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The Innovation Value Chain

Eight case-studies of Swedish manufacturing

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Introduction

Problem Background

Innovation is a concept involved in improving an organisations ability to perform better, be more profitable, efficient or productive through creative activities. By cleverly managing its resources, steering them towards continuous improvements, a company might excel at outperforming its competitors. Innovation in an organisation involves both tangible and intangible assets as well as the composition and infrastructure that unite them. Organisations that develop and manage their knowledge assets usually perform better than those who do not.

So, why does change occur? Or more fundamentally, why do companies innovate? According to Schumpeter (1934), the company is constantly seeking rents, thus the term 'Schumpeterian rents' which per definition involves rents accruing to firms who innovate faster and/or better than competitors (Galunic & Rodan, 1998). In terms of productivity-enhancing process innovations the purpose lies in producing more efficiently, leading to cost advantage over competitors which in turn allows the company to gain a higher mark-up at the current market price. A product innovation on the other hand, allows the company to gain a temporary monopoly position in terms of a technological head start or patent advantages. Even though Schumpeter figured this out in the thirties, his explanation is valid yet today. Of course, the competitive environment has changed many times since then, and competitive factors of today are very different from those relevant in the past.

Innovation occurs in different shapes. It can be a technologically new product whose technological characteristics or intended use differs from that of previous products. It can also be a technologically improved product, suggesting that an existing product has been significantly upgraded or enhanced in its performance. Innovation might also arise in terms of technological process innovation where changes in equipment, production organisation or the two in combination occurs as result of new knowledge. In this thesis, no distinction will be made between product innovation and process innovation in terms of investigating its origin (OECD Oslo Manual, 1997). In the Oslo Manual, when analysing the innovativeness of firms, both types of innovations are pooled under same expression; Technological Product and Process (TPP) Innovations where the term "product" covers both goods and services. Indeed, Pisano and Wheelwright (1995) supports the notion of managing both products and processes simultaneously when innovating. Although their research is based on high-tech companies where product technology rapidly evolves their conclusion that "manufacturing-process innovation is becoming an increasingly critical capability for product innovation" is valid in many other industries as well.

Problem Formulation

The connection between innovation and a steady stream of new and improved, added-value, products and services that would enable a business to achieve higher margins is disputed. However, there resides a general consensus within the academic community regarding the implications and importance of innovation for organisations long-term profitability and survival. This clear connection between sustainability and innovation compel many organisations to dedicate both time and resources into the establishment of an 'innovative organisational structure'. This becomes transparent when consider the number of organisations that proactively seek after a means to become ever innovative to outperform competitors and ensure future survival. This behaviour becomes more transparent in the developed world, as firms operating within these environments are facing stiffer competition from both one another and firms from the developing world as trade barriers continues to decrease.

Now that we are fairly certain as to what innovation means and also why it is needed. Then the question arises as to how innovation is created, stimulated and managed. In answering these questions, an in-depth study of current theories around the subject is to be made as well as a thorough discussion as to how these theories interconnect and depend on each other. Furthermore, tests are needed in proving the validation and reliability of the theoretical implications.

Research Question -koppling till

In order to identify factors that drive innovation and test those on Swedish manufacturing firms the following research question will be used:

- To what extent do contemporary Swedish manufacturing firms foster an organically innovative environment?

Purpose

Identify what factors drive innovation from a theoretical perspective and then use these to assess Swedish manufacturing firms' innovativeness.

Methodology

Research Framework

In the initial stage of our research it was of our understanding that our research problem would require thorough investigation of a particular phenomenon as well as extensive documentation from an empirical perspective. This is reinforced as the scope of this research problem touches upon what we believed to be fairly open topics for discussion, namely: Where does innovation stem from? How do firms stimulate such an environment? How do firms capitalize upon this? These factors, in combination with our apparent lack of knowledge within the field of our research problem, forced us to start our scientific journey using an exploratory approach to gain an understanding of the problems at hand. Nonetheless, after a preliminary investigation, which enabled us to gain interesting information within the field, we overcame these issues when noticing that there was a rather consistent view regarding the evolution and capitalisation of innovation.

Following this, our initial task has been to consider what would be the most appropriate approach to tackle our research problem. Consequently, we needed to assess and determine the most suitable approach. We believe that great emphasis has to be put into this as it is a critical and difficult step since it would facilitate a reduction in various forthcoming setbacks when writing a thesis. In fact, it is practically impossible to evaluate and clearly identify all the obstacles, concerns, and problems that might arise throughout a research project. It is therefore important to develop a structure of the research process which would minimise these obstacles, concerns and problems and ensure a smooth sequence of procedures.

There exists a number of different ways to structure a research process when trying to solve a problem, according to Yin (1994). However, the commonly used strategic approaches, respectively, have their own inherited advantages and disadvantages and are further best applicable under specific research conditions. Nevertheless, as this research problem involves what we believe to be several different issues with varying research focuses, a difficulty in identifying the most appropriate research strategy arises. We therefore believe that the best way of structuring this research and ensure the necessary smooth outcome is to divide the research question into differing ‘sections’ or ‘areas’. The main argument supporting this approach is that these different areas would enable us great freedom to deeply explore several areas of the research problem. It further clearly determines what type of data which needs to be gathered for each specific area.

We thus decided to divide the research problem into more manageable areas of further research by using the design display approach in order to minimise the separate sections deviation from the research problems. Indeed, Miles and Huberman (1994) seem to support such an approach. They suggest that using displays is a way of ensuring that each step in the data collection, methodology, and analysis of a research project fits together to create a logical and cohesive whole. Although aware that this methodology might seem a bit unorthodox and somewhat unusual, we firmly believe it to be suitable for this particular approach. We therefore initially set out to construct a display in which our research problem was split into smaller areas of investigation.

This research strategy quickly proved to be of great assistance, as we not far into the research process encountered a number of unfortunate setbacks that forced us to alter our research focus. Indeed, our initial intent to conduct a qualitative in-depth study within a selected company became unfeasible after a series of unfortunate events and circumstances. This initiated a sequence of alterations regarding our research focus and method, as new problems regarding the validity and reliability of our research became apparent with these amendments.

The initial setback forced us to shift our focus from and in-depth qualitative case study to a quantitative case study. However, this quantitative approach later proved itself to be neither academically or scientifically viable, as the depth proved to be very limited. A second amendment was therefore required to regain the reliability of our research. We thus set out to widen the scope of our research as it lacked the depth necessary, by gaining additional company sources. Our problem regarding reliability of the quantitative method continued despite the attempts to gain additional scope. A final alteration was thus to retrieve our initial quantitative method with the difference of opting for a wide instead of a deep scope.

Nonetheless, as we decided to divide the research problem into manageable parts, the effect of this cause was only apparent in one area of our research and thus became more manageable than it otherwise might have been.

Research Design Display

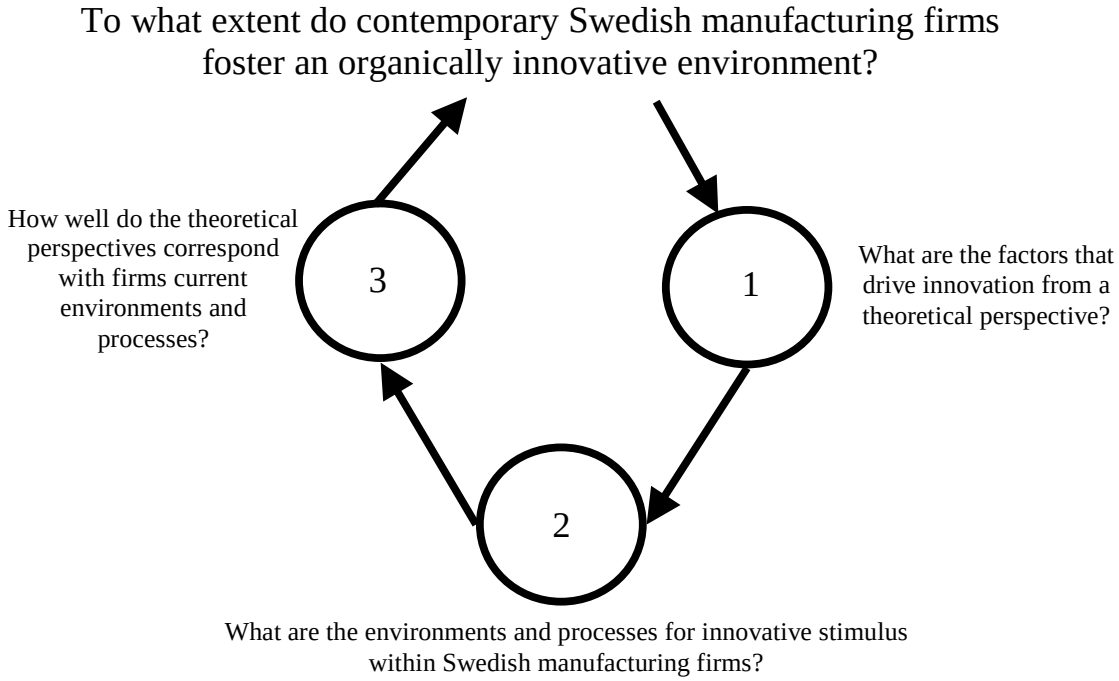


Figure 2.1 – Research Design Display

Figure 2.1 illustrates how our initial research problem was fragmented into separate manageable areas, and thus describes the adopted research design. This division into manageable fields not only assisted in minimising the impact of problems but also helped us to divide and pay specific attention to separate research areas, or as in our case: research questions. These areas operate in a kind of symbiotic manner yet act as independent research scopes, which subsequently enabled us to thoroughly investigate each field by adopting the most appropriate research strategy.

To answer the first research question it became apparent that we were required to investigate, assess, and analyse the current theoretical theories, models, and conclusion currently available. This was necessary in order to gain a clear picture of the evolution of innovation as well as account the state of the research conducted within the field. Indeed, a set of criteria was needed to benchmark and judge whether or not Swedish manufacturing companies actually foster an innovative environment or not. The first section is consequently devoted to clarifying and identifying theoretical aspects and theories that drive and foster innovation within firms.

Information which would enable us to gain a picture of current firms' environments and processes that stimulate innovative behaviour is necessary to answer the research question. In fact, this is a critical step in answering our research problem. The second research question is thus created to highlight and identify the varying firms' respective environments and processes that stimulate innovative behaviour.

Following the completion of the two prior investigations, an analysis of the participating firms' actual innovative abilities is achieved through a comparison with the collected theoretical and firm data. The identified theoretical framework will thus act as a measurement of how 'ideally' a firm should act to obtain the maximum amount of innovativeness and its compliance with the 'actual' behaviour of Swedish manufacturing firms. Hence, this would facilitate a demonstration of the degree of compliance or divergence firms actually have in comparison with 'ideal' theoretical solutions.

We believe that when these research questions are fully and a thoroughly studied a significant amount of information can be obtained, both theoretical and empirical. The comparison of the theoretical framework and participatory firms would then allow us to draw valid generalisations regarding Swedish manufacturing firms' abilities to foster an innovative environment for organic growth. Hence, it would permit us to formulate clear and relevant conclusions.

Conducting the Research

Another vital issue that arises after determining the research design is how to collect relevant information in an efficient way. The assumption that objectivity is virtually impossible to overcome becomes valid when considering that every research approach has shortcomings in terms of objectivity. Indeed, this is supported by Bill Gillham (2000) who argues that human intelligence is by nature selective. We therefore decided to adopt a set of rules or values when it came to collecting evidence. However, these rules would not guarantee complete objectivity, but we nonetheless wanted to avoid falling into the trap of 'uncritical subjectivity'. As such, we adopted a set of rules that we needed to follow throughout the course of this thesis when gathering, processing, and analysing collected data, to minimise or preferably eliminate falling into this trap. The set of rules can be summarised as follows:

- Always keep an open and critical mind
- Always look out for contradictory data
- When investigating a specific issue, always use the most reliable and objective sources

It became apparent in the initial stage of our research process that the research data needed to be gathered in a different manner, regarding the separate questions, mainly as these tackle differing areas. We consequently explored which methods would be most appropriate and thus opted to implement these when answering the different research questions.

Research Area One

In order to fulfil the first research question, an inductive approach has to be taken. Indeed, in order to fulfil the objectives, we assumed that an extensive literature review of numerous theories, models and conclusions had to be conducted. As the success of the analysis is highly dependent upon the theoretical validity, it is of utmost importance that the theories discussed remains relevant. Indeed, this becomes apparent when considering that we needed to develop a theoretical framework as a basis for our analysis and interpretation of the further data. It is therefore not merely enough to collect facts and describe what it is; rather it requires an assessment and analysis of the collected facts to aid the formation of independent thoughts and concussions.

Extensive theoretical data was thus gathered from published authors in well known and respected publications, within the academic community, to elaborate on a coherent and valid theoretical framework. Various practical case examples where additionally highlighted in our theoretical framework to further enhance the credibility of our suggested theoretical framework. This culminates with the holistic case presentation of 3M's inspiring environment to stimulate innovative behaviour. 3M was primarily selected because of its widely known proactive behaviour to stimulate innovative behaviour. In fact, innovation is perceived within 3M to be their primary source of competitive advantage. These factors would nonetheless enable us to diminish or eliminate possible discrepancies and contradictions, thus permit us to derive relevant generalisations from the works already published by experts within the field of innovation.

Research Area Two

Research field two would require a deductive approach, as its main intention is to reflect and determine the actual innovation stimuli among Swedish manufacturing companies. In our perspective, to enable a valid and holistic 'snapshot' of Swedish firms' current innovative trends, there is a necessity to gain a reasonably degree of both depth and scope. This was overcome by setting out to conduct both qualitative and quantitative methods within the participating firms. However, this would prove to be rather difficult, as many firms declined to participate and those who did were often reluctant to conduct the

extensive research required. Hence, most companies would only participate within a qualitative survey.

Nonetheless, company information was gathered through a primary qualitative in-depth interviews and a quantitative web-based questioner. Although various methods could be used for collecting data, we opted to choose these as they seemed to fit our intent. Indeed, it gave us the opportunity to quickly gain an overall firm perspective with the use of the web-based questioner and an in-depth with the interviews. It furthermore made it feasible to gain the necessary scope required for our research problem within the limited time frame. Combining an in-depth interview with a questionnaire survey would assist us in avoiding each of these approaches' inherited methodological weaknesses and consequently strengthen the validity of our study. Preliminary tests and interviews, regarding both approaches, were conducted to identify probable weaknesses and inconsistencies as well as assessing the content, structure and understanding of them. Identified flaws within these preliminary tests and interviews were amended and revised to strengthen both the validity and reliability of our thesis.

The primary studies were complemented with secondary company information from internal data, leaflets and annual report to fill and extend potential gaps and questions. Additional telephone and e-mail follow-up interviews were also conducted to fill in gaps and gain further information, if deemed necessary. This rather extensive research was intended to further strengthen the reliability of our research and validity of the answer to our research problem.

The companies that participated in our research were selected using a purposive sampling procedure, when we knowingly selected and contacted a number of firms which shared similar characteristics. Critical variables when selecting these companies were, besides the necessity of being Swedish manufacturing firms, that they were large internationally operating firms. However, this initial intent was somewhat undermined as many of the intended companies were reluctant to participate.

The gathered information could, nevertheless, be perceived as fairly subjective in the sense that it originates from the companies themselves. Indeed, drawbacks to our validity and reliability became apparent to us during the course of the research as information sometimes was perceived as more of a 'marketing' and 'politically correct' nature than reflecting reality. Information retrieved was thus scrutinised extra to remove doubtful data and hopefully minimise or avoid that trap of uncritical subjectivity, and as such facilitate the emergence of the actual environment. Further stressing the need of careful examination

was the fact that answers sometimes were somewhat evasive regarding certain questions and at some points.

Quantitative Web-based Questionnaire

The quantitative web-based questionnaire was purposely sent to employees within the participating firms, to gain the general thoughts and feelings within the organisations regarding innovation. The questionnaire consisted of structured questions, with a varying degree of multiple-choice, dichotomous and scale questions (Appendix X). These types of questions were used to derive as sufficient amount of unbiased information as possible from the requested short questionnaire (participating firms requested a short questionnaire).

However, firms seemed rather reluctant to participate in our web-based survey, as the general excuse provided was the lack of time for such a survey. This reluctance affected the required scope, as several firms opted not to participate in the study, as well as the reliability of our research. The firms involved in our survey are listed below:

FOSS Analytical – was sent to employees in varying functions and positions the 5th of December 2004 and collected the 5th of January (10 respondents).

Gambro – was sent to employees in varying functions and positions at the Lund office the 23rd of December 2004 and collected the 5th of January (15 respondents).

SSAB Tunnplåt– was sent to employees in varying functions and positions the 6th of December 2004 and collected the 5th of January (9 respondents).

Trelleborg Engineering Systems – was sent to employees in varying functions and positions the 3rd of December 2004 and collected the 5th of January (18 respondents).

Respondents were to originate from varying positions and divisions within the organisations, so that the holistic view required regarding the firms' innovative abilities could be obtained. The questionnaire was to be distributed by a contact person at each company to improve the response rate. However, it afterward became apparent that these questionnaires often were sent to a limited division or parts of the organisation, which significantly limited the reliability. Further hampering the reliability was that the questionnaire seemed to be perceived as a voluntary and not a mandatory survey as intended. This became apparent with the unit non-response rate, referring to the relatively low response rate received from the participating companies' employees. An additional problem which further weakened the reliability of the survey was the item non-response, hence the fact that a number of questions were left blank.

Appropriate methods that possibly could overcome these problems were assessed, such as imputation. Although the item non-response could be surmounted, the high unit non-response rate proved to be very difficult as it would not allow us to form an objective picture of the current trends through reliable statistical data. The intention of the interview therefore shifted from a holistic to a more descriptive purpose.

Qualitative In-depth Interviews

The backbone of this thesis therefore became the qualitative in-depth interviews (Appendix X), due to the difficulties and barriers of conducting the quantitative research. These in-depth interviews were semi-structured to keep the interviews somewhat structured but at the same time enabling us to follow up on ideas, probe responses and investigate motives and feelings. This rather formalised approach would allow us to thoroughly analyse and explore each selected firms' innovative behaviour, as well as gaining an as truthful picture as possible of the actual environments and process. The guided in-depth structure additionally ensured that all vital topics to the research were covered as well as facilitating the aggregation and comparison of the gathered data.

Not all contacted firms chose to participate in our in-depth study, despite attempts to involve all firms. However, we soon came to the point where we believed that a reasonably response rate of participating firms was reached that would both fit the time scope and ensure validity and reliability. The participating firms and their representatives interviewed are listed below:

Alfa Laval – Fredrik Bertilsson, Innovation Manager, was interviewed at the head office in Lund the 21st of December 2004.

FOSS Analytical– Håkan Wedelsbäck, Team Manager R&D Department FOSS Analytical, was interviewed at the office in Höganäs the 17th of December

Gambro – Ingemar Barman, Assistant Chief Science Officer, was interviewed at the office in Lund the 21st of December 2004.

Husqvarna - Dan Eriksson, Research Manager, was interviewed at the head office in Husqvarna the 30th of December

Nolato – Bengt Erlandson, Manager of Production and Human Resources Nolato Polymer, was interviewed at the head office in Torekov the 15th of December 2004.

SSAB Tunnplåt – Nils Åkerblom, Marketing Director Nordic Region for SSAB Tunnplåt, was interviewed the 22nd December 2004.

Tetra Pak – Sven Andren, Global Process Driver Idea Management, was interviewed at the head office in Lund the 21st of December 2004.

Trelleborg Engineered Systems – Sefan Ekström, General Manager Product Area Agri, was interviewed at its Trelleborg Head office the 29th of December 2004.

Hampering and affecting the validity and reliability of this research is the respondents' different positions within each company, which somewhat affected their respective abilities to answer our questions as we are striving to gain a holistic company picture. It additionally complicated the subsequent analysis through the difficulty that arose when compiling and comparing the gathered company information. In fact, the ideal situation to gain a complete picture from the companies, both the official and unofficial, would be to interview persons with identical positions and conduct a thorough in-depth study covering multiple divisions and organisational layers within each individual case company. Yet the accomplishment of this broad and deep scope was rather limited, as we encountered initial setbacks in our research focus as well as companies' reluctance for multiple in-depth interviews.

Nonetheless, as the aim of our research is to determine general trends among Swedish manufacturing firms regarding innovation in combination with the time allocated for the completion of this thesis, it became apparent that it was out of our scope to both cover a wide range of companies in addition to completing in-depth studies. Moreover, even though we set out to deliberately address the issue of respondents, as it is of critical essence, it became clear this was a hurdle beyond our sphere of control. Mainly as the individuals needed and requested for were in some cases simply not available or reluctant to participate in our in-depth interviews.

Research Area Three

Research question three would require an abductive approach as it is a combination of the inductive and deductive approaches. In fact, there is a need to combine both the theoretical and empirical findings to answer this question. This would further facilitate that valid suggestions and conclusions are to be devised regarding both theory and empirical data, which would hereafter assist us in answering our research problem.

Limitations

We would further like to reaffirm the issue regarding the difficulties in collecting and obtaining reliable data that could be compiled in a constructive manner. Hence, it will therefore reduce the validity and credibility of our research.

This lack of comprehensive company support and insight further limited our abilities to evaluate the direct output of innovative activities, as this would require detailed information regarding the evolution of specific product or process innovations.

Furthermore, in measuring the innovative value of an implemented process or marketed product would involve extensive cost-benefit analysis pre- and post technology change.

Thesis Disposal

A clarification of our choices regarding the design of the research framework as well as the methodology is necessary to provide an overview of our research. It would additionally illustrate the different steps conducted in their respective order. A combination of all our methodological choices is therefore illustrated in a thesis disposal display (Figure 2.2), which enables the reader to gain a clear picture of how we conducted our research.

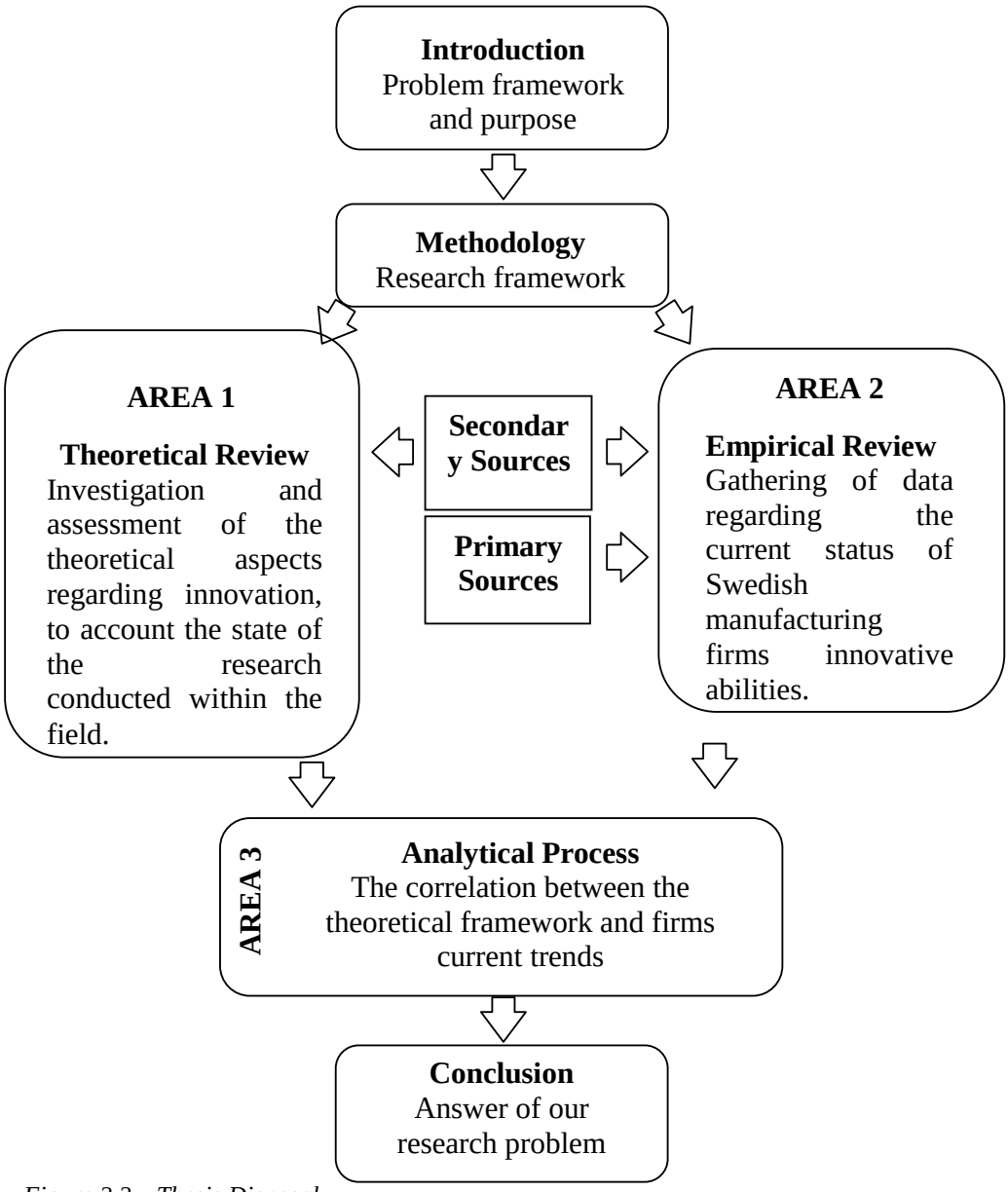


Figure 2.2 – Thesis Disposal

Theoretical framework

What is Innovation?

In literature, there are numerous definitions of the concept of innovation. The pioneering research in the field was done by Schumpeter in 1934. He was the first to recognize the need for organisations to acknowledge innovation as a changing competitive factor and thus also the need to stimulate the creation of innovation (Schumpeter, 1934). Galbraith (1982) describes innovation as a 'process of applying a new idea to create a new process or product', hence separating the activity of innovating from that of inventing. Van de Ven (1986) takes it one step further and defines the process of innovation as 'the development and implementation of new ideas by people who over time engage in transactions with others within an institutional context'. Van de Ven adds to Galbraith definition the notion that an innovation needs transactions, here defined as agreements or exchanges linking individuals to each other within an institutional context. An innovation thus needs a suitable environment in order for the process to be favourable for the innovator. Maidique (1980) further adds to the reasoning, implying that an innovation needs a combination of entrepreneurial, managerial and technological roles in order to be successful. These roles will further be discussed later in this paper.

Teece (1987) defines *innovators* as 'those firms that are first to commercialize a new product or process to the market' thus suggesting that an innovation must be commercialised in the market in order for it to be labelled *innovation*. However, the word commercialisation implies that the product or process needs to generate revenue in order to qualify as an innovation. The authors disagree with Teece on this point as the authors believe that an organisation can be labelled innovative without necessarily putting products or services on the market as a result. The innovativeness within an organisation can also result in new ways to communicate knowledge, improved processes of learning or removing barriers of corporate evolution.

Stimulating Innovativeness in the Organisation

The primary essence of innovation is knowledge linked with creativity. Creativity is fostered by uncertainty, diversity and turbulence that in a sense contradict the essence of strategic planning (Grant, 2002, p.358). This highlights the importance strategic formulations play in an organisation's ability to innovate, and accordingly they should pay careful attention to the organisational processes through which innovations emerge. Hence, the most crucial challenge facing organisations is how to create a dynamic entrepreneurial environment, which motivates the employees' creativity. Thus reinforcing the expression

that the core asset of an organisation lies not within its fixed assets, but within the intelligence, knowledge, skill and experience of employees. Indeed, in a European Commission Green Paper (1996, p.1) concerning innovation the innovative characteristics in a firm are grouped into *strategic* and *organisational* skills;

Strategic skills; long-term view; ability to identify and even anticipate market trends; willingness and ability to collect, process and assimilate technological and economic information,

Organisational skills; taste for and mastery of risk; internal co-operation between the various operational departments and external cooperation with public research, consultancies, customers and suppliers; involvement of the whole of the firm in the process of change and investment in human resources.

In large part coherent with foremost the second skill mentioned above, the organisational aspect, Van de Ven's (1986) builds upon this more knowledge-based view and states that innovation is: "the development and implementation of new ideas by people who over time engage in transaction with others within an institutional order". Using this definition, Van de Ven manages to create a generic framework that enables organisations to foster an innovative environment by focusing on four basic factors; namely new ideas, people, transactions and institutional context. Inherited within each of these four factors and how they relate to each other are four central problems confronting management of innovation: (1) *a process problem in managing new ideas into good currency*, (2) *a human problem of managing attention*, (3) *a structural problem of managing part-whole relationships*, and (4*) a strategic problem of institutional leadership*. Adding to this notion of organic innovation management the OECD Oslo Manual reads:

"The higher-level or systems view of innovation emphasizes the importance of the transfer and diffusion of ideas, skills, knowledge, information and signals of many kinds. The channels and networks through which this information circulates are embedded in a social, political and cultural background, they are strongly guided and constrained by the institutional framework."

OECD Oslo Manual (1997) p. 17

The theoretical reasoning suggesting these questions are further supported in level two and three presented in Xu, Liu, Shen's (2003) three levels of innovation. The second level, *Portfolio Innovation*, involves integrating technology and businesses with customers, emphasising coordination of product and process innovation as well as technology and organisational innovation. The third level, *Total Innovation Management*, focuses on

creating value and enhancing innovation competence through the company's strategy, technology, structure, business processes, culture and people.

In the authors' view, Van de Ven's theoretical framework in stimulating innovation is general, involves the organic innovative processes and proposes problems suited for tests on manufacturing companies as those participating in this study. However, since the problems stated are fairly general and also sprung from but one source there is a need to further explore each problem's correlation to other theories in those areas.

In addition to the four central problems in managing innovation presented in the following sections, subsequently a discussion on what to do with emerging business ventures differing from that of the company's current core business will be dealt with.

Managing a New Idea into 'Good Currency'

Managing a new idea into good currency[1] within an organisation is a process-problem focused on deciding which ideas will be implemented and institutionalized as well as how to perform these actions. While the invention or conception of innovative ideas may be an individual activity, Van de Ven (1986) states that innovation is a collective achievement of "pushing and riding those ideas into good currency".

The Socio-political Process

Social and political dynamics of the innovation process early stages become paramount as one addresses the energy and commitment that are needed among coalitions of interest groups to develop an innovation. In his article, Van de Ven refers to Schön's (1971) model of the social-political dynamics that determine which ideas will be pursued. Schön suggests that pursued ideas either result in an 'innovation' or a 'mistake'. It is simply not possible to determine in advance whether or not an idea will be profitable. This uncertainty is the basis for discussions concerning the promotion and manipulation of people's perceptions of ideas. The first problem in turning an idea into good currency is bringing it up to debate in the company. This debate is not only dependent on the concept of the idea, but also on who brings the idea to corporate attention and who uses it as a mean to gain power. As the ideas are taken up by people with formal or informal power in the organisation, the ideas can provide the supporter with legitimacy and power to change institutional structures. Schön's model focuses on the social-political dynamics of the innovation process. His description emphasizes the idea as the rallying point around which collective action is mobilized. Thus, organisational structures emerge and are modified as the innovation progresses over time. Ideas provide the vehicle for otherwise isolated, disconnected or competitive individuals

[1] Being able to capitalise on an innovative idea.

and stakeholders to come together and contribute their unique frames of reference to the innovation process.

The second part of the problem is how the company can capitalize on the idea, once it has been chosen. Van de Ven (1986) argues that for an idea to be pursued and implemented, it must attract people that are willing to take on the risk of exploring the idea. To overcome this problem, the ownership of the idea must be opened to multiple individualist in order to firstly reduce the risk of the 'Not-Invented-Here'-syndrome and secondly to allow personal opportunities for the people involved benefit the innovation process, that is to have them work for their own goal instead of another person's.

The question is thus, which ideas gain support from the organisation? The answer to this question depends on who it is addressed to. The reasons for this are twofold. First, since the future can not be determined with any real accuracy, it is impossible to prove which idea is the best. The people involved can only discuss and argue the different options and courses of action. The second reason is that the people involved and their frames of references will affect the outcome of the discussions. These implications will be further discussed in a latter part of this text, namely the consequences of institutional leadership.

How an idea is received by an organisation depends in large part on people's perception of the idea. The more radical the idea is, the more resistance and uncertainty it will receive from the organisation. If the idea only involves incremental adjustments it is likely to be accepted, but it will only have a minor effect on the organisation. In order for an idea to survive the discussions and politics, Galbraith (1982) maintains that it will need a sponsor with relatively strong formal or informal power that supports it throughout these processes. A sponsor is a person that chooses which of the ideas in the organisation he thinks should be commercialised and by sponsoring these ideas he uses his authority to promote them. For an organisation to be innovative it is important not only to have people come up with good ideas, but also to have people willing to take risks in sponsoring them. Hence, Galbraith stresses that an organisation can improve its odds of being innovative by recognizing and funding the role of sponsors. To further stimulate risk taking, it is important to reward the successful endeavours as well as to avoid punishment of the unsuccessful ones.

Another way of stimulating innovation is removing barriers of 'skunkworks' defined by Abetti (1999) as unauthorized but tolerated innovation in part of a larger area of underground innovation. In effect, this means that innovational thinking and action is allowed during work time without official sanctioning from management, thus improving the company 'in the dark'.

Lessons to be learned for Corporate Managers

In managing the new ideas Van de Ven consequently suggests three important problems that management needs to address. First, according to Van de Ven, individuals and organisations tend to have a short-term orientation on which problems to focus on, and sometimes feign an appearance of progress. In effect, problems that are addressed are problems that are currently 'in fashion'. Consequently, problems are dismissed as they go 'out of fashion' instead of when solved. This premature abandonment of ideas often leads to a hopeless feeling of being unable to change situations.

The second problem is an inadequate pool of ideas. This problem arises due to difficulties in scanning the relevant environment to get the overall picture needed in order to expand an idea. Idea makers often come up with ideas that address their specific area of expertise. To overcome this, people should try to view the problem from other experts' point of view. The third and most relevant problem is the management of attention which also constitutes Van de Ven's second factor in managing for innovation.

Managing Attention

Left unattended, people and organisations tend to be mostly concerned with maintaining 'business as usual'. By referring to cognitive psychologists Van de Ven claims that the reasons for this lies within psychological limitations of human beings, of adapting to slowly changing environments and of minimizing internal group conflicts. To overcome these problems, management of attention focuses on how to make people pay attention to new ideas and how to trigger people's action threshold. Slowly changing environments never reach a level that triggers an individual's threshold for action, hence individuals are unconsciously adapting to these changes. When people's thresholds for action are finally triggered, the changes usually have progressed to a point where the situation demands a reactive response and the possibility to innovate is thus transformed into a situation of forced crisis management. These forced-upon processes are usually characterized by a defensive attitude from the people involved, often resulting in an outcome likely to be labelled a mistake. To overcome this problem, it is important to have employees that continuously question existing conditions. A minimum requisite for the employees to do this is for them to have the time to think and be innovative.

When people come together in groups and organisations, they tend to minimize internal conflicts and conform to the norms. Hence organisations consisting of people with homogeneous backgrounds will focus on repetitive tasks instead of innovative behaviour. Constant intervention from a strong leader may slow these rudimentary processes down.

Preferably, groups should consist of people with heterogeneous backgrounds, increasing the probability that they will come up with ideas that take 'the whole picture' into account.

An important stimulus for supporting attention is to give employees time to pay attention and ponder on why and what they are doing, as well as what could be done. Van de Ven maintains three problems that managers often overlook. The first is the value of keeping a close relation to customers, as most innovations on a certain field come from the people involved within that field. Secondly, personal confrontation with employees, customers, and sources of problem is likely to trigger people's thresholds for action through strong leadership involving personal confrontation with employees and through that challenge them to progression. This is an effective way of motivating or forcing people to pay attention, but it may also create unwanted stress. Finally, triggering employee's threshold for attention is not fruitful if it does not result in constructive actions. Single-loop learning involves improving what you do, based upon what you have done. Van de Ven instead argues a double loop approach that focuses on what you could do. This may be an effective tool in guiding the organisation into fruitful actions, but it may also create uncertainty leading to defensive behaviour.

Managing the Problem of Part-whole Relationships

The structural problem of managing part-whole relationships, described by Van de Ven (1986), emphasizes the situation were an individual, as a part of the whole innovation process, looses context over the goal convergence riding the idea into. The individual becomes too focused on his or hers specific contribution to the process at hand, hence looses perspective of 'the big picture'. In theory, the ideal situation of managing this problem would be to have specialists in each and every function of the innovation process, work on their specific area of expertise and then have them all coordinated to work towards a mutual goal. In reality however, in a global corporation of significant size, this approach seldom prevails due to lack of communication or misunderstandings between units of separate functions (i.e. scientific, engineering, customers, manufacturers or marketers). As Van de Ven implies, managing the innovation comes down to a collective achievement, and in order to succeed in the process, each and every individual contribution to the innovation needs to be coordinated towards a mutual goal. Every unit or individual working on implementing the innovation needs to concentrate on the specific part at hand whilst also focusing on the whole, which is the successful implementation of the idea. The key issue for management here is coordination and goal convergence. The activities involved in the innovation process needs to build from a shared knowledge platform towards a common goal set by the management in charge of implementing a new idea. Otherwise there is a risk

of two units performing the same activities or having units work contra-productively towards each other.

Managing Knowledge

In order to have a shared knowledge platform, the global organisation needs to be able to understand each other as well as benefit from the collective knowledge of all units. In his article concerning the knowledge-creating company, Nonaka (1991) emphasises the importance of making tacit knowledge explicit through articulation. Explicit knowledge tends to be formal and systematic and thus easily communicated and shared, through product specifications, scientific formulas or computer software. Once explicit, the knowledge can be communicated through the company and internalized in each separate individual's own tacit knowledge base, i.e. within each person's head. Nonaka's suggestion to establish this process is to store "figurative language and symbolism that managers can draw from to articulate their intuitions and insights". A significant part of coordinating the activities related in managing the innovation lies within the communication between various units or individuals in clarifying the stated short-term goals, the institutional long-term goal and correlated activities shared among the constituents of the innovation process.
A common language is needed, as well as the ability of making tacit knowledge explicit in order to share knowledge throughout the organisation. This permits all individuals the same opportunity to use collective knowledge. For example, many of the consultancy firms of today use 'knowledge warehouses' where practical and theoretical information from each and every project is stored in a database where other employees can access the information and apply it to their specific situation.

In an innovative company, the creation of knowledge is interlinked with the sharing of it, which is also highlighted by Nonaka when suggesting that; 'Knowledge creation centres on the building of both tacit and explicit knowledge and, more importantly, on the interchange between these two aspects of knowledge through internalisation and externalisation' (Nonaka, 1994:20). Kotha (1995) sustains that both the creation and the sharing of knowledge can be sustained in mechanisms such as; Team-based quality circle efforts, Work place suggestion systems, Everyday involvement of workers in Kaizen[2],Continuous improvement activities. An example of practical use of these techniques is illustrated in Innovation Highlight 3.1.

[2] Continual improvement of all areas of a company, not just quality.

Innovation Highlight 3.1 - **NBIC**

A possible approach to the issues of creating and sharing knowledge was seen in the Japanese firm NBIC(The National Bicycle Industrial Company), manufacturing bicycles, where one factory focused on mass custom manufacturing, i.e. tacit knowledge resided within each person's head, whereas the other focused on mass production, i.e, mainly explicit knowledge applied by the collective workforce. The managers of NBIC made the effort of rotating top-rated and highly skilled workers between the two different factories in order for them to share both explicit and tacit knowledge.

The highest-skilled workers (craftsmen), using advanced computer-controlled machines, work on unique customer requirements at the mass custom factory. (…) It is in this production setting that these workers both create and internalize their tacit skills in bicycle manufacturing. (Kotha, 1995, p31).

Furthermore, these craftsmen are later required to train other employees in manufacturing processes which literally forces them to articulate their tacit knowledge. Additionally, NBIC instituted a centralised group, consisting of both process and product engineers, in order to facilitate the sharing of information and knowledge between the separate entities in the organisation.

The case of NBIC states that, with proper network technology as means of articulating and transferring tacit knowledge, a company can disperse its intellectual resources throughout the organisation. Garvin (1993) encourages the appliance of the rotation procedure in NBIC and sustain that this method is one of the most powerful methods of transferring knowledge within a firm.

Kotha (1995)

The next step in generating innovations through knowledge sharing is thus to let individuals build from the platform of collective knowledge and by doing so refine the innovative process as it progresses. The Simultaneous Coupling model, depicted among others by Galbraith (1982) suggest that the three functions of R&D, manufacturing, and marketing needs to be coordinated in order to build a collective platform and thus stimulate innovation. The simultaneous coupling innovation process is the follower of the first and second generation of simple linear sequential processes, dominating the view of innovation during the 1960s and early 1970s, where R&D and then manufacturing is directly derived from market demand (Figure 3.1).

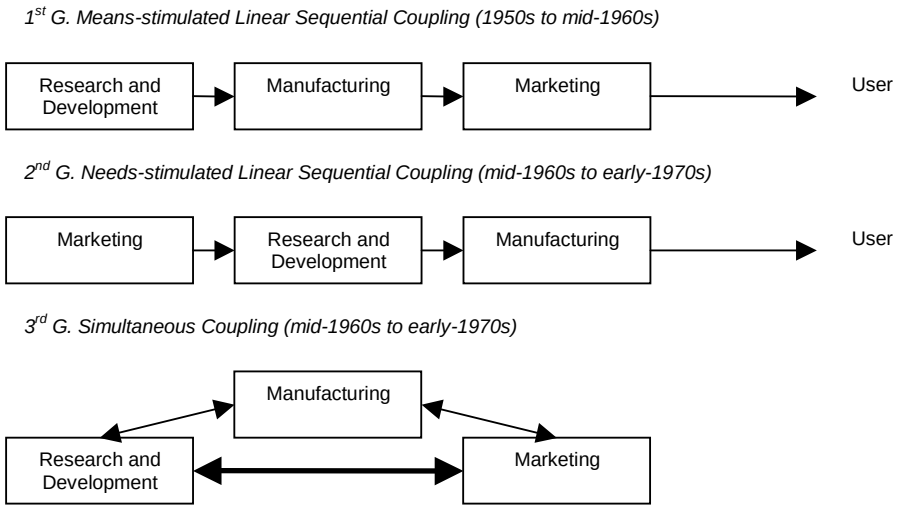


Figure 3.1 – The evolution of Innovation thinking, first to third generation
Source: Galbraith (1982)

Roy Rothwell of University of Sussex, UK, insinuates that Galbraith's simultaneous coupling is but the third of five generations of the continuously developing innovation process. The fourth generation, the integrated model, emerged in the early 1980s and continued as for ten years and was characterized by parallel and integrated development teams where the company sustained a close connection with leading-edge suppliers and where the products were designed in collaboration with suppliers to be easily manufactured (Rothwell, 1994).

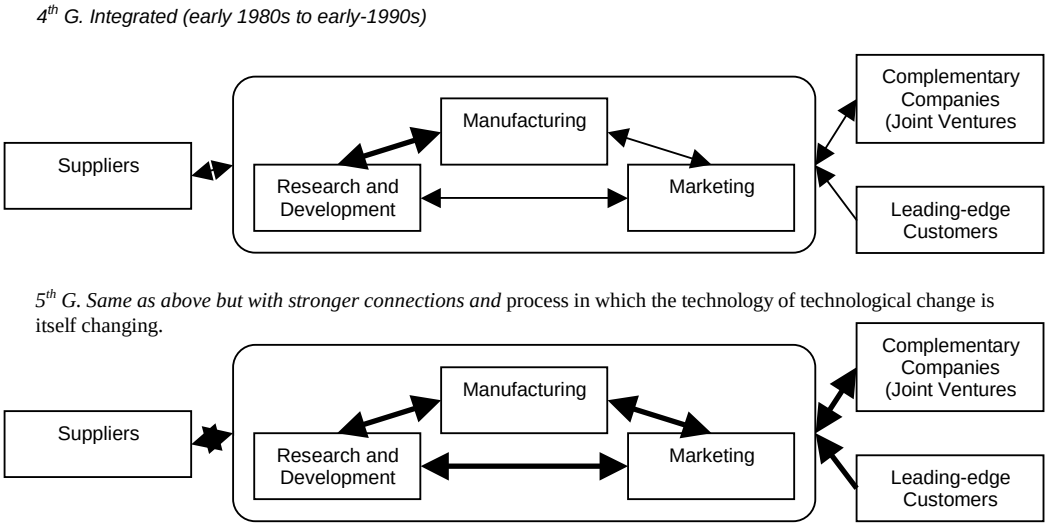


Figure 3.2 – The evolution of Innovation thinking, fourth and fifth generation
Source: Dodgson (2000)

In a study of Japanese companies during the eighties, Rothwell (1994) found that the companies examined in large part integrated the suppliers in the production development process, drawing on collective knowledge to develop a better product. At the same time, all of the in-house departments in the company were integrated as well allowing knowledge and technology to flow freely. This method is referred to as the 'rugby' approach by Imai et al (1985) and illustrates a practical example of the fourth generation of innovation.

In the period after the early 1990s, speed became the number one priority in the production process and consequently also in the innovation process. Rothwell (1992) lists 24 factors, of which none will be mentioned here, that he identifies leading innovative companies use in improving both speed and efficiency in product development and innovativeness. In essence these factors represents the fifth generation of innovation process; 'These factors include, centrally, integrated and parallel development processes, early and strong vertical linkages, well developed corporate structures and the use of electronics-based design and information systems (…) i.e. innovation is becoming more of a networking process.' (Rothwell, 1994). This statement is also confirmed by Dodgson (2000) in that the fifth generation innovation process to an increasing extent relies on *strategic* and *technology* integration. Two practical examples of the two different aspects of integration can be found in Innovation Highlight 3.2.

Innovation Highlight 3.2
Boeing & The Hybrid Car

***Strategic Integration* – the Boeing 777 project.**
The 777 program was launched in October 1990 with an order from United Airlines. The phrase 'working together' had at this point become a new direction in Boeing corporate strategy. The new strategy manifested itself in the procedure of designing and building the new jet. Eight international airlines, customers of Boeing, were invited to join in the creation of the jet. These eight companies met over twelve months and together expressed the features that each company required from the 777. Also the suppliers were closely working together with Boeing in the manufacturing process. For example, fuselage and rudder were subcontracted to Australian and Japanese companies and the engines were constructed in close collaboration with Pratt and Whitney.

***Technology Integration* – The Hybrid Car**
The Hybrid Electrical Vehicle is a vehicle that is run by multiple sources of propulsion systems, thus combining different means of making a vehicle move forward. Two technologies have merged in order to reduce toxic emissions.

Dodgson (2000)
www.ndu.edu/sdcfp/Boeing24%20may.doc 2004-12-08
www.boeing.com/commercial/777family/background.html2004-12-08
www.pw.utc.com/pr_072302.asp 2004-12-08

Coordinating Intellectual Capital

Galbraith's conclusion to the simultaneous coupling model is that these three functions should be coordinated preferably 'intra-personally', which means in one person only or at least in as few people as possible. However, this imposes a slight problem in today's Multinational Corporation's (MNC), where it is in no way a simple task to coordinate and control the evolution of an innovation. Nonetheless, coordination could be facilitated through a common and integrated system among the different constituents of the process. It requires integrated, synchronized networks of teams and individuals with elaborate communication possibilities. A MNC's global units are required to be in sync, in order to prevent dual work and the risk of 're-inventing the wheel'. One possible solution of organising the company to prevent such inertia is suggested by Bartlett and Ghoshal (1990) in their theoretical model of globally linked innovation processes (Figure 3.3).

The idea is to have every local unit related to the innovation process and have the MNC linked together electronically through a network, enabling each unit to work locally with goal convergence. Behind the organisational idea of a globally-linked innovation process, is the reasoning that it will create synergies that can leverage MNCs innovation process through a network of flexible links. In this way, every unit can be up to speed on what other units, within the organisation, are conducting as well as coordinating future focus on an innovation. However, problems could arise with adopting this approach since it is relatively expensive to uphold and heavily relies on internal coordination processes and technology. An organisation therefore needs to dedicate large amounts of resources and funds to maintain this network approach up and running.

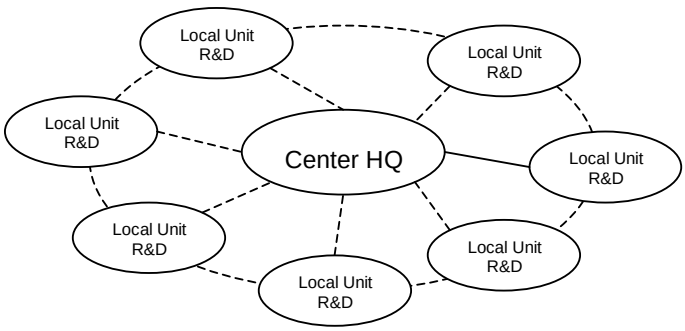


Figure 3.3 - Globally Linked Innovation Process

The Strategic Problem of Institutional Leadership

Van de Ven's (1986) stress that an innovation is not the enterprise of a single individual or employee but rather interaction between individuals directly impacts upon the leadership style selected. He specifically argues that innovation is more of a network-building effort that centres on "the creation, adoption, and sustained implementations among people who, through transactions, become sufficiently committed to these ideas", which lead them to transforming these innovations into good currency. Hence, Van de Ven emphasises the

importance organisational culture and context has upon an organisation's ability to innovative. Nonetheless, the organisational environment required to foster innovation is not merely limited to internal issues, but involves all aspects of human interaction, indicating that this network-building activity must emerge from both within and outside the organisation.

The strategic problem is thus, in addition to the previous, an organisation's ability or inability to create an infrastructure that inspires innovation. Following this line, organisations needs to create transaction-networks drawing upon both intra- and extra-organisational infrastructures, wherein innovation could flourish. The extra-organisational context includes a wide array of cultural- and resource contributions that a society could offer an organisation. Van de Ven exemplifies some of these as laws, government regulations, institutions of knowledge and resources (i.e. universities, research laboratories), and the structure of the industry wherein the innovation is competing. The need for interaction with these externalities lies with the fact that organisations are not isolated entities, but live in symbiosis with its environment, suggesting that they should thus interact with the larger community and absorb necessary knowledge.

Consequently, forcing organisations to comprehend and consider the societal characteristics that either sustain or restrain innovation. Thomke and von Hippel (2002) identified a concrete example of how corporations can take advantage and incorporate these externalities. They discovered that within certain industries, organisations improved their innovation capability and flexibility by transferring aspects of the innovation cycle over to their customers. The difference between the traditional approach and integrating customers within the innovation cycle is that a 'customer-as-innovator'-organisation provides customers with certain tools, which enable them to design and develop application-specific parts to their product. Shifting the supplier-customer interface and trial-and-error inertias over to the customers (Figure 3.4) significantly increases development speed and effectiveness, in addition to broadening the scope for innovations. Indeed, Grant (2002) states that customers are a fertile source of innovation by emphasising the expression;

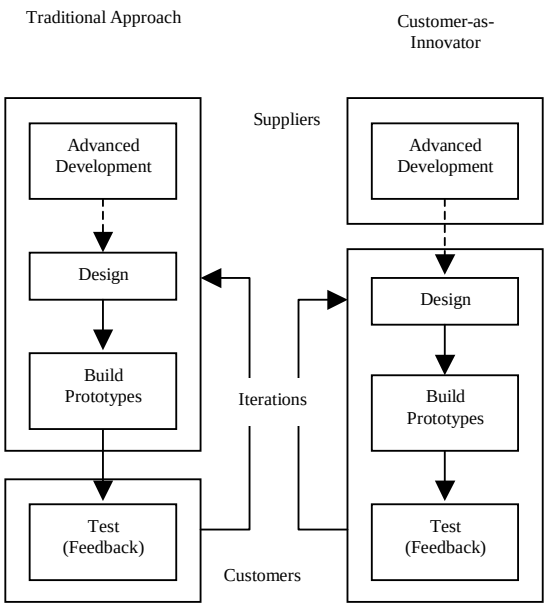


Figure 3.4 – Customers as Innovators
Source: Thomke & von Hippel (2002)

“necessity is the mother of invention”.

According to Van de Ven, innovation originates from both internal and external interaction, institutional leadership is consequently essential in the creation of a cultural environment that encourage innovations as well as builds an organisational strategy, structure and system that supports innovation. The necessity of involving employees from different positions and sub-units as well as external sources, requires institutional decision-making in order to maintain and control the necessary ‘chaos’ within an organisation. Hence, institutional leadership preserves the uncertainty, diversity and turbulence within an organisation, and thus creates the dynamic environment that is especially vital for the creativity and sustainability. Additionally it facilitates the possibility of unifying and gearing an organisation to pursue a common goal, since the relatively wide scope of participants within the decision-making process assists the possibilities of a uniform set of values and thus in part solves the part-whole dilemma. Institutional leadership thus implies a strategic leadership shift, from planning to recognition.

Manville and Ober (2003) support the idea of institutional leadership and discuss it further. Their suggestion is that organisations should take a step further and build a company of citizens to enable organisations to enter the knowledge economy, instead of maintaining managerial and governance systems that are a relic form the industrial era. A company of citizens implies opting for a sort of democratic leadership, which shares several characteristics with institutional leadership with the exception increased employee empowerment. The basis of their argument lies with the alienation gap between organisations and their employees, which may result in ‘knowledge’-workers feeling “estranged from their organisations – their outlook distrustful, their attitude cynical, and their loyalty tenuous”. Their model of a democratic organisation, which could stimulate employees and innovative behaviour, originates from the historic yet compelling example of the ancient city-state of Athens that, albeit with flaws, rose to unprecedented political, economic and cultural heights, see Innovation Highlight 4.2.

Innovation Highlight 3.2

Athens

The fundamental factor behind Athens' achievements was a system of governance, which gave it citizens a voice and active role in civic governance. Athens open democratic atmosphere created an experimental and entrepreneurial spirit that attracted philosophers, artists, scientists and poets from all over the then known world, resulting in the development of numerous new innovative theories concerning most aspects of life. Unleashing the creativity of its citizens, the democratic system managed to transform these innovations into the general good for society as a whole. Thus, harnessing individual initiative and common cause into harmony, which is, according to Manville and Ober, exactly what contemporary organisations needs to achieve in order to unleash the full potential of employees and thrive.

The democratic system was successful because it was holistic, involving all aspects of society, just as corporate culture should inform all aspects of an organisation and its management. The Athenian decision-making process was based upon a rotating basis for the electives and a participatory structure. The participatory structure meant that people with expertise in particular areas and citizens that were affected by a decision, would come forward when needed, without becoming part of the standing administration. Amateur engagements were seen as preferable to professional management because it encouraged constant input of new viewpoints and knowledge. However, even though citizens were free and even encouraged to participate they were not expected to constantly engage themselves in public matters, but only when their skills and perspectives were needed. This process made the ancient Athenians motivated by the sense of shared ownership in their city's destiny, much unlike most present day organisations, which made it reach its unprecedented political, economic and cultural heights.

Nonetheless, Manville and Ober recognise the difficulties an implementation of citizenship would present contemporary organisations with. Primarily the crucial issue of who should be considered a citizen; should it be unconditional or limited with lesser rights and responsibilities for some. Further, which should be the benefits, rights and responsibilities that follow a citizenship? However, a corporation of citizens cannot, even though these inherited problems are solved, be imposed from above but must grow from the grassroots within an organisation. Hence, must come for the employees themselves. Institutional leadership could therefore be seen as one step towards the creation of a corporation of citizens, and one step closer of utilizing the full capacity of the employees and the innovation capabilities within an organisation.

Manville and Ober (2003)

Ambidextrous Organisations

O'Reilly and Tushman (2004) discovered, when investigating how contemporary organisations manage the pursuit of innovation that lies beyond their current products or market, that some organisations have been quite successful at both exploiting the present and exploring the future. Their research suggested that these successful organisations shared an important characteristic. In essence, the organisations separated their new, exploratory unit from their traditional exploiting ones. Thus, allowing for different processes, structures and cultures, whilst maintaining tight links at the senior executive level.

O'Reilly and Tushman referred to these kinds of organisations as 'ambidextrous organisations'. These ambidextrous organisations showed unprecedented success, of which 90% achieved their objectives within the empirical study, in comparison with other preferred organisational structures. The authors argue that the superiority of the ambidextrous organisation resides within its structure, which "allows cross-fertilization among units while preventing cross-contamination" (Figure I). Throughout their article, O'Reilly and Tushman stress and empirically prove the benefits of opting for an ambidextrous organisational structure when pursuing an innovation. However, they exclude the organisational processes and requirements vital for maintaining an exploratory stimulating environment. The gap within O'Reilly and Tushman's article is consequently how organisations generate innovation. The intention of this report is thus to fill O'Reilly and Tushman's gap, with the appliance of other existing theories, the purpose being to identify a suitable theoretical framework, which could be used in conjunction with O'Reilly and Tushman's ambidextrous organisational approach. Additionally, the intention is further, to support and illustrate the selected theoretical framework with a concrete empirical case example of a successful 'best practise' innovative corporation. Our analysis is primarily directed to the management of organic innovation, hence not the acquired or the rented.

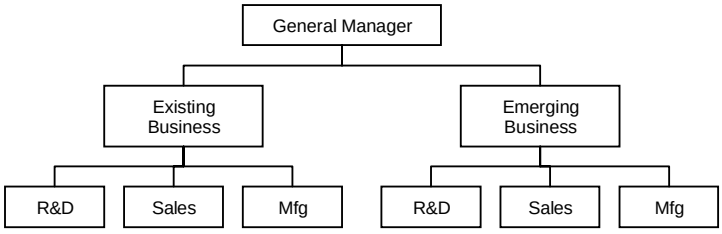


Figure 3.5 – The Ambidextrous Organisation
Source: O'Reilly & Tushman (2004)

Case:

3M's Core Competence - Innovation

Founded in 1902, Minnesota Mining and Manufacturing Company (3M) originally focused on grinding-wheel abrasives for mining minerals. However, circumstances shifted 3M's focus from grinding-wheel abrasives to sandpaper products. From this shift and meagre beginning, 3M has vastly expanded and diversified into many different markets and segments during its lifetime. 3M established itself as an extremely efficient and effective innovative corporation, mainly through its long-term commitment to stimulate R&D and to foster innovative behaviour within the corporation. This innovative focus has enabled 3M to out-distance many of its competitors in technological ingenuity and market position. Indeed, 3M's track record of more than 60,000 different products manufactured, including famous household brands such as Scotch cellophane tape and Post-it Notes, demonstrates its innovative edge.

Proactive actions to stimulate innovative thinking within the firm have always been sought after. Indeed, one of many examples of this is the initiation of the Genesis Program in 1984. The purpose of the program was to stimulate all kinds of innovation, even the kind that did not yet qualify for the ordinary 3M budget. Instead, it raised and funded these 'out-of-the-box' innovations through irregular internal and external venture capitalist sources while sill maintaining control of the emerging innovations.

Organisational Stimulus

The principal factor contributing to 3M's continuous success is its ability to foster and encourage innovative behaviour within the organisation. The source for this behaviour becomes transparent when analysing its organisational structure, which at first glance gives a clear descriptive picture of a fairly hierarchical and bureaucratic structure. However, 3M is divided into main divisions, wherein each separate division focuses upon a particular product category or industry. Each of these divisions' are then subdivided into separate product units, which consist of cross-functional teams. These divisions operate as autonomous units that are self-organised with minimum management intervention, to empower these divisional 'teams' (accountants, designers, engineers, marketers etc) with the ability to set up and pursue their own product adapted strategy.

The product units' cross-functional teams operate under a matrix principle, where the different divisional teams' interactivity facilitates that a uniform and coherent strategic

objective could be pursued. Furthermore, this decision-making heterogeneity partially forms the foundation of 3M's dynamic and innovative culture. Meaning that these product units' have the ability to understand all the necessary aspects, concerns and constraints of an innovation, thus enabling it to gain a holistic picture regarding the tasks required to develop a innovation.

Motivational Stimulus

3M has devised three main group objectives to coordinate, assist and improve their respective innovative abilities, despite the product units' degree of autonomy, which are; open ownership, time and communication. 3M's decisions to disown ideas and make them available throughout the organisation opens up the possibility for product stretching and improvements, by making innovations accessible to all of 3M's divisions and product units. The intention with this is to provide employees with an incentive to take the risk of exploring as well as stimulate investment within emerging or new ideas.

A further attempt to stimulate this innovative procedure has been to allocate fifteen percent of key employees time to think about their existing and new innovations or inventions that ha the potential of becoming profitable for 3M. Indeed, this method has, according to 3M, resulted in the emergence of a multitude of new innovations as it provides their employees with the opportunity to actually be innovative.

The need for a common language was identified as many problems could be overcome through a general understanding between the employees within its organisation. This made the company realised that they needed to build a world-spanning network that would facilitate the creation of a common language. Through open ownership of ideas and the common language approach, 3M successfully managed to build a networked platform, from which the whole organisation could draw on collective knowledge.

3M's employees were thereby free and motivated to devise new ideas, albeit somewhat forced to share their ideas, inventions or innovations with other employees within the organisation due to the open-ownership structure.

Integrating and Coordinating Innovation

Another issue 3M has been working hard to develop and extract knowledge from is its external environment. It has therefore been working hard to integrate and coordinate all units as well as establish and maintain close relations with external sources. To overcome this hurdle 3M created a Technical Forum where ideas are shared and

accessible to all key personnel within the company. This formal institution was created to coordinate and streamline the communicational flows of these ideas both from within and outside the organisational scope. Hence, this is where ideas are voluntarily discussed, inquired upon and shared, although only

Capitalisation

Before 3M even considers investing in an idea, they have created a code of conduct whereby an innovation needs to be supported by a certain number of employees in order to be acceptance (implementation). This implies that managers lead by a sort of supportive leadership which puts an emphasis on strategic recognition rather then planning. Nonetheless, after an innovation has gone through this process, an evaluation of the prospective innovation's potential contribution to 3M. This forms the basis of whether or not an investment is made into a specific product. However, external venture capital could be sought after by the 'inventor'. Nonetheless, innovation that fit within 3M's current structure are place appropriately, whereas the ones that do not are implemented using an ambidextrous approach.

3M's information and communicational flows are illustrated in figure 3.2 to visualise and make these rather complex processes clear.

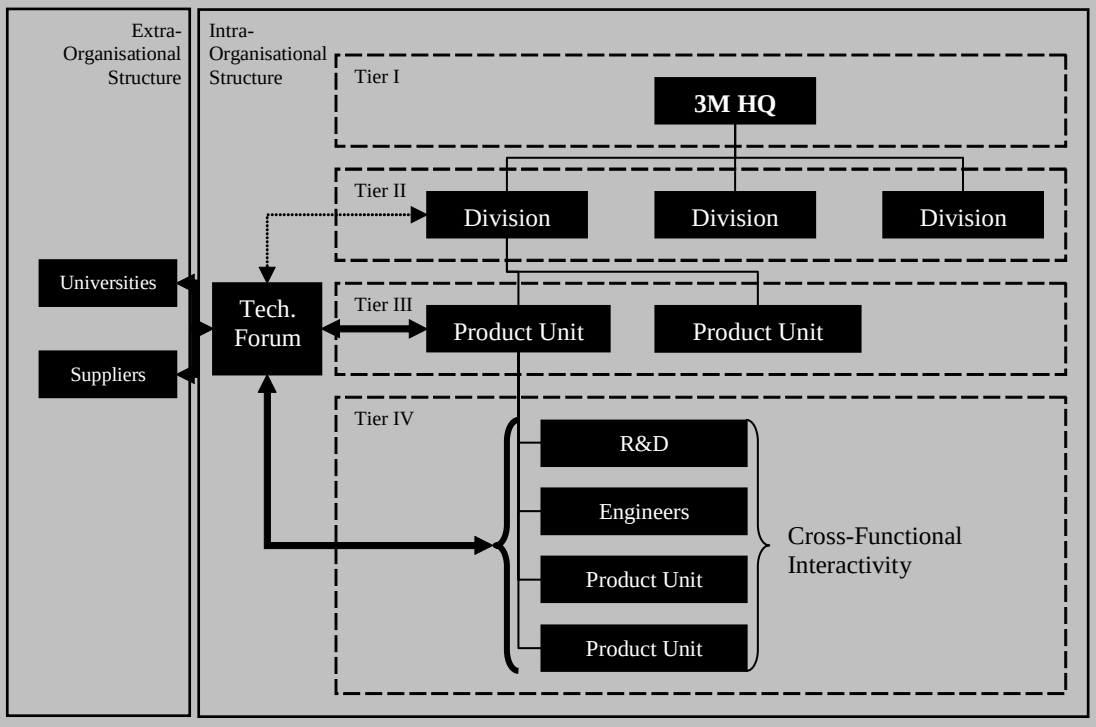


Figure 3.6 – 3M's Corporate Knowledge Structure

Innovation Parameters

After assessing the contemporary theoretical framework in conjunction with the highlighted and presented cases, it became apparent that there reside a number of different factors that are critical when striving for an innovative organisation. Indeed, the identified factors seem to foster and encourage the dynamic and chaotic environments necessary for individual innovative behaviour under controlled forms. This highlights the vital importance of implementation for firms that wishes to derive the maximum amount of ingenuity and value from its employees.

The critical factors where divided and organised into separate parameters to facilitate the identification of potential innovation gaps, which persists and exists within contemporary organisations. This approach would enable firms to actively benchmark their innovative capabilities with other organisations and perhaps gain valuable tactical solutions to current innovation dilemmas. An assessment of Swedish manufacturing firms' respective and collective innovative abilities would thus be attainable, when using this parameter approach.

Nonetheless, the identified necessary theoretical parameters of innovation stimulus are thus as follows:

- Motivate reflection over operational chores
- Motivate risk taking
- Remove barriers to skunkworks
- Promote heterogeneous group dynamics
- Identify and empower idea generators and sponsors
- Establish and maintain external networks
    - with key customers
    - with key suppliers
    - with key institutions
- Uphold goal convergence in part-whole relationships
- Facilitate and encourage access to knowledge warehouse
- Promote institutional or democratic leadership
- Safeguard Emerging Business Ventures

To stimulate a high degree of innovative behavior, a number of actions have to be taken within each respective parameter. Each parameter's actions will therefore be elaborated further to assist firms in fine-tuning their innovation process.

Motivate reflection of operational chores

There is a need to provide employees with time, during working hours, so that they could to stop and assess their current and potential contribution within the organisation, as well as their purpose in the idea evolution process. The assigned time will then encourage employees to contemplate over possible improvements within their immediate environment or for the organisations in general. The additional time could also provide a means for employees to devise new radical solutions.

Theory not only advocates that the time aspect stimulates the motivation of these behaviours, but also through monetary payoffs or the opportunity to do something else (e.g. join a separate team project).

Motivate risk taking

There are two relatively easy measures to take in order to prevent the risk adversities normally found among employees when it comes to 'sticking one's neck out' and pursue a possibly risky venture. To minimise or cease possible individual or collective punishments in failing project is the first measure that needs to be taken as this stems the pursuit of ideas. Hence, employees need to be notified and certain that no harm would come to them or their colleagues from pursuing or experimenting with ideas.

A second means to stimulate risk taking is to clearly state and communicate monetary and non-monetary benefits involved in thinking about and pursuing ideas that might potentially benefit the organisation.

Remove barriers to skunk-works

In the various levels of the entire workforce there are sometimes highly motivated individuals working on innovative projects without official sanction and funding from management working on a project or in general production often possess important The knowledge these employees possess needs to be brought into corporate attention as well as managed without interrupting its continuation.

Promote heterogeneous group dynamics

Homogenous groups usually strive towards unit conformity and promotes status quo, which thus counteracts the creation of an innovative environment. This stresses the need to strive for heterogeneous group configurations. These environments could be achieved through a strong leadership which prevents homogeneous conformity, workplace rotations and trigger the workforce's action threshold.

Identify and empower idea generators and sponsors

Once organisations identify employees in possession of a promising idea, they need to empower them to explore the idea by instructing and providing them with authority to pursue the idea. This authority could be given either directly or through the assistance of other key employees. However, a further assessment is required to determine whether or

not this employee needs informal or reinforced formal powers to proceed in the development of the idea. If the individual employee is not suited or properly equipped, corrective action needs to be taken by management in order to enforce and fund the role of the idea sponsor.

Establish and maintain external networks

Organisations could further enhance their internal innovative abilities by scanning environments for possible means to complement and improve their innovation process. Integration with external sources would amplify the heterogeneous effect as new perspectives are taken into account. However, there exists numerous of possible solution in which organisations could gain additional external sources. Nonetheless, the primary source of exchange should preferably occur with ones key customer and suppliers.

- with key customers

The most demanding customers are usually the best allies when it comes to improving and developing new products and processes. Integration with these customers could provide the company with valuable industry specific information form a customer perspective. Hence, integrating and keeping one anther updated regarding innovative abilities and limitations would enable an organisation to draw on a wider set of collective knowledge to develop new products or processes.

- with key suppliers

Similarly to the customer integration process, supplier integration would provide a broader set of knowledge to draw conclusion upon, although from an supplier perspective.

- with key institutions

The extra-organisational context includes a wide array of cultural- and resource contributions that a society could offer an organisation. Universities, schools of higher education and other institutions often have differing views and perspectives from corporations. These could therefore provide valuable ‘fresh’ perspectives regarding difference issues into an organisation.

Uphold goal convergence in part-whole relationships

Every employee involved in an idea development and implementation needs to be aligned and aware with the end goals of the project to facilitate goal convergence as it is of utmost importance to a projects outcome. This is overcome through the development of networks where communication could be coordinated to facilitate the creation of a common ‘language’ among participants. An effect of this is the minimisation of dual

work and misunderstandings as well as the codification and diffusion of tacit knowledge.

Facilitate and encourage access to knowledge warehouse

A common knowledge platform, accessible to all employees, would provide a mean to build upon the collective organisational knowledge and thought rather than the individual. It would further act as an encyclopaedia and practical guide as to how to proceed in different situations for an employee, without necessarily requiring the assistance of a colleague or manager. Allowing employees to build and develop ideas within a platform of collective knowledge is a means to refine innovation processes by documenting the idea evolution.

Promote institutional or democratic leadership

Empowering employees to participate in the decision-making process creates heterogeneous dynamic environment and provides them with a sense of belonging. Institutional and democratic leadership thus provides organisations with a means of minimising the part-whole problem and the firm establishment of an innovative environment.

Safeguard Emerging Business Ventures

Organisations need to capitalise on both ideas that are suitable and unsuitable for the core businesses. In fact, it is important that all opportunities are equally evaluated in disregard of the strategic fit as they regardless could prove valuable. Theory suggests two generic approaches to profit from non-core innovations, hence the ambidextrous or spinning-off approach.

Empirical Review

Alfa Laval

1. Alfa Laval			
Company:	Alfa Laval	roducts:	Produces specialised cooling, separating, transportation products and engineering solution for the oil, water, chemicals, beverages, foodstuff, starch and pharmaceuticals sectors.
Employees:	9 350		
Revenues:	13.9 billion SEK		
Operations:	Global		
Ownership:	Listed Company		
Source:	Interview		

This globally operating organisation is structured in a fairly hierarchical fashion, consisting of three main divisions. These divisions are the two *Equipment* (ED) (focus is on tailor-made solutions) and *Process Technology* (PT) (focus is on mass-production) "sales" divisions, in addition to the *Operations* division (consisting of manufacturing, logistics, etc.). The Equipment and Process Technology divisions are further segmented into separate 'business areas', which operates independent of one another. In addition to these business areas, the divisions have separate R&D functions and product managers with specialised knowledge regarding a certain field. *Regions* incorporate the multitude of differing sales companies that are geographically organised into three main regions (Western Europe & North America; Asia; Eastern Europe & South America).

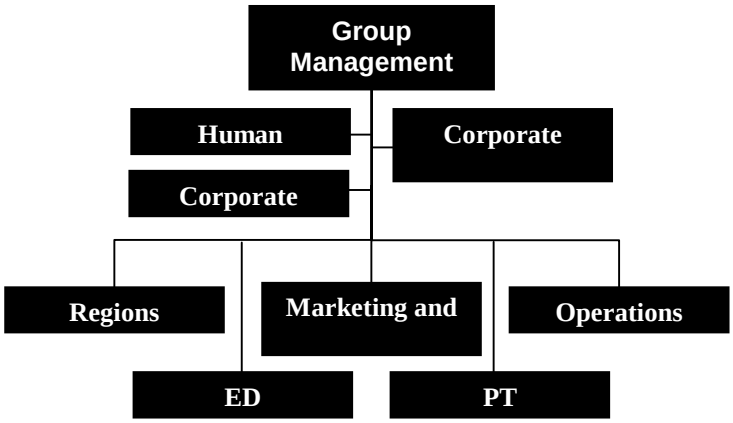


Figure 4.1 – Organisational structure of Alf Laval

Innovative Processes

Ideas at Alfa Laval are predominantly passed on to the subsequent management, as it is a rather large and hierarchical organisation. In fact, it is very rare that an idea generator follows the organisational ladder further than two levels. Although, in certain cases, there is an exception to this rule if the idea generator possesses specialised knowledge regarding the new innovation. However, this kind of conduct is relatively rare within the organisation. Meetings could thus be perceived as rather homogeneous as ideas get passed up through the organisation ladder. The underlying reason for this procedure is the different divisions' segments organisational structure of independence, which facilitates these to focus on their specific 'niche'. Indeed, co-operation between the

Equipment and Process Technology divisions is limited to collaboration between their respective R&D and project management divisions.

Nonetheless, there exists a formalised structure where ideas that arise within lower levels of the organisations are processed in a relatively heterogeneous environment. This takes place when managers from different divisions and levels meet in a "product council" to discuss new product and process innovations. Albeit, mostly consisting of senior managers and not lower level employees. However, interactions do also occur between varying levels and divisions within the organisations, but these are more on an ad hoc basis than on a structured basis.

A separation between product and process innovation is made as these arise from different parts of the organisation, due to the organisational structure (sales and operative divisions).

Process innovations originating from factories are collected through either the "suggestion box" where employees can pass on their suggested thoughts or through a bottom-up process as no other structured process exists. Nonetheless, a system exists to share knowledge and experiences between the different Operations divisions, through the rotation of employees with similar tasks. There are also managers accountable for all types of certain factories, which are responsible for the transfer of knowledge and improvements in production between these factories. This sharing process is less transparent within the other two divisions. The process differs slightly when it comes to emerging product innovations within the production branch (operations division), as no apparent formalised structure exists have to take a bottom-up path.

The most frequent formalised structure for processing emerging product innovations is the channelling of ideas through a "portfolio manager", who is responsible for handling and processing each segments' innovative ideas and improvements. In addition, their responsibility is to identify if there resides further market or customer needs and requirements for development of products. Customers are thus involved within the innovation process as these keep in touch with their requests. These ideas are then passed on to an appropriate product group, which place them into a product plan if deemed feasible. Following this is a decision of the appropriate R&D budget required for developing an idea. An assessment is simultaneously made if other departments could derive any advantages from the development of a certain idea.

Portfolio and product groups from the varying divisions and segments additionally meet on a regular basis twice a year (before budget and revision) in a product council. The council's main purpose is to decide and provide recommendations regarding which projects Alfa Laval should proceed with, their importance and respective budgets. Decisions and recommendations are made in a form of consensus, although seniority

weighs more and has the final word. These decisions are then passed further up the organisational ladder to a "product board", which consists of the managers within each respective product group for a final decision, and is, if necessary, further pushed to senior management (group management).

A different system exists when it comes to out-of-the-box ideas. These often revolutionary ideas should be processed through the corporate development unit, which was established to take care of these categories of ideas. This is due to the fact that these ideas often lie outside the scope of the current business and thus require knowledge that does not exists within the current organisation. Furthermore, as this unit focuses on business development and not technical development it could determine the feasibility of success with each concept. The concepts that pass through this scrutiny are then provided with financial assistance for product testing outside the scope of current operations. There does however not exist a formal structure for the procedure of out-of-the-box ideas, these often climb bottom-up before reaching a manager that passes on to the corporate development unit.

Skunk work is not perceived as something bad if kept within a reasonable level and does not affect the 'normal' work load. However, both 'official' and 'unofficial' skunkworks does exist at Alfa Laval, but regardless it does not punish employs for it as they at the same time are dependent upon these creative persons.

Stimulation of innovative thinking

Alfa Laval does not have an institutionalised system to stimulate innovative thinking, besides the divisional systems in place to process emerging innovations. The incentive for innovation is more an individual driven issue than an institutional one. There is nonetheless an institutionalised reward system regarding productions, a 'suggestion box', where employees receive different forms of incentives if an idea leads to implementation (i.e. economic). However, no other reward system is used or communicated, besides the individual's pleasure, in certain cases, to visually see their ideas evolve into full-scale projects.

A different process exists when it comes to out-of-the-box ideas, as these often require new knowledge. Idea generators for one of these ideas that gets approved for further development by the corporate development unit, is thus requested to follow the implementation and evolvement of this new product innovation. There is therefore an incentive for employees to continue with this behaviour as the idea generator often gains a higher salary, bonuses and professional acknowledgment since it leads to higher organisational position and risk.

External Relations

A close connection with customers is maintained when it comes to the development of new ideas, more within the Equipment than the Process Technology division due to their nature. This customer connection is nonetheless made through the portfolio managers, who besides processing internal ideas identify and gather what needs and requirements customers or markets have. Customers are thus involved within the innovation process as these keep in touch with their requests. Additional external interaction is obtained in partnership with different universities to improve different products and processes within the organisation (i.e. collaboration with Linköpings University regarding functional sales).

Further improvements of current innovation processes

Alfa Laval should and is in the process of trying to develop a formal structure to handle and process the emergence of new ideas (i.e. an IT system). However, opting against such an investment is the potential cost of developing it and employee involvement. Another issue regarding innovation is to develop both a formal and informal cross-functional network between employees. In fact, selected employees from various backgrounds and positions were during a previous organisational structure brought together in an Alpine village. This led to the creation of informal networks that later proved to be fruitful.

Alfa Laval further needs to better stimulate idea generation and entrepreneurial behaviour. It is good at rewarding employees for gaining further skills and education but rather bad at rewarding innovative behaviour. A system for the development and motivation of new ideas is therefore sought after. In fact, a long term objective of Alfa Laval is to formalise processes that suits this organisational culture to address this issue.

FOSS Analytical

2. FOSS Analytical		
Company:	FOSS Analytical	Products: Analytical solutions for food and agricultural applications. Independent laboratory systems to provide results based on wet chemistry analysis or they can be used to create valid calibrations for NIR(Near Infrared)/NIT(Near Infrared Transmittance) analysis systems.
Employees:	250	
Annual Sales:	N/A	
Operations:	Global	
Group:	FOSS A/S Denmark	
Employees:	1074	
Annual Sales:	1 544 Million SEK	
Sources:	Survey and interview	

The organisational structure is roughly made up of five hierarchical levels, namely the CEO at the top, then Directors, Senior Managers, People Managers and then the lowest level of workforce. The hierarchical ladder is well respected among its participants and seldom overstepped in the decision process. Decision making is bureaucratic and risk adverse in general and corporate risk taking when it comes to new ventures remains constant, indifferent to the state of the market.

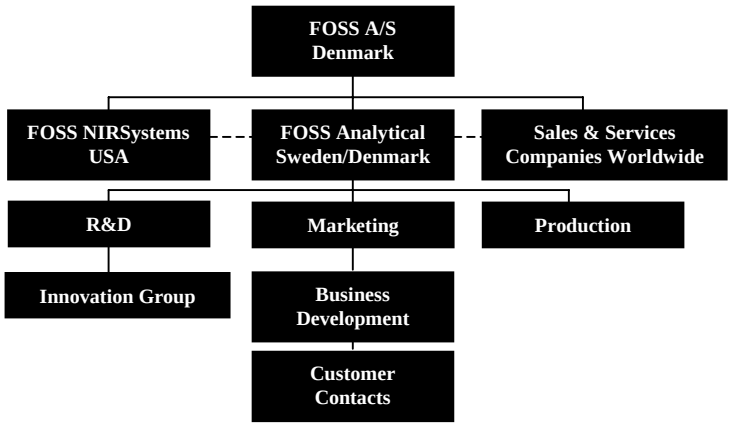


Figure 4.2 – Organisational structure of FOSS Analytical

Innovative Processes at FOSS Analytical

Most of the process-related as well as some minor product improvements are made by the production department, major product improvements are operated and supervised by the R&D department. The most important decisions are made at top management level, normally without discussing the matter with employees in possession of relevant expertise.

The decision process plays out as follows; the Business Development (BD) finds out market needs through direct customer contact or through information from sales offices worldwide and communicates this information to the Research and Development (R&D) department. R&D develops a product proposal and presents this to the Management Board who in turn decides whether to pursue the project or not. If the project qualifies for follow-through this is communicated to R&D that constructs product specification and communicates this to the Production Department (PD)

through project team discussions. The production department remains practically uninvolved in the development of the product.

The idea development procedure is structured in FOSS. When an employee is in need of discussing a possible improvement, protocol suggests that they consult a colleague in their opinion and contribution to the idea at hand and then turn to the superior manager when bringing the idea into corporate attention and pursuance. In deciding on what to do, top management are supplied with oral or written background information on the decision. Good ideas not suitable for the company's current operations are generally set aside. FOSS Analytical tends to keep to its core businesses and hence there is little room for emerging businesses ventures.

The goal convergence within FOSS Analytical is well functioning, which means that different departments and segments tend to know what their colleagues are doing. The communication works well between the managers of the different functional areas located in both Denmark and in Sweden, partially because of the actual physical presence of the managers varies from Denmark and Sweden on an almost day-to-day basis. They travel between offices and meet with each other on a regular basis.

Within the R&D department, a lot of the knowledge among the co-workers can be labelled as tacit. It is often hard to communicate their opinions and suggestions to other department because of the difference in technical 'language' and different ways to think. The procedure of workplace rotation is not applied in the FOSS organisation and would probably involve substantial costs since production is highly complex and differing in tasks. The consequence being that work groups in general tend to be fairly homogenous in daily activities, the exception being team projects where heterogeneity in terms of participants from different departments is promoted.

Stimulation of Innovative Thinking at FOSS Analytical

Of the persons questioned, two thirds stated that they spent more than 4 hours per week of their time at work thinking about possible improvements related to general improvements in the company. The type of improvement differed highly between individuals.

The general perception among the employees at FOSS is that the company wants their opinion in possible company improvements and in most cases also takes their opinion under consideration. Generally, the company encourages their employees fairly well in thinking about improvements, mainly with the encouragement of earning participation in the idea development. If an employee is to pursue with an idea he knows that no punishment will reflect on him or her if the project later turns out to be a failure.

It is clear that FOSS stimulates their employees through different encouragement to think about improvements. However, the economic benefits of a promotion, bonus or salary increase are negligible or almost non-existent when it comes to pursuing own or another person's idea, the manager being the exception. It is apparent in the survey results that the benefits involved in developing ideas related to product improvement are poorly communicated to the employees, which was also confirmed in the interview. Potential benefits are for example a bottle of wine or your name on the patent but most of all it is the personal satisfaction of succeeding in your project that stimulates the employee to pursue and sponsor an idea. When it comes to general contemplation over one's occupational chores there are no incitements in terms of assigned time to do so.

Of the employees participating in the survey, more than half of them were only moderately satisfied with the communication functionality in the company. The perception of communication functionality was slightly better in the separate business unit and even better in the departments. The most frequent means of communication within FOSS is E-mail, followed by telephone and face-to-face conversations.

External Relations

The integration with customers is well developed. FOSS Analytical's customers holds a clear insight as to what the company is capable of delivering but very limited access to process-related information concerning what is actually done and how. Market needs are usually brought to company attention through the BD function, which measures the need through communication with customers. Sometimes suggestions can also be derived from the many different sales offices around the world.

The company is also very much in network with academic institutions and remains updated on current academic research relating to specific technology or organisational aspects. For instance, a Professor from Stockholm University is a part-time employee of FOSS, seated in the Innovation Group, and with him a staff of PhD students at his partial disposal.

Further Improvements of Current Innovation Processes

The communication between different departments/functions of FOSS needs to draw more knowledge and expertise of each other. Apparently, product specifications need clarification at an earlier stage to prevent mishaps in the latter stages of production. Also, production/manufacturing should not start until goals and structure of the production is unmistakable and comprehensible to all parts related to project.

Gambro

3. Gambro

Company:	Gambro	Products: Gambro Blood Component Technology is situated in Denver, USA and provides technology and products to blood centres and hospital blood banks around the world. Gambro Renal Products offers a wide range of products for kidney healthcare.
Employees:	8300 (2003)	
Annual Sales:	9940 Million SEK (2003)	
Operations:	Global	
Sources:	Survey and interview	

This globally operating organisation is structured in a rather hierarchical fashion, consisting of two business units; Blood Component Technology (BCT) and Gambro Renal Products (GRP). GRP has a matrix organisation with four product divisions; solutions, dialyser, monitor, and bloodlines. These serve three market units; haemodialysis (HD), peritoneal dialysis (PD) and renal intensive care (RIC). The Corporate Centre of Gambro is situated in Stockholm and the Corporate Research Manager is also situated there, but the major part of the Corporate Research (CR) is situated in Lund, Sweden with four different competence groups.

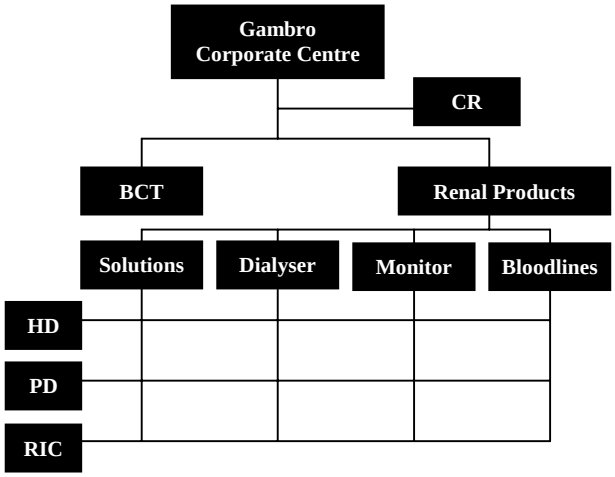


Figure 4.3 – Organisational structure of Gambro

Innovative Processes at Gambro

The market units (market managers) order and fund research projects originating from CR. These requests are usually market needs assessed by the marketing unit. CR also holds clinical tests and market surveys in order to determine market needs and trends. Fairly often, these findings differ from the requests presented by the marketing units. The market units usually act in their own best interests, i.e. maximising their bonus, which is why their research horizon often spans over one to two years. CR also funds own research projects which usually span over five to six years.

The projects requested by the market units run by CR amounts to 70 percent of CR's annual budget, the remaining 30 percent are under CR control. Decisions on how these 30 percent are to be allocated are made jointly by the Corporate Research Manager and the CEO. The projects funded by the market units are decided upon after a process of persuading the market unit managers of HD, PD, and RIC. During this process three

official decisions are made; The first decision is made by the manager of the competence group holding the idea at CR. This is his individual decision and it is based on whether or not he thinks that the idea is worth exploring. The second decision is made by the managers of the four competence groups at CR. They decide in consent which projects are to be presented and recommend to the market units for funds. The third and final decision is made by the market managers, as they meet with the managers of the four competence groups.

The project decided on by CR is transferred into the development department that prepares the product for production. Ideas are carried out as projects in a well established process involving a heterogeneous project group.

When production personnel have ideas on how to improve a process or product the ideas are placed in a suggestion box and then transferred to different people depending on the nature of the idea. Process improvements are handled by the development department while major product ideas are transferred to CR that decides what to do with them. Other product improvements are transferred to and judged by the market unit manager, as he is responsible over funding the project.

Ideas handed to CR are documented and published in Gambro's internal database GamBrain. This system compares the idea with other ideas in the database and displays the fifteen most related previously published ideas, patents, and publication abstracts, to display the current documented knowledgebase. Twice a year, the market unit managers meet with CR, the development department, the strategic development department, and sometimes also people from production. At these meetings, current projects, possible changes and improvements are discussed.

A good idea unfit with the current product portfolio is usually pursued with the allowance brought by the 30 percent controlled by CR alone. When ideas have been developed they are usually safeguarded, until they fit into the portfolio. If they never fit the portfolio, they are abandoned.

Corporate risk taking, when it comes to new ventures, remains constant, indifferent to the state of the market.

Stimulation of innovative thinking at Gambro

Employees at CR are required to contemplate over improvements during work while other personnel, such as production personnel are not. In order to stimulate people to be innovative, patents are rewarded with recognition, publicity and sometimes also a cash amount that depends on the revenues of the patent. In addition, employees at the CR department are able to participate in the implementation and exploration of ideas. These incentives are widely known within the company; therefore they are not communicated

explicitly by the company. Contradictory to this the survey shows that almost half of the employees say that the company has no incentives and hardly no one feel that there are any benefits to motivate them into doing this. There are no punishments for bad ideas or failing ideas.

There is no rotation of personnel other than when people change their positions within the company or when people ask to be transferred to a site abroad.

In the different units, spontaneous informal contact between employees spreads company knowledge. No meetings with purpose to spread knowledge and encourage communication are arranged.

External Relations

Gambro always tests their new products on people and sometimes on animals. They are compelled by law to do this but it is also a valuable opportunity to communicate and to get feedback from the end-user. During these tests, the end-user is able to suggest different improvements and changes.

External tests are almost exclusively carried out at university hospitals. Not only to ensure high quality, but also help build good relations with doctors. Some of the ideas that have been developed by Gambro have been presented to the company by doctors.

The company also has close relations to certain institutes of technology in both Sweden and Germany. They also participate in EU-financed and smaller locally funded projects. All these projects are co-operations with other companies and since the business of dialysis is limited too few, often big, companies, they often tend to know each other.

Gambro's integration with their suppliers is rather limited, restricted only to ensuring the quality of the products Gambro purchases.

Further improvements of current innovation processes

According to Barman, Gambro should make their employees more aware of what goes on in parts of the company other than their own. In big projects people from different departments participate, but normally their work is limited to the particular department or division.

Also, a big problem today is the rather limited outcome of a big research budget. One of the reasons for this may be that too many projects are being run at the same time; suggesting that most projects are run with inadequate funding. Another reason may be that the CR department is geographically dispersed.

Husqvarna

4. Husqvarna

Company:	Husqvarna
Employees:	2200 (2003)
Annual Sales:	5500 Million SEK (2003)
Operations:	Global
Group:	Electrolux
Employees:	77000 (2003)
Annual Sales:	124000 Million SEK (2003)
Source:	Interview

Products: Outdoor power products, such as chain saws, power cutters, brush cutters, and lawn mowers for use in parks, forest and gardens. The product range contains models for professionals as well as for leisure users.

The organisational structure consists of a CEO that oversees five product areas, a development department, and a marketing department.

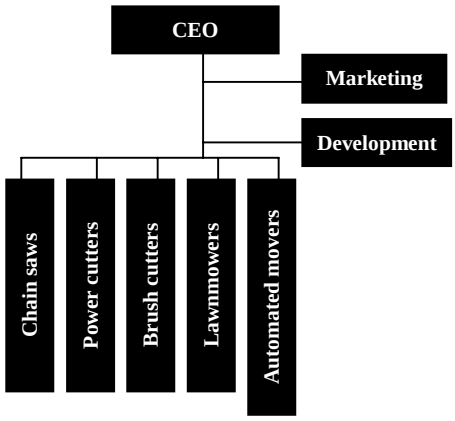


Figure 4.4 – Organisational structure of Husqvarna

Innovative Processes at Husqvarna

There are two ways for employees to introduce new ideas to the company. First there is a suggestion box where ideas are passed on to relevant area within the company. Second, the employee can apply to write a patent application. Patent applications are filed and are accessible to all employees but in reality they are hardly ever read, except when executives and development personnel now and then look back on them. In the past, an open database stored ideas but it was subsequently shut down due to lack of employee usage.

The company has developed a Product Creation Process (PCP), which outlines the processes used in defining and carrying out the product strategy. The overall PCP-process is divided into a Pre-Integrated-Product-phase (Pre-IPD) and an Integrated-Product-Development-phase (IPD).

The purpose of the Pre-IPD phase is to define the company's product strategy, screen surfaced ideas and make sure that the company pre-empts competition. The phase begins with a 'Product Calendar' meeting that states the product strategy. The decisions these meetings are preferably taken by consensus, while the CEO settles the final outcome. Aside from the CEO, only top executives from marketing, production, development, and the different product areas attend these meetings. The new product projects are decided on with a timeframe of usually 5-6 years into the future and once commenced, the IPD phase takes over. Around five times a year additional Pre-IPD meetings define and questions the technology strategy, overall future product

specifications and screens through internal patent applications as well as external patents. These meetings are attended by the same people as the Product Calendar meeting, marketing excluded. The outcome may result in specified demands on future products or develop already surfaced ideas but it does not stimulate new ideas.

The IPD phase is launched with the approval of the Product Council, consisting of the same people as the Product Calendar meeting. A project team is then created which will take the new product to the market. This is done through three defined processes; project specification, realization, and mass production.

Suppliers, production personnel, customers, and marketing personnel does not normally participate in product development. A few times a year product events are arranged, with the purpose of testing new products on selected customers in order to receive feedback. At some of these events, development personnel participate to stay in contact with the end-user. Selected customers are also interviewed for new ideas and trends. Sometimes customers mail in suggestions on new products, but these are the only ways customers affect new product development.

When developing new products the overall picture is maintained by the Primary Components Development group and the Material group. These groups co-ordinate all the different product areas' needs for components. Without this control every product area would optimise their own products, instead of promoting the company's performance. Other communication and co-ordination needs between the product areas are informal as most managers know each other well. All in all, informal relations are highly promoted by Husqvarna.

There is no system for rotating personnel; instead employees are encouraged to apply to job openings within the company. When new products are to be put in production, production personnel sometimes visit the research department to learn about the new product. This is the only way tacit knowledge is spread within the company.

Every second month problems in production, development, and service are addressed. The basis of the discussion are reported problems and warranty statistics. At these meetings all product areas are represented save for marketing.

Stimulation of innovative thinking at Husqvarna

Ideas that are handed in via the suggestion box may provide the idea generator royalties on the invention. Good ideas that are not implemented or profitable may also be awarded. Patents that are approved generate a financial reward, of SEK 30 000-40 000. These rewards are the only incentive for the employees to be innovative. As this is widely known in the company the company does not communicate them.

When an idea is approved the idea generator is denied further involvement in the idea development. Bad ideas or unsuccessful ideas are not punished in any way. Good ideas unsuited for the company's current portfolio are not pursued, instead the idea generator receives ownership of that idea.

Employees are allowed to spend up to five percent of their time at work developing their own ideas. However, middle managers are generally unaware of this, resulting in having the unawareness passed on further down the corporate ladder. The reason for the poor communication is claimed to be that 'innovative' people, if left unattended, are presumed to be innovative by themselves. Skunkworks is only accepted if the outcome fits within the company's current product portfolio, and within the five percent rule.

Dan Eriksson maintains that people at Husqvarna are constantly willing and able willingness to take risks and test new ideas.

External Relations

The Primary Components Development group and the Material group keep a close relationship with the company's suppliers. This is done in order to know the suppliers internal processes of how they produce their products, so Husqvarna will be able to foresee how components can be designed.

The integration with their customers, the end users, is limited to the product events.

Further improvements of current innovation processes

There are two problems with the current innovation process. The first is the employee's lack of time. They lack the time to be innovative, to come up with ideas, to develop ideas into prototypes, and to reflect on what they do. Secondly, the company lacks the time to follow up and process all ideas.

Nolato Polymer

5. Nolato Polymer

Company:	Nolato Polymer
Employees:	100
Annual Sales:	115 Million SEK
Operations:	Semi-global
Group:	Nolato
Employees:	2479
Annual Sales:	2671 Million SEK
Source:	Interview

Products: Nolato Polymer is oriented towards a few leading customers, whom the company will offer a complete line of form-died components in polymer materials

The Nolato Group consists of four companies; Telecom Mobile Phones, Nolato Medical, Industrial Components and Industrial Components Central Europe. Nolato Polymer is a part of Industrial Components.

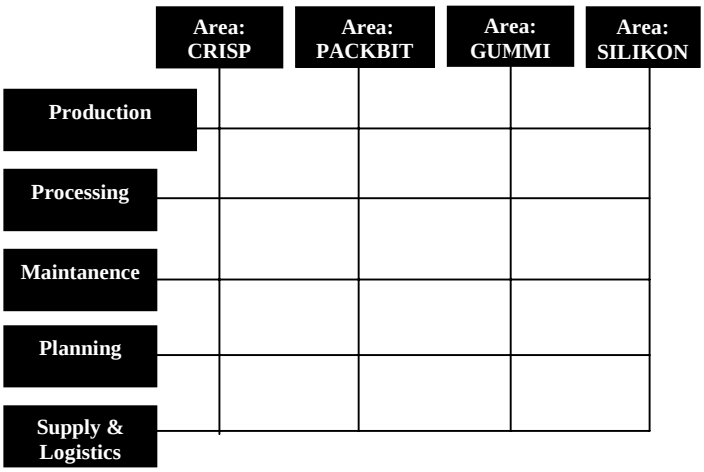


Figure 4.5 – Organisation structure of Nolato Polymer

Innovative Processes at Nolato Polymer

The production at Nolato Polymer is located in Torekov and Ängelholm, both in Sweden. The company is organised with supportive functions surrounding the production, such as processing technology, maintenance, planning and supply/logistics. These supportive functions, together with the different production teams, form a matrix organisation.

At Nolato Polymer there is only two hierarchical levels, the people in the Corporate Management Group and the co-workers. The people in the Corporate Management Group have their offices stationed on the production floor. The purpose of this is to remove physical and mental barriers of communication. Any contact with these people is a direct dialog with the top management, which speeds up communications internally. The communication within each factory is in large part face-to-face. Most of the contact between the production sites in Torekov and Ängelholm is maintained through email and telephone, but a couple of times a week people in the Corporate Management Group visit one another at their respective factory.

The production is divided into different autonomous profit centres. Each profit centre is responsible for satisfying overall production and profit goals set by top management. However, they are free to plan their working hours, specify targets for quality, and plan

logistics in order to keep deliveries on time. Every month the financial result of each production group is reviewed. Each group also has the mandate to make extra purchases or investments up to SEK 10 000. Larger investments have to be sanctioned by top management in a meeting held every second week. At this meeting, as well as at other meetings, all decisions are taken by consensus among the participants.

Each week the production groups meet to discuss continuous improvements according to the Kaizen-method. Here all groups ventilate problems that have arisen in production, waste and reclaims. An incentive system rewards all production personnel equally for their joint efforts. Hence, it is in everyone's interest that all groups meet their specified targets. Therefore, all groups mutually own and becomes a part of each problem. If one group needs help, the surrounding supportive functions are at hand and help can be delegate to other groups. These meetings on continuous improvements are often visited by a top manager assuming a supportive role, as the meeting is run and controlled by the production personnel.

When new products are developed, a database that contains earlier samples is used to assist, so that the 'wheel is not reinvented'. Another database contains reclaims and the subsequent measures and yet another one for deviations in production. Unfortunately, usage is low as it is time-consuming to document and store information in the database. No database exists containing earlier innovative ideas.

Corporate risk taking in new ventures is indifferent to the state of the market save for the Nolato School, which was used by the entire Nolato group to instruct personnel on how to organise and carry out projects. However, the project was cancelled when the company had to rationalise in order to meet reduced demand on the market in the year 2000.

Stimulation of innovative thinking at Nolato Polymer

The company maintains an unused suggestion box that can yield the idea generator a small reward. New ideas are instead ventilated through informal discussion with either a colleague in possession of relevant expertise, or at the meeting for continuous improvements. There are no incentives for personnel to implement and develop ideas. At Nolato all personnel work together and if someone does something extraordinary the only reward is verbal recognition. Instead of having individual rewards the company arranges events for all their personnel, in order to build company moral and team spirit.

Internally surfaced ideas are discussed at both hierarchical levels in the company and often with the company's customers. When an idea is rejected, the reason is usually customer rejection or too long payback time.

Each production group works independently and autonomously, there is little monitoring save for their stated overall goals. Erlandson believes in avoiding organisational restraints. At the same time he maintains that it is not easy to receive responsibility and autonomy, as it comes with a great deal of responsibility. Mistakes are allowed at Nolato Polymer and there are no punishments, instead there is a requirement to ask for help where it is needed.

External Relations

The company has consciously reduced its number of customers (from 350 to 20 in ten years) in order to focus on the large contracts. When a new product order arrives it usually means the start of a dialogue between Nolato Polymer and the customer, in order to determine the actual need of the customer. This means defining and specifying the product requirements. The contact with the customer is initiated by the marketing department, and subsequently continued by material and quality technicians at Nolato and the customer's.

After Nolato Polymer reduced the number customers they have strived to increase their integration with their customers. For some of their customers they control the stock volumes and deliveries, enabling them to manage their stock at a constant low level.

SSAB Tunnplåt

6. SSAB Tunnplåt

Company:	SSAB Tunnplåt (SSABT)
Ownership:	Full-owned subsidiary (Listed)
Employees:	4604 (2003)
Annual Sales:	SEK 10 583 million (2003)
Operations:	Global
Group:	SSAB
Employees:	9374 (2003)
Annual Sales:	SEK 19 806 million (2003)
Sources:	Survey and interview

Products: High strength steel sheets (hot-rolled, hot-dip galvanized, cold-reduced steel sheet and pre-painted steel sheets) for trains, vehicles and containers.

Innovative Processes at SSABT

The steel sheets made by SSABT figures in vehicles such as trains and cars. Every process- or product related change in production thus requires thorough analysis and approval concerning ISO standards

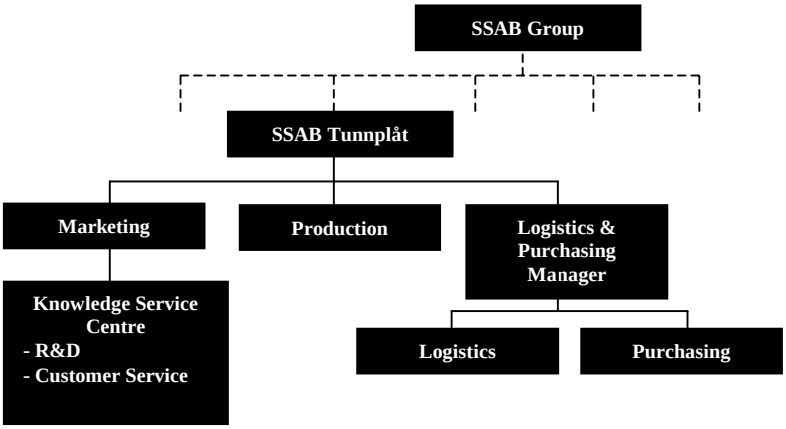


Figure 4.6 – Organisational structure of SSAB Tunnplåt

and environmental issues. Hence, there is not much room for improvisation and experimentation on an individual level. Due to the ISO standards and environmental issues, no projects are pursued unattended and the risk of being punished in any way for pursuing an idea without results is therefore non-existent. However, since the idea development procedure is so controlled, it is hard to stimulate creative thinking and experimentation. Perhaps because of this there are few, if any, promotional or salary-related benefits in pushing or pursuing an idea for further experimentation or implementation in the company. Generally, if an idea spurs into further implementation, the idea generator is invited to participate in- and get feedback from the projects progression.

The hierarchical and bureaucratic structure of the decision process is unmistakable in both the survey and interview. The superior manager is central in the decision process, in the case of pursuing an idea further as well as consultation on what to do with ideas not suited for SSABT's core businesses. No measures are taken to further pursue these ideas outside the current market of SSABT's. SSABT is in general a risk adverse corporation and corporate risk taking is usually the same no matter what the state of the economy. According to Nils Åkerblom, SSABT can be somewhat too risk adverse sometimes, leading to missed opportunities and slow development processes, as opposed to SSABT's Finnish competitor Rautaruukki that can be fairly bold in its corporate ventures.

In developing a new idea, whether it be process- or product oriented, affected functions like Research and Development, Marketing, Production and Logistics may be present in team-based projects, depending on the need of each department's involvement.

Codifying tacit knowledge and spreading it throughout the organisation is a problem at SSABT. Skilled employees in possession of valuable knowledge are often reluctant or unable to put their knowledge on paper. Efforts to suppress this problem have been made in terms of locating key individuals, removing them from their position and relocating them as mentors to other employees. According to Åkerblom, SSABT was formerly not good and handling this but the system of mentorship is now working satisfyingly. On Åkerblom's initiative, the Marketing department was first to implement a Senior Adviser Role [3] that later became applied on the SSABT Group level, disseminating Senior Adviser roles throughout various other departments in the corporation.

Stimulation of Innovation Thinking at SSABT

The general perception among the employees is that SSABT extensively stimulates innovative thinking although the motivation factors differs between no incitements at all, salary benefits related to new ideas, and participation in the development of new

[3] Involving practical procedure in managing generation shifts in the organization through mentorship.

ideas. With or without incitements, employees are nevertheless stimulated. The employees participating in the survey generally spend 4-5 hours a week or more, thinking about possible improvements for the company. The kind of improvement thought of differs though, either specific work process-, departmental- or company related improvements are represented. According to the survey, the opinions differ as to whether or not SSABT wants and also considers different level employees views of, and proposals to, improvements in the organisation.

There are individual benefits involved in coming up with a new idea and pushing that idea into further pursuance but empirical results point to that they are either hard to locate or poorly communicated in the organisation. Information concerning incitements in improving firm innovativeness is presented on the company intranet. However, two thirds of the employees participating in the survey stated that they rarely or never frequent the intranet of SSABT. This problem was confirmed by Åkerblom, who also believed that SSABT should engage in improving corporate communication to employees. The general opinion among the employees questioned was that communication works poorly or just okay in the organisation and the majority of the employees in the survey stated that they seldom communicated with departments other than the one they operated in. Nevertheless, except for 2 persons, all were satisfied with the communication within the specific department. The most frequently used means of communication in SSABT is E-mail, followed by telephone and then face-to-face contact.

Project-teams, related to improvements in the company's products or processes, is fairly frequent and usually involves several different departments. The decision process depends on the nature of the idea, many of the minor decisions related to products and processes are dealt with on middle management level, i.e. decentralised decision making, while the larger issues like company policies and financial resource deployment require corporate management involvement, i.e. centralised decision making.

A 'suggestion box' system exists where employees can place a suggestion with a separate unit in the marketing department. This unit filters the suggestion and consults relevant expertise and decision makers before deciding on whether or not to pursue the idea.

External Relations

Åkerblom believes SSABT to be well ahead of the competition in integrating and locking in customers, being keen on their product requirements and drawing on their knowledge. A lot of effort is placed in communicating with the market with for example

newsletters such as the DOMEX-[4] and PRELAQ-School[5] to customers, providing them with insights as to what SSABT could offer in terms of productivity, manufacture and logistical solutions.

On the supplier side, Åkerblom recognises that a lot can be done in terms of integration and communication. Too much emphasis is now placed in short-term solutions and the responsibility is SSABT's in Åkerblom's view. The suppliers have poor insight in SSABT's structure and processes.

The steel industry is significantly open as far as production methods, material handling and practical use of material. With these facts, in combination with the other benefits external networks bring to the company, SSABT has chosen to work closely with different academic institutions, e.g. Stockholm Royal Institute of Technology, Luleå University of Technology. For instance, they supply schools with technical course literature and a professor from KTH figures in the innovation team mentioned earlier.

Further Improvements of Current Innovation Processes

Åkerblom does not believe there are any major improvements necessary in the marketing area, but perhaps in the production area and further states that co-ordination between departments in SSABT is a bottleneck in the idea development process as well as continuous work improvement matters. The possibility of rotating workforce in production plants in an effort to spread knowledge and allow employees to grasp the whole production process as well as the desired corporate goals, is encouraged by corporate management but hard to implement in reality. Åkerblom indicates that this problem will be easier to deal with in the future since the younger workforce is more inclined to change their work environment on a regular basis.

[4] SSABT's hot-rolled steels used in applications such as ships, bridges, buildings, machinery, various types of vehicles, lifting devices, tanks and containers.

[5] A building material usually used for roofing and wall cladding on buildings, for rainwater goods and flashings.

Trelleborg Agri

7. Trelleborg Agri

Company:	Trelleborg Agri
Employees:	42
Revenues:	Approximately SEK 60 million
Operations:	Global
Group:	Trelleborg AB
Employees:	21 000
Revenues:	SEK 17.96 billion
Ownership:	Listed Company
Source:	Interview

Products: Produces OEM rubber products to the milking equipment industry. These products are thus specially designed, manufactured, branded and distributed in accordance to the specifications provided by its customers.

The Trelleborg group is a decentralised organisation divided into five business areas (Trelleborg Automotive; Wheel Systems; Engineered Systems; Building Systems; and Sealing Solution). These are then further subdivided into a great number of semi-independent Business units and product areas. Trelleborg Agri is one of these semi-independent product areas within the Moulded Components business unit and Engineered Systems business area.

Organised as a small autonomous company within the business unit, Trelleborg Agri has its own independently running functions. It is organised into three basic hierarchical levels, consisting of a general manager who supervise the product unit, followed by the second tier of 'production', 'supply' and 'marketing and sales', which finally is followed by a 'collective' tier.

Figure 4.7 – Organisational structure of Trelleborg

Innovative Processes

Emerging ideas are processed through various systems. Internal ideas are processed within a "suggestion process", which is a uniformly developed system within the Trelleborg Group, to process employee product and process innovations. These processes consist of a system where employee ideas and suggestions get treated in different levels of "suggestions committees". The intention with these committees is to create a forum where ideas and suggestions could be spread and further developed. Nonetheless, each respective idea's feasibility and overall contribution together with the potential financial contribution is assessed within these suggestion committees to facilitate a decision whether or not to proceed.

This procedure starts at the level where committees, of three to four employees from different business functions (at Agri) meet to process the emerging ideas originating

from their respective organisation. If an idea is deemed feasible the committee rapports and passes it to a similar committee that concerns the entire business area. A final step in this process is when an idea reaches the control committee, which includes the CEO. However, every idea will not climb this far up the 'corporate ladder', merely the ideas with a broader scope or those that are in the wrong product units usually climb the hierarchical levels. Decisions within these committees are made under a form of consensus where the final decision rests with seniority. However, the consensus is something that is strived for within the organisation. This is specifically good as the communicational flow within Agri is very good. Its particular niche and decentralised organisation facilitates a good communicational flow within the product unit, as they do not need to have a structured or formal procedure as bigger units might require. Indeed, this in combination with the fact that it is small and geographically located at one place makes it possible to have meetings on a rather ad hoc basis. However, communication with other departments (business area, business or product units) is rather limited, which becomes gradually more apparent as one climbs the hierarchical layers.

No formal plan of conduct exists for out-of-the-box ideas and it thus often takes the 'normal' bottom-up approach through the suggestion committees or through a decisional process within each business unit and area. The final destination of these ideas is to reach the groups that work with business development or to connect it with the most appropriate sphere that the idea might fit.

Product innovation is not prioritised within the Agri division as they sell OEM products. Agri does as such not have any formal plan when it concerns product development or innovation. Collaboration with other units within the group is therefore rather scarce and undeveloped, primarily as Agri operates in its own little niche market of supplying rubber products to the milking equipment industry. There resides a variation between the varying product units within the Trelleborg group regarding their innovative focus as Agri works with OME products and is rather small in comparison with other operative units. This does not however include the development of polymer materials, where it works in a rather close collaboration with other departments in Trelleborg (i.e. a technical centre) to spread and gain further information.

The production employees are mainly involved with the improvements of existing processes and not the development of products. No apparent structure to handle product innovation thus exists within the production department. However, representatives from the production unit are involved when it comes to implementation of new innovation that would affect them. The involvement of 'expert' representatives from the various functions affected by an innovation is generally common practice at Trelleborg Agri, which is done to obtain a more holistic perspective.

Stimulation of innovative thinking

Incentives exist (i.e. economic) and are well communicated and known among the employees as it is an old system that has been in use for many years. The economic incentives are decided by the suggestion committees which assess the potential of each respective idea's pure financial contribution to the company and then decide what amount the idea generator or generators should receive. It also runs campaigns if the number of contributing ideas has decreased to stimulate an interest for innovative thinking within the organisation or if there is a need for a certain type of improvement. This is achieved by raising employees' interest and making them aware of certain needs or improvements, by providing minor economic compensation for eventual idea contribution (i.e. cinema tickets, books etc.). Other formalised group incentives do not exist to stimulate ideas, probably due to the group's organisational structure.

External Relations

Since Trelleborg Agri only works with OEM customers, and does not 'own' its products, it is required and has to co-operate very closely with its customers regarding product development as they possess the expert knowledge. Indeed, if a customer develops a new concept close collaboration regarding our material and process knowledge has to be interlinked with the customers' product to determine whether it is feasible or not. In other words, the know-how regarding the material is possessed by Trelleborg while the design and product knowledge is customers, which requires that it sometimes has to alter the material properties to suit the customers' needs. Trelleborg Agri's technicians, experts in chemistry and process technology, thus regularly meet with its customers' development employees. Nonetheless, this system is only run with five of its major customers, where they meet their biggest customer at lest every sixth week. Development is however also focused towards developing future demands regarding material properties. This kind of development is mostly conducted through contact with the market and suppliers as well as institutions and regulatory authorities (governments) concerning foodstuff. A number of their bigger suppliers are also involved in this development process, whereby they meet on a regular basis (four times per year) to discuss what the current trends are and what development tests they could conduct.

Relations with Universities have also been sought after although this proved to be difficult as they operate in a very niche market and were thus recommended by varying University to contact their customers as they possessed the specialist knowledge.

Further improvements of current innovation processes

There are structural problems of innovations regarding the communication and sharing of information of polymer solutions from a group perspective. Sharing its core competence knowledge in a better and more structured manner would most likely benefit the corporation as a whole through immense synergistic effects. However, this

would be rather difficult as Trelleborg is a decentralised organisation which does not have a centralised development unit.

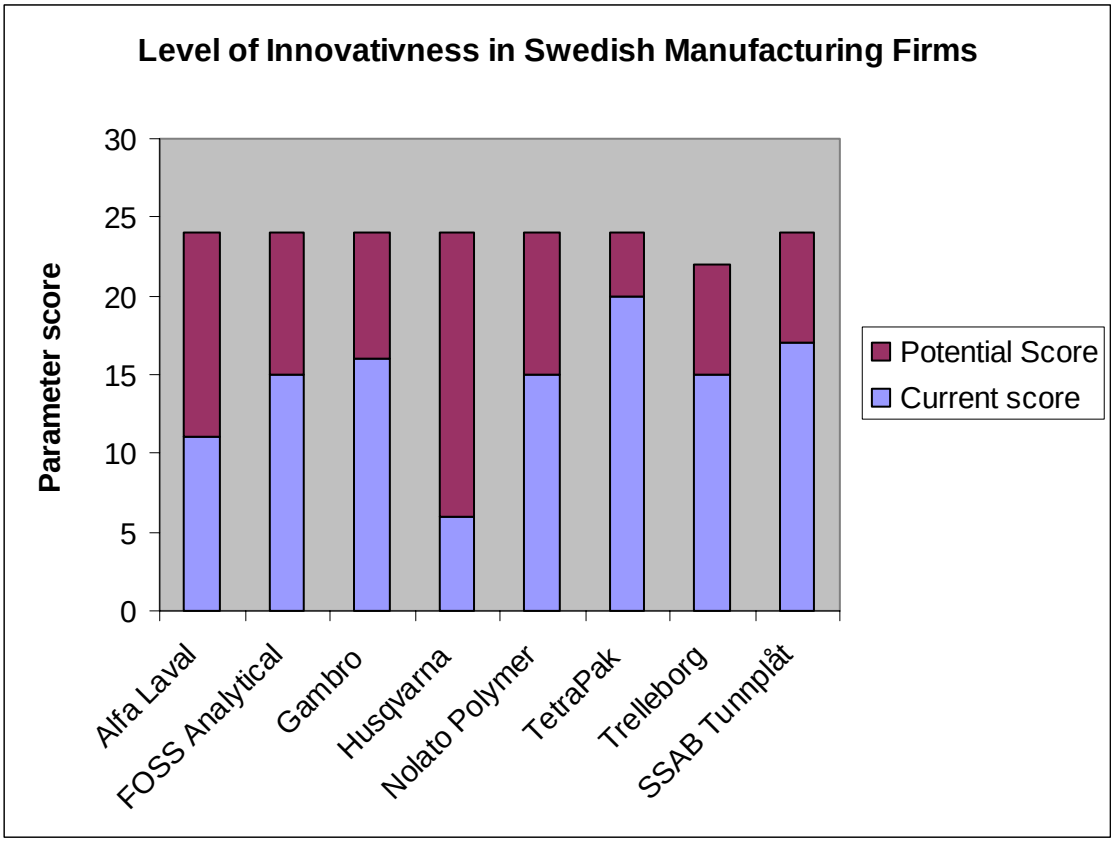
Analysis Part One – Parameter Analysis

The theoretical framework of this thesis is somewhat difficult to precisely measure and consequently also difficult to compare among the companies participating in the research. In order to make comparisons easier to interpret the parameters presented earlier in the thesis have been applied to each company, providing us with the matrix table presented in table 1.

Theoretical Parameters	**Alfa Laval**	**FOSS Analytical**	**Gambro**	**Husqvarna**	**Nolato**	**TetraPak**	**Trelleborg**	**SSAB Tunnplåt**
Motivate reflection over operational chores	✗	✓	✓	✗	✓	✓	✓	✓
Motivate risk taking	✓	✓/✗	✓	✓/✗	✓/✗	✓	✓/✗	✓
Remove barriers to skunkworks	✓	✗	✓	✓	✗	✓	**N/A**	✓
Promote heterogeneous group dynamics	✗	✗	✗	✗	✓	✓	✓	✓/✗
Identify and empower idea generators and sponsors	✓/✗	✓	✓/✗	✗	✓	✓	✓	✓/✗
Establish and maintain external networks with key customers	✓	✓	✓/✗	✗	✓	✓	✓	✓
Establish and maintain external networks with key suppliers	✗	✓	✓/✗	✓/✗	✗	✗	✓	✗
Establish and maintain external networks with key institutions	✓	✓	✓	✓/✗	✗	✓	✗	✓
Uphold goal convergence in part-whole relationships	✗	✓	✗	✓/✗	✓	✓	✓	✓/✗
Facilitate and encourage access to knowledge warehouse	✗	✓	✓	✗	✓	✓	✗	✓
Promote institutional or democratic leadership	✗	✗	✓	✗	✓	✗	✗	✓
Safeguard Emerging Business Ventures	✓	✗	✓/✗	✗	✗	✓	✓	✗

Table 1 – Matrix of Innovation Parameters

Data and information may not have been established identically for each and every one company, thus hampering the possibilities of comparing them in a specific parameter. However, the above table displays the companies' correspondence to the given parameters in relation to each other. From this we can derive the level of innovativeness within the different companies based upon the suggested parameters derived from the theoretical framework displayed in chapter three.. To visualise the companies innovative standings in relation to each other they are displayed in in graph 1 below. The chart is based on values assigned to the company's correspondence to the parameters. In essence, if the company in question endorses the parameter they are assigned two points, if not zero points and in between endorsing and not endorsing grant the company the value 1. Hence the maximum number of points are 24, i.e. twelve parameters times two, which is displayed as the darker column. The light-coloured column represents the company's current status in relation to the potential maximum of 24.



Graph 1 – Actual level of innovativeness in relation to potential

This ranking gives us an appreciation of the relative innovativeness among the Firms participating in the study. As we can see, Tetra Pak is the most innovative company in terms of the stated parameters and Husqvarna ends up as the least innovative company. However, this comparison has its limitations since the companies participating are far from similar in all aspects.

After applying the theoretical parameters to the participating firms, it became clear that this analysis alone is not sufficient for determining whether or not organisations are innovative. Indeed, after the analysis was completed and each respective firm's innovative score was concluded it became transparent that it only takes the separate functions in consideration. Hence, it only assesses the parameters separately, in disregard of one another, and as such only identifies incorporated or excluded innovative factors. This type of analysis is therefore only valid to identify why specific innovative activities are implemented or not and thereafter draw generic conclusions concerning the cause.

In consequence, after thoroughly reassessing our theoretical framework and parameters in conjunction with the empirical data gathered, it became apparent that the identified parameters operated in a symbiotic manner. Indeed, the parameters were even seen to build upon each others inherited strengths and minimise their respective weaknesses. These individual parameters operate as building blocks, where some form the basis of other and as such amplify the collective innovative behaviour. This process of innovative augmentation could be seen as a system of separate events working together. In consequence, a generic framework is needed to analyse the entire process of innovation. In other words, a framework that depicts a roadmap to become and innovative company. The results are presented in part three of the analysis.

Analysis Part Two – The IVC Framework

Below is a generic framework established to facilitate the analysis of a separate company's innovative features.

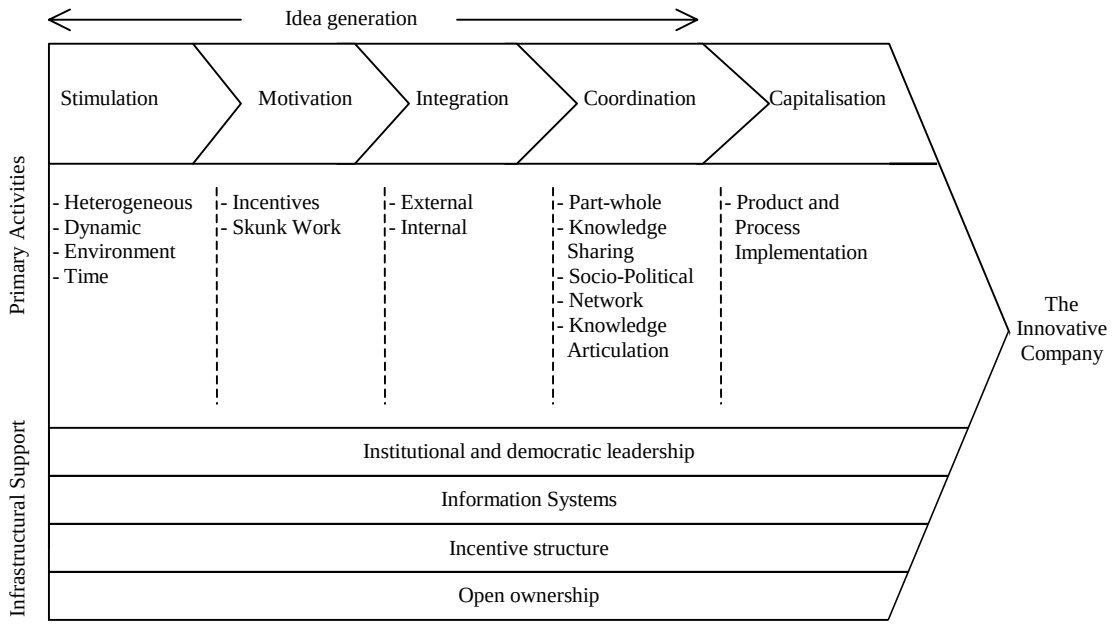


Figure 5.1 - The Innovation Value Chain Framework (IVC)

Where the parameters offer a structured comparison among the companies a more complete analysis is needed in evaluating the separate entities in order to view the companies' characteristics as a whole. Hence, the framework presented in figure 5.1 was derived from theories as well as lessons from the 3M-case in chapter three and the empirical findings from interviews and questionnaire results. This framework provides us with a basis for evaluating each company's performance all together.

In short, in order to be innovative the company needs to stimulate the environment of its employees by preventing homogenous group structure and instead aim for a heterogenic dynamicity whilst also providing key individuals with designated 'think time' to reflect on their everyday tasks. While the environment stimulates employees to think they will need further motivation to act on their thoughts and bring them into corporate attention. Incentives of different kinds usually provide this motivation as for instance salary- or promotion related benefits in taking action or an invitation to participate in the subsequent development of the idea and by that offer the employee an opportunity to do something different and disrupt the monotony that sometimes comes about in performing the same tasks day-in and day-out.

Furthermore, the company needs to exploit potential sources of knowledge residing in its external environment, i.e. suppliers, customers and other external institutions. Indeed, the empirical findings support the notion that Swedish manufacturing companies to a great extent cooperates with for instance universities and governmental institutions. The following activity in the IVC framework suggests that coordination among the different parties involved in the innovative environment, i.e. all of the above mentioned, requires coordination and communication in order to be in sync in terms of idea development, value chain collaboration, public research. To accomplish this, knowledge needs to be easily collected, codified and diffused throughout a network, whether it be an electronic network or a smaller traditional network depends on the size of the company as well as the geographical dispersion of its operations.

Finally, an innovation is not of use for an organisation unless it can be capitalised on. The product or process innovation needs to be pursued either through implementation in the organisation or through further idea development and subsequently production.

In addition to the primary activities, the innovation value chain can be supported and facilitated through a supporting infrastructure. As seen in the figure depicting the IVC framework, this infrastructure assists the innovation cycle throughout its course and consists of;

Institutional and democratic leadership – Important decisions involving innovation activities needs to be made in consent with parties in possession of relevant expertise and knowledge.

Information Systems – The company, or rather the individuals making decisions, need sound information in order to appreciate the whole picture and make the right decisions. An operational Enterprise Resource Planning (ERP)-system can for instance supply individual employees with access to relevant information in other units of the company, supplier capabilities, customer requirements and documented business intelligence from the market and other external sources of information. This part of infrastructure will also be improved if the company maintains an ERP-system operational. A network in more traditional sense needs to be governed as well where knowledge transfer and information exchange is encouraged and facilitated.

Incentive structure – Employees throughout the organisation needs the motivation to support or more fundamentally *constitute* the innovative activities of the corporation. Examples of incentives are; bonus-systems tied to progress, involvement in projects, assigned think-time or team events unrelated to their current tasks.

Open ownership – If people are reluctant to share their knowledge because of various reasons, e.g. fear of consequences, loss of control, the ‘Not-Invented-Here’-syndrome, it

might hinder the innovation process. Therefore it is of importance to open the ownership of the innovation in order to share both positive and negative aspects in the project.

Analysis Part Three – IVC-analysis of Case Companies

An IVC-analysis of Alfa Laval

Current Process

Alfa Laval predominantly motivates their employees to contribute with process innovations, as there is a formal suggestion box system in place that is associated with economic incentives. Product development is mostly associated with the fairly liberal view regarding skunkworks, which partially allows its existence. However, the incentive of further promotion and recognition exists when it comes to the development of new radical ideas outside of the current scope. Connections to broaden the scope of creativity, is also made through the establishment of external networks with both suppliers and universities. Capitalization of process and product innovations is conduction under a suitable unit within the organisation. An ambidextrous approach is taken if an innovation is outside the scope of the current organisation if proven feasible.

Suggested Process Improvements

Alfa Laval's personal leadership style and rather bureaucratic decision making process is resulting in the creation of homogeneous groups. These factors inhibit the creation of the vital dynamic environment that stimulates an innovative environment. These drawbacks could be overcome by the implementation of either an institutional or democratic leadership style, which would facilitate the creation of heterogeneous groups as well as strengthening the goal convergence.

There probably further resides an untapped source of employee potential as the incentives for product innovations is more an individually driven issue than an institutional one. This clearly hampers employees' awareness and motivation to participate in the innovation system. The creation of a formalised system for product innovation incentives, which smoothly could be communication to all employees would most likely increase employee participation and involvement in the innovation process. A supportive information system would further amplify this process as it would ease the communication and accessibility to employees.

An IVC-analysis of FOSS Analytical

Current Process

Employees are stimulated and motivated by top management through participation in idea development. Ideas are discussed with colleagues and brought to corporate attention through the superior manager. Integration with key customers and suppliers is sound and a knowledge transfer through dialog exists. Also, information exchange with

academic institutions is developed and frequent. Internal communication within departments is common and reliable. Diffusion of knowledge is encouraged through knowledge warehouses with shared access by project leaders. Product- or process improvement ideas outside core businesses are disregarded by top management. The hierarchy in organisational processes is apparent which affects the speed at which decisions can be made and information communicated.

Suggested Process Improvements

Empirical data revealed that individuals tended to think about improvements although the group dynamics of the department suggested a slight tendency towards homogenous group thinking. However, since workplace rotation was considered a too costly venture, other measures need to be explored. Extracting key individuals and assigning them mentorship status might prove a less costly and feasible alternative. Incentive does exist for the employees to perform but they are non-monetary. Also, additional motivation through monetary or promotional incentives as well as thorough communication of these might enhance the sponsorship of ideas.

FOSS Analytical's relations to external entities are well functional and developed in communication. Priority should now be to engage in discussion on product specifics, public research, logistically efficient improvements and so forth in order to continue and amplify the knowledge transfer between outside and inside parties.

Attention is needed in the communication between different levels in the organisation as well as between functions. Managerial decisions need consent from various key individuals with expertise related to decision. The relatively strict hierarchy prevents personal communication and the swift action proximity to problems enables, this in turn slows down organisational efficiency. Also, knowledge sharing is today hindered by the difficulty in codifying and transferring the individual tacit knowledge. A frequently applied, and to all functions common language is needed to speed up a uniformed comprehension of company problems and solutions.

Finally, a formalised system for conserving ideas outside core business needs to be considered and evaluated, as well as a plan to subsequently or presently investigate their potential lucrative execution.

An IVC-analysis of Gambro

Current Processes

Employees are stimulated and motivated to be innovative through recognition, participation in idea development, and financial incentives. Ideas are discussed by personnel at different levels in the company but the final decision is taken by top management. Integration with suppliers is limited and does not provide any knowledge

transfer. Information exchange with academic institutions is developed and frequent. The organisational structure is hierarchical and decentralised. Communications within departments is common and reliable. Knowledge is codified to facilitate knowledge sharing and stored in a common database to prevent the reinvention of the wheel. Product- or process improvement ideas outside core businesses are developed and safeguarded, until they fit into the portfolio. If they never fit the portfolio, they are abandoned.

Suggested Process Improvements

A problem for Gambro is their focus on current work within their current department. They need to reduce homogenous conformity in groups, preferably by heterogeneous meetings that can improve the communication and knowledge sharing between departments. Another way to foster the integration and enhance knowledge transfer between the departments is through workplace rotation.

Gambro have incentives for their employees to be innovative, but they need to communicate them clearly. They do not communicate them at all, as they think that they are widely known, but in the survey almost half of the employees say that the company has no incentives. Gambro should reconsider the benefits offered for pursuing personal ideas or promoting other peoples ideas, because today hardly no one feel that there are any benefits to motivate them into doing this.

The external integration with customers and suppliers should be improved. Gambro should establish a closer relationship based on communication and knowledge sharing and integrate their customers earlier in the process of developing new products, and not just only test new products on them.

An IVC-analysis of Husqvarna

Current Process

Employees are stimulated and motivated by top management through financial rewards for approved patents and implemented ideas that prove valuable. Ideas are gathered through an idea box. These ideas are handed to and read by related departments within the company. The decision of which projects to develop is made by top management in the company. Internal communication is informal and face-to-face. The coordination of the company is partially maintained by the Primary Components Development group and the Material group. Skunkworks it not communicated in the organisation, but is accepted under certain conditions. The contact with suppliers is limited to a mere observation of their internal processes. Integration with customers exists, but is limited to a few customer events where customers test and give feedback on already developed products.

Suggested Process Improvements

Huqvarna's system for developing new products is too focused on the development department and places them distant from the rest of the company. There is a need for formal systems that can facilitate and foster the innovativeness in the entire company. Only having financial incentives that are hard to earn is not enough to foster an innovative environment. Instead of passively assume that ideas will surface by themselves from the organisation the company would gain from having proactive formal processes.

The environment in the company is pressured and everyone lacks time to do anything but take care of everyday tasks, and consequently also to be innovative. Husqvarna should strive towards creating a dynamic environment where key individuals throughout the company have the time and resources to be innovative. For Husqvarna to foster a dynamic environment they need to reduce the time pressure on their employees, that today also prevents personnel from developing their new ideas. Husqvarna need also to identify and promote the right employees to sponsor and pursue innovative ideas. If these key roles in the innovative process are neglected, innovation will be hindered.

Heterogeneous meetings would help spread knowledge within the company and also prevent the development department from conforming around mutual ideas and instead open the process of new product development to involve the rest of the company.

The incentives for being innovative today could improve. Once an idea is accepted the idea generator is removed from the idea and further involvement in it. At best the idea generator will receive a financial reward in the distant future. By giving the idea generator the possibility to be involved in the exploration of the idea and communicate the value of good ideas to the employees, the company would be able to improve the status and motivation of being innovativeness. Also, as skunkworks is such an important activity the company should communicate the possibilities for accepted skunkworks an promote it.

The external integration with suppliers and other external institutions is limited to rather unrewarding observations of what the other part is doing. Therefore Husqvarna would benefit from establishing a closer relationship based on communication and knowledge sharing. Establishing a dialog with the customers and involve them earlier in the product development process would enable the company to use customers as innovators and not just get feedback on new developed products.

It is not just knowledge sharing externally that needs to be improved but also internally. Today it is hindered by the lack of ability to codify and transfer the individual tacit knowledge. Husqvarna should also decentralise their decision making, and instead

implement institutional leadership to solidify its decisions and draw on the organisation's collective knowledge.

An IVC-analysis of SSABT

Current Processes

Employees are motivated by top management through participation in the idea development and the possibility to plan their own work time. Ideas are discussed with colleagues, informally or at a weekly meeting with all production groups but the final decisions are made by top management. Integration with key customers is good and a knowledge transfer between the companies through dialog exists. Internal communication is common, reliable, informal and face to face. Heterogeneous teams with participants from the whole company meet every week to share knowledge and coordinate the company. The organisational structure is flat and decentralised. Product- or process improvement ideas outside core businesses are disregarded by top management.

Suggested Process Improvements

Nolato Polymer's major problem is their lack of individual incentives. A reward system would motivate their employees to develop new ideas, support good ideas, implement, and develop them. The company needs to communicate the value of good ideas, recognise the importance of idea generators and sponsors, in order to improve the status and motivation of being innovative.

External integration with suppliers and academic institutions through network infrastructure and activities would further develop the opportunity to gain information and knowledge from outside sources.

At the weekly meetings with the production personnel problems are communicated and tacit knowledge is articulated, this codification of tacit knowledge should be done more properly and documented in a database that should contain earlier innovative, problems in handling them and their respective solutions. Of course, the knowledge resides in the individual that works at Nolato but when he or she chooses to leave, the knowledge leaves with them. Proper documentation will prevent this from happening.

To enhance the integration and knowledge transfer between the different production plants a system of workplace rotation could be experiment with. The proximity of the factories in relation to each other provides an excellent opportunity for this procedure since all the workers live fairly nearby.

Finally, a formalised system for conserving ideas outside core business needs to be considered and evaluated, as well as a plan to subsequently or presently investigate their potential lucrative execution.

An IVC-analysis of SSABT

Current Process

The environment of SSABT in terms of freedom to experiment and assess one's working procedure is restricted in large part by the demands on their products. Nonetheless, employees at SSABT are encouraged to reflect on their work processes through either participation in idea development, salary increase and bonus systems or simply without incitements. Individual benefits in sponsoring ideas exist and communicated to the employees through the intranet. The industry is fairly open and external networks provide SSABT with valuable knowledge from academic institutions as well as its customers. Knowledge transfer is mostly restricted to within the separate departments, save for team projects from time to time involving several affected departments. The structure of SSABT is indeed hierarchical but as the decision making is fairly decentralised, the efficiency is not affected. Knowledge warehouses exist and are frequented by managers in project management. Product- or process improvement ideas outside core businesses are disregarded by top management.

Suggested Process Improvements

A more heterogeneous group dynamic is needed to prevent potential 'group thinking' and contra-innovative conformity to 'business as usual'. There is also a problem in codifying tacit knowledge and diffusing it throughout the organisation. Both these problems might be prevented through workplace rotation, which is currently under discussion at SSABT, as well as the mentorship strategy already executed in some parts of SSABT. By doing this, knowledge that is hard to codify might nevertheless be shared in the organisation through oral and practical instructions. Also, rotating the workforce reveals different ways of performing one's work as well as aides the employee in understanding the 'whole picture' mentioned in the part-whole discussion.

SSABT's coordination and communication needs attention. The incentives involved in sponsoring ideas require better communication to the employees in order for them to value idea generation. As it is, the intranet solution clearly does not work. The company must also ensure that the employees are under the impression that their opinions are appreciated by top management, no matter the level of use for the company. Communication and coordination across the different departments must also be stimulated. This can be achieved through the opportunity of cross-departmental socialising events such as team-building activities or joint barbeques on Friday afternoons.

The problem of being too risk adverse can be tackled through a more institutional and democratic leadership by ensuring a wider view in solving problems as well as spreading the responsibility of the consequences the decision might bring. As far as risk taking goes, SSABT has an advantage over its competitors in terms of being market leaders with good reputation as well as having strong relations with its customers. Furthermore, suppliers must no longer be neglected. They comprise a valuable source of knowledge in terms of what they can offer the company, whether it be logistical solutions or material capabilities. Short-term solutions are not sustainable in the long run.

Finally, a formalised system for conserving ideas outside core business needs to be considered and evaluated, as well as a plan to subsequently or presently investigate their potential lucrative execution.

An IVC-analysis of Trelleborg Agri

Current Process

Emerging process and product innovations are discussed and processed within the dynamic and heterogeneous suggestions process. Innovative behaviour is encouraged by the well known and established incentives systems in conjunction with the proactive behaviour by Trelleborg to steer and stimulate creativity. External network connections are established with a number of varying actors to both widen the scope of knowledge. In fact, collaboration is proactively maintained with key customers and supplies as well as legislative and control institutions.

Suggested Process Improvements

Trelleborgs lack of communication and sharing regarding its vital polymer core competence know-how clearly affects its long-term sustainability. It also decreases the collective synergistic effects that could be derived through a collective innovations system. This apparent part-whole problem could be solved by the implementation of a number of varying alternatives. However, an open informational system accessible to all employees would facilitate the sharing of not only emerging and existing innovations related to its core competence, but all kinds of innovations. The establishment of a pan-organisational system would thus potentially solve the part-whole problem. Another alternative or complementary solution is the establishment of formal and informal networks among key employees within the organisation. The formal networks could be established through a institutional or democratic leadership, whereas the informal ones could be created during coordinated events or gatherings. These would solve the part-whole problem and provide Trelleborg with a means to derive a further amount of employee ingenuity and value than currently is the case.

Conclusions

When summarising the theories and empirical findings resulting in the IVC framework, some concluding remarks can be made from the company evaluations. We set out to explore to which extent Swedish manufacturing companies stimulated their environments for organic innovation. Results from our initial parameter analysis concluded that there were several differences among the participatory firms' strategies in tackling the innovative problem. There were several flaws identified with this study, primarily regarding the approach of tackling the various parameters as separate issues. This was related with the fact that we arrived to the conclusion that an innovation could not be measured by the parameters separately. Additionally, we found that the identified parameters by themselves could not be ranked in any specific order, as one parameter is not more important than another.

An additional framework was therefore needed that could take the entire innovation process into consideration, as well as the structural and organisational processes of the companies targeted within this research. This setback led to the development of the IVC framework. This framework made it possible to assess the individual activities, first separately and then in conjunction with one another. By performing these tasks in that order, a reasonable assessment to the investigated companies' innovation capabilities could be made and thus also be able to answer the very questions we set out to investigate. Also, from the generic framework that was constructed in an effort to analyse empirical data, suggestions as to what the companies' potential improvements might consist of could be made with reasonable accuracy.

In summary;
We have identified parameters that potentially drives innovation.
We have tested these parameters on eight Swedish manufacturing firms
We have concluded that Swedish firms in part foster an innovative environment
We have finally also recognized that further improvements can be made

Needless to say, our findings in this area are somewhat unreliable, in large part due to the methodological limitations presented. However, our contribution to the debate on innovation today lies not within our empirical findings, but in the potential of our research parameters and IVC-framework. With these instruments, we believe that further research with sounder empirical foundation might add further credibility or doubts when testing the framework's reliability.

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