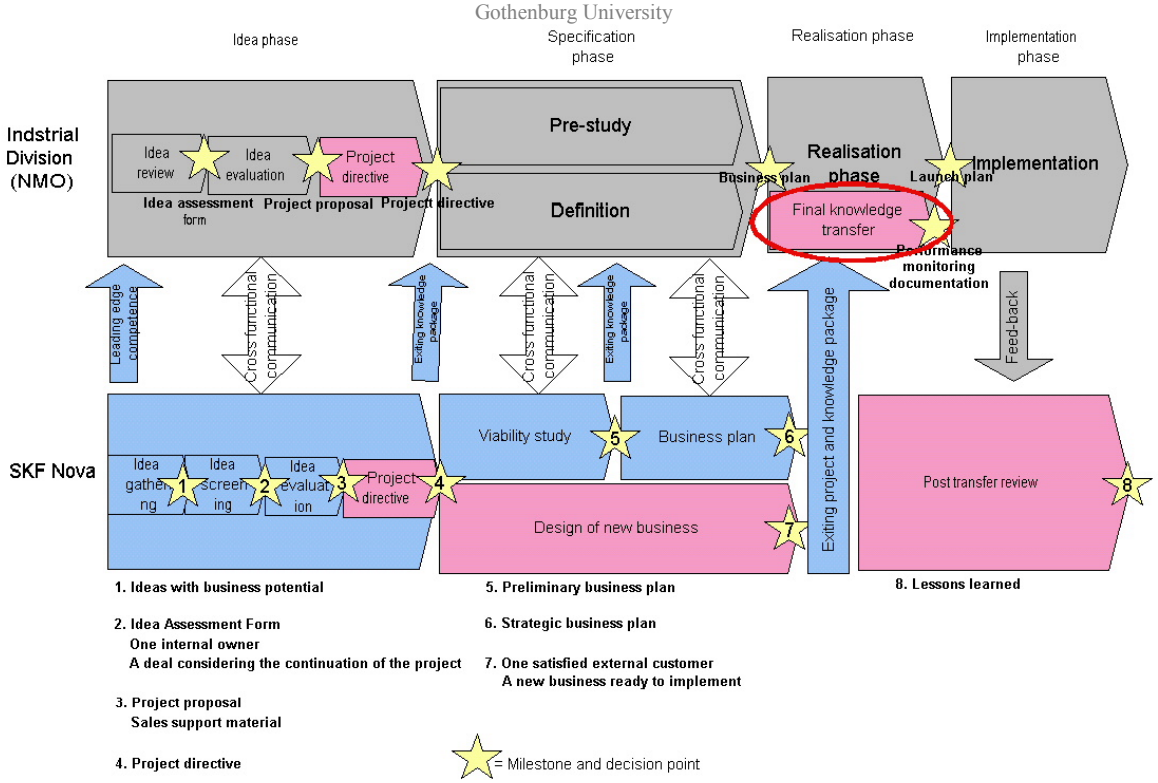

Figure 43 – The new activity called Final knowledge transfer, (Hanna Janzon 2001).

The table presents the purpose of the activity called Final knowledge transfer.

Activity	Purpose of the activity
Final knowledge transfer	To ensure a successful knowledge transfer

Final knowledge transfer

Ensuring a successful knowledge transfer

- Co-operate with the recipients within the SKF group
- Realise the strategic business plan
- Realise the operational business plan

- Monitor performance of knowledge and project transfer
- Ensure sustained value creation
  - – Generate supplier commitments for production intent
  - – Check that design reflects customer needs and that features and functionality are validated against performance indicators of quality, cost and delivery and against customer satisfaction targets by means of iterative development and score testing processes.
  - – Verify supplier commitment and capability
  - – Confirm product design stability before actual spending of funds/ resources for production scale up is authorised.
  - – Pilot production to confirm production conformance to specifications requirements and also for the validation of support documentation

Deliverable: Performance monitoring documentation
Zairi (1999) suggests further deliverables of the realisation phase.[374]

[374] Please refer to: "Toolbox for SKF Nova".

9.2 Tools that SKF Nova may use to add value during the innovation process

9.2.1 Idea phase: Idea screening

Monroe's value definition to estimate the perceived customer value of the product

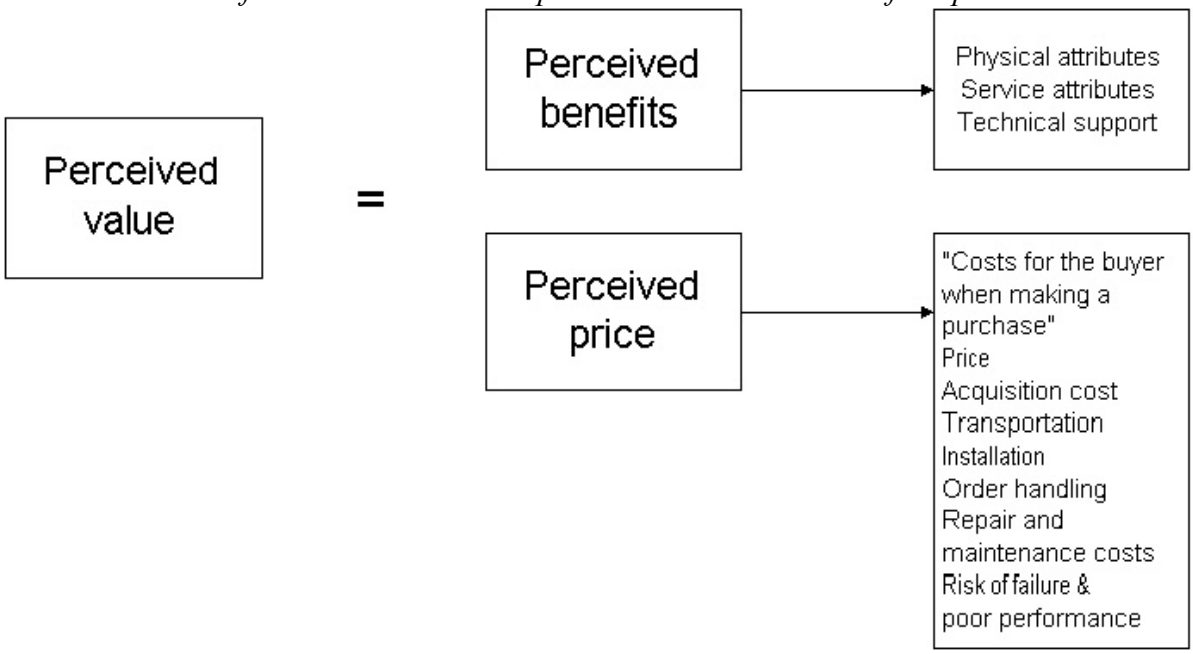

Figure 44 – Monroe's value definition, (Monroe 1999).

A market/ technology assessment tool

The table presents a tool to evaluate whether an idea considers radical or incremental innovation.

Consumer/ Technology	New markets	Delivery of unmet needs	Improved benefits	Existing benefits
Radical new	Breakthrough			
Next generation		Platform		
Upgraded technology			Derivative	
Existing technology				Existing brand support

The Hax analysis
The Hax analysis can be used to evaluate if it is possible for SKF to succeed with the proposed solution. If you are on the right hand side of the dotted line, why waste the investment?

- Will your product achieve a 1, 2 or 3 position in its sector within 1,2 or 3 years?
- Who is your major competitor?
- What are your unique competencies relevant to this market?
- What are theirs?
- When will they try to regain the advantage?

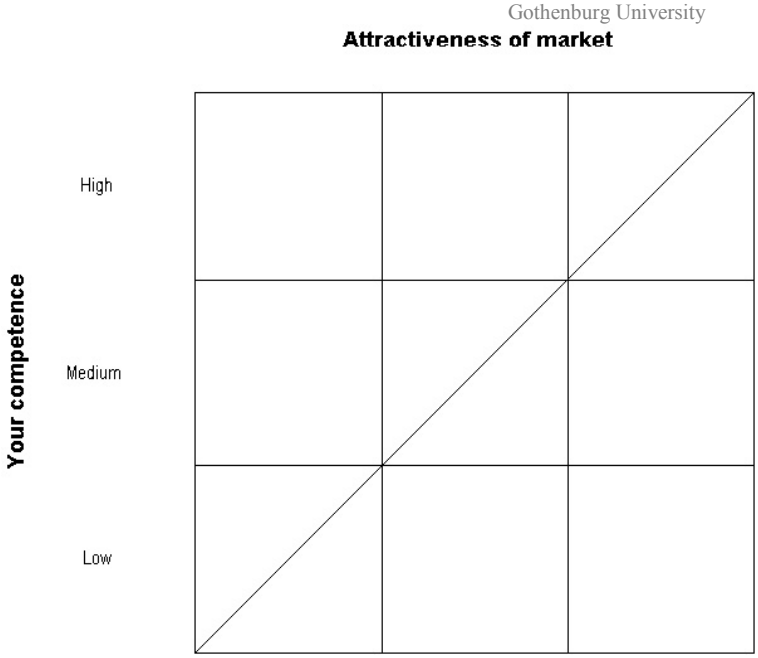

Figure 45 - The Hax analysis, (Harryson 2000).

9.2.2 Idea phase: Idea evaluation

The Five forces model

The table presents the Five-force model suggested by Porter

	Good market	*Poor market*
Barriers to entry	High	Low
Barriers to exit	Low	High
Strengths of customers	Many equal size	Few dominant
Strength of suppliers	Many competent	Few dominant
Availability of other technology substitutes	None as good	Many other options

The dimensions of business design suggested by Slywotzky/Morrison

The table presents the dimensions of business design suggested by Slywotzky/Morrison

Dimension	*1. Customer selection*	*2. Value capture*	*3. Differentiation, strategic control*	*4. Scope*
Key issue	Which customers do I want to serve?	How do I make profit?	How do I protect my value stream?	What activities do I perform?
Key Questions	• To which customers can I add value? • Which customers will allow me profit? • Which customers do I not want to serve?	• How do I capture a portion of the customer value, as own profit? • What is my profit model?	• Why do my chosen customers by from me? • What makes my value proposition unique, i.e. differentiated? • What strategic control points can counterbalance customer or competitive power?	• What products, services and solutions do I want to sell? • Which activities or functions do I want to perform in-house? • Which ones do I want to subcontract, outsource or work with a partner to provide? • How do I bring my offer to the market?

9.2.3 Additional suggestions for deliverables of the Idea phase

The following deliverables originate from studies of innovation best practice.[375]

Marketing
Market/ Consumer requirements clearly defined based on input from internal functions and through market research.
Brand technical/competitive details worked out, linkages determined and initial customer satisfaction goals highlighted.
Preliminary market testing carried out to ensure that work could continue on the idea.
A scoped business case put together to ensure that the proposed launch and size of the market opportunity is commensurate with the business needs.

Technology
Technical assessments completed.
Technical options evaluated and defined from best of breed practice.
Technical strategy clearly defined.
Design for production initiated.
Assessments on materials and supplies completed.

Supply chain
Brand goals developed and completed.
Product performance determined.
Initial manufacturing strategy defined.

9.2.4 Additional suggestions for deliverables of the Specification phase

The following deliverables originate from studies of innovation best practice.[376]

Marketing
Contract book developed for the launch
Market requirements for the brand determined and confirmed, pricing/ forecasts demands, launch configurations, target markets and marketing channels all determined.

Technical development
Product formulation developed based on best in breed practices.
Technical specifications and procedures checked and prepared.
Technology optimisation studies completed for tooling and process lines.
Delivery process of the suppliers completed.

Supply chain
Initial manufacturing plan completed.

9.2.5 Additional suggestions for deliverables of the Realisation phase

The following deliverables originate from studies of innovation best practice.[377]

[375] Zairi, M (1999). p.224.
[376] Zairi, M (1999). p.225.
[377] Zairi, M (1999). p.226.

Marketing:
Global Brand Marketing Plan completed – Business Case updated.
Comments on Launch proposal received from various stakeholders and Global Brand Marketing Plan consolidated.

Technical development
All project specifications completed and management procedures put in place.
Design process completed.
Integrated test plan updated.

Supply chain
Manufacturing production processes completed.
Quality and delivery commitments of suppliers established.
Inventory standards set.
Manufacturing cost variance plan defined.
Supply/ Demand process implemented.

9.3 Quality improvement tools

9.3.1 Required components of an innovative and creative process:

- Techniques for improving an individual's ability to use the creative potential in solving problems. Examples of useful techniques are synetics, gaining an understanding of how the creative mind works, morphological analysis, problem redefinition and the scientific method.[378]
- The construction of a creative environment in which people can work creatively.
- The ability of interdisciplinary groups to work creatively and to their full potential. Equally important is that they work in partnership with each other rather than using individual groups within the organisation to optimise their own capabilities at the expense of wider synergy with other teams and individuals. Examples of useful techniques are brainstorming, hitchhiking, creative listening, creative sessions, trigger sessions, the Taguchi method, association and software approaches.[379]
- Successfully moving from an idea to successful, profitable or beneficial implementation. [380]

9.3.2 Tools for effective project management

A variety of tools can be used for the effective management of innovation. [381]

- Technology assessment and market assessment tools

These tools are used to develop innovation goals and objectives. Matrix analyses are often used. A new product development strategy can be used form this, which will enable the

[378] Zairi, M (1999). P.74-82.
[379] Zairi, M (1999). P.87-97.
[380] Zairi, M (1999). P.74.
[381] Zairi, M (1999). p.217

organisation concerned to decide how to achieve its innovation target, what project types are going to be sponsored, what is the most desirable mix, resource requirement issues and so on.

- An aggregate project plan
  The aggregate project plan is intended to help the organisation decide the right number and mix of projects, the best scenarios for delivering the strategic goals, the best approach for using existing resources and the optimum involvement of people with expertise in managing the various projects.

- A stage gate innovation process
  The stage gate process manages innovation and delivers projects.

- Activity planning
  Activity planning is a micro level, detailed tool to be used so that projects are managed effectively. The following stages are involved in activity planning:
  - Identifying key activities required at each stage of the project and milestones to be reached
  - Identifying the key people to be involved for each activity
  - Clearly identify roles and responsibilities for each task/ activity
  - Produce an estimate of key resources required for each activity
  - Produce a schedule for all key activities

Auditing innovation through effective performance measurement
Measurements are the key trigger for action as it keeps people's minds and energies focused on adding value and are the best means possible for preventing complacency.[382]

The type of measures relevant concerning innovation should be:
- Concerned with speed, cost and quality
- Taken on a regular basis
- Linked to innovation process rather than just concerned with outcomes only[383]

[382] Zairi, M (1999). p.338.
[383] Zairi, M (1999). p.338.

9.4 Definitions

Radical innovation
Radical innovation implies the creation of a new product or service. Radical innovation is often intended to gain new markets. Both of the two previous sentences indicate that there is a high level of uncertainty involved in the creation of radical innovations. This requires a high amount of creativity, which makes it extremely difficult to plan. In order to ensure creativity the development process to perform radical innovations must involve the flexibility to take the unique characteristics of each innovation into account.

Incremental innovation
The study reveals that the concept of innovation can be confusing. Innovation usually means to create something new. Incremental innovation, on the contrary, means maintenance or refinement of the already existing business. I claim that product development is a more appropriate word that should be used instead of the word incremental innovation. I have used the word incremental innovation in the thesis when the respondents have talked about product development but used the word innovation.

The library approach to Knowledge Management
The library approach stresses the importance of codification of explicit knowledge and re-use of already existing codified knowledge.

The know-who approach to knowledge management
Harryson (2000) claims that companies that gain their competitive advantage primarily by sharing and enhancing tacit knowledge for the creation of new and innovative solutions are more likely to gain their competitive advantage from the know-who based approach. [384] The know-who approach – aims more at leveraging tacit knowledge within and beyond corporate borders than reusing documented knowledge. The know-who approach is based on connecting the right people into human networks.

Effectiveness (what)
To do the right thing.

Efficiency (how)
To do something the right way.

Efficacy (feasibility)
Is the system feasible?

Methodology
Refer to a group of methods, i.e. a framework of methods at a Meta level.

Method
A specific method developed to serve a well-defined purpose.

[384] Harryson Sigvald, J. (2000).p.248.

Data
Data are a set of discrete unorganised facts that can easily be stored in computers.

Information
Information is data that is organised, patterned, grouped or structured.

Knowledge
Knowledge is familiarity, awareness or understanding gained through experience or study. It is context rather than content. Compared to information it is richer and contains meaning. Because it is intuitive knowledge is difficult to capture on machines and is a challenge to transfer. According to Quintas, P., Lefrere P. and Jones, G., knowledge adds value to knowledge by providing selectivity and judgement.[385]

Types of knowledge: explicit and tacit
Knowledge exists in explicit and tacit forms. Explicit knowledge includes patents, procedures, best practices and lessons learned. Explicit knowledge is relatively easy to capture and store in databases and documents. Tacit knowledge is the knowledge that people carry in their minds. This type of knowledge generally requires extensive personal contact and trust to share effectively. Tacit knowledge includes scientific expertise, operational know-how, and insights about an industry, business judgement and technological expertise. It is difficult to articulate in writing and is acquired through personal experience.[386]

Project
A project is defined as a non-repetitive, one-off undertaking with a start and a finish.

Product
A product or service. A technical product most often consists of a combination of hardware and software.[387]

Primary product
Represents the main product that is presented for the user. A product has functional and perceived values. The functional value of a product concerns its usability in solving a specific customer need or problem. The perceived value concern the value that the customer actually experiences when using the product.[388]

Secondary product
Is a part or a system that has to do with the functioning and usability of the main product. This can for example concern educational material, sales support and technical manuals.[389]

Concept
A concept here means a template or a general model that can be re-used in different projects. A concept can represent a valuable tool for SKF Nova, for example it can be a template considering how to structure a specific report or process.

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[385] Quintas, P. & Lefrere P. & Jones, G (1997), p.388.

[386] M, T. Hansen & N, Nohria & T, Thierney, (1999).
[387] Ottosson, Stig, (1999), p. 41.
[388] Ottosson, Stig, (1999), p. 41.
[389] Ottosson, Stig, (1999), p. 31.

Process
A process composes more than one activity and can be performed by one or several individuals. The different activities are often separated by a specified milestone when a certain result must be delivered in order to continue into the next activity. A process has a defiend start and end point and a pre-defined goal.

Activity
An activity is a specific task to be performed. Several activities compose a process. Each activity has a specified purpose.

Model
A simplified representation of a system, which illustrates certain aspects of the system. The aspects should be relevant considering the purpose of the model.

System
Everything that receives an input, transforms the input and produces an output represents a system. In order to study a system the boundaries of the system initially need to be defined.

System architecture
The information system architecture represents "the sum of the total of all information related flows, structures, functions and so on, both manual and automated, which are in place and/ or required to support the relationships between the entities that make up the business".[390]

Technology
Technology is any tool or technique, any product or process, any physical equipment or method of doing or making, by which human capability is extended.[391]In the operations context, technology is technical knowledge (or "know-how") applied to improve an organisations ability to provide products and services.[392]Improvement includes extending, augmenting, refining or replacing some elements of the organisations operational processes and value-adding capabilities in order to achieve one or more functional objectives such as: technical performance enhancement, capacity increases, flexibility and variety increases, conformance quality improvement, personnel skills development, cost reduction and task and process time reduction.[393]

Typology
A typology is a conceptually derived classification scheme where the classifications are ideal types, each of which represents a unique combination of organisational attributes. [394] A typology is an application of the configurational approach to the study of an organisational phenomenon.[395]It allows researchers to express complicated and interrelated relationships among many variables without resorting to artificial oversimplification of the phenomenon of interest.[396]

Exit

[390] Zachman. (1978).p.9.
[391] Tatikonda, M. & Stock, G. (2000). p. 720.
[392] Tatikonda, M. & Stock, G. (2000). p. 720.
[393] Tatikonda, M. & Stock, G. (2000). p. 720.
[394] Tatikonda, M. & Stock, G. (2000). p. 720.
[395] Tatikonda, M. & Stock, G. (2000). p. 720.
[396] Tatikonda, M. & Stock, G. (2000). p. 720.

An exit here represents a transfer of responsibility from the smaller SKF Nova system to the system of the SKF group. The responsibility involves receiving, implementing and utilising new technology knowledge.

"To be in traffic"

"To be in traffic" is an expression used by the representatives of the SKF divisions. The expression refers to the ability of an employee to make associations and to trace patterns in the technology trends and between the internal divisional projects. The expression includes the ability to find and combine different technologies into a useful package.

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