Limits of Learning

An analysis of contrasting learning approaches in the biotechnology industry

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Abstract

This thesis directs attention to collaborations and organisational learning. It combines the two concepts viewing in what way learning influence collaborations. More exactly, the thesis shows that collaborations can be constrained by contrasting approaches to learning. As firms continuously search to be the most competitive firm and more and more use collaborations to create value, this thesis can be an interesting perspective on learning and collaboration. My objective with this thesis is to examine if contrasting approaches to learning between collaborating firms interfere with the progress of the joint work. In other words, I want to examine if the nature of learning affects the progress of collaborations. I use empirical material from the biotechnology industry to illustrate and support the theoretical discussion.

With the support of empirical material the thesis illustrates that collaborations can be hampered if firms applies too different approaches to transfer knowledge. This hamper the transferability of knowledge and in that way affects the combination of competencies between the firms. It showed that the approach to store knowledge also hampered the transferability of knowledge, as these activities are closely connected. In addition, the study demonstrates that contrasting problem-solving routines can generate lack of creativeness in the joint work. The empirical material illustrated further that the activities in focus needed to be balanced. It showed that contrasting ways of handle with documents, different goals and interest, and contrasting approaches in decision-making influenced the progress of collaborations. If the study wasn’t supported by a representative selection of entities, it indicated that learning in biotechnology firms is individualised, flexible, and continuous.

Keywords: Organisational learning; Collaboration; Biotechnology firms; Knowledge
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1. Introduction

During the last 20 years there have been a big increase in the number of collaborations. Recent reports show that strategic alliances between companies worldwide have, since 1987, increased with an annual growth of 25%. Despite the increase, there are reports stressing the failure rate of business alliances and joint ventures of approximately 50 percent. According to the failure rate one could have expected the rate of strategic alliances decreasing in the future, but that is not the case. The increase seems to continue (Harbison & Pekar 1998 in Barringer and Harrison 2000). This reality mirrors a belief in the rewards of collaborations, a situation were the advantages overcome the disadvantages.

More and more firms are dependent on knowledge outside the firm and are forced to join with other firms to collaborate. But as the figures are indicating, it is not that easy. Knowledge has become very important for the survival of organisations in today’s competitive environment (Foray 2001, and Cowan et al. 2000). Nonaka and Takeuchi (1995) claim that knowledge has replaced the traditional input factors of capital, natural resources and labour. Even if there are critiques directed on the growing importance of knowledge it is consensus on the fact that knowledge is a crucial input factor. Dominique Foray (2001), uses the concept of “Knowledge Based Economy” and Lundvall (1997), calls the new features of the society “the Learning Economy”. Lundvall, (1997) claims knowledge as the most important product and learning as the most important process in the world economy. Learning has become important for organisations because changes in the business-environment affect the outcome of the performance of the firm. Learning processes and increasing amount of knowledge facilitate the firm to innovate and compete with competitors. This thesis addresses both these topical economic features on a micro level.
In today’s competitive market firm tries to distinguish them selves from its competitors by creating competitive competences. In the same time they join collaborations to create more value. This implies that competitive advantages can in a collaboration be a disadvantage, as firms are too separated in their way of acting. The thesis will emphasise how learning as a core capacity in the competitive market also represent a disadvantage. The focus of the thesis is directed to learning as a factor influencing the progress of collaborations. In so, the thesis participates to the understanding of why collaborations can fail.

2. Objective and Method

This thesis seeks to shed light upon how the firm-specific, dynamic, competence of learning can influence collaborations. The perspective builds upon the premise that firms develop specific core competence in learning, which has its roots in internal negotiations, history of the firm, and patterns of relations inside each firm. The applied perspective is limited, emphasising firm-specific grounds for approaches to learning. Internal structures can in turn be influenced by other social or economic structures, (Lam 1998) though not emphasised in this thesis grounded the size.

As firms develop different approaches to learning based on their internal structure, this requires a framework describing the approach. I have chosen to emphasise an activity-based view of organisational learning and focus upon 6 activities, which can differ between firms. These are; learning from others, problem-solving, experimental activity, learning from past experience, transferring of knowledge, and storage of knowledge.
My objective with this thesis is to examine if contrasting approaches to learning between collaborating firms interfere with the progress of the joint work. In other words, I want to examine if the nature of learning affects the progress of collaborations.

The objective of this thesis is expressed in two goals:

- First, I want to find out if the theoretical framework is sufficient to characterise approaches to learning in organisations.
- Second, I want to investigate if contrasting approaches to learning in organisations can highlight constraining processes influencing the progress of collaborations.

My preconceived idea, which derived from the theoretical discussion, is that contrasting learning system can be a source to challenges and problems occurring in collaborations. In order to follow up the goals, I see the use of embedding the theoretical discussion in empirical material. Therefore I use the empirical material to illustrate and the support the theoretical discussion. The empirical material is collected from small firms in the Biotechnology industry, who are experienced in collaborations.

To obtain the objective of the thesis, I have divided the thesis in a theoretical part and an empirical part. This represents the outline of the thesis. First, with the help of existing literature, a theoretical framework is presented describing the factors constituting collaborations. The focus of the thesis is on internal processes increasing knowledge in firms, and how these factors influence the progress of the collaboration. Naturally it is a limitation of the thesis not painting the whole picture of challenges in collaborations, but necessary for the practicability of the thesis. I am aware, there are other relevant factors constraining collaborations. The purpose of elaborating with a theoretical framework is to form an opinion
of constrains and problems occur in collaborations. In the end, preconceived ideas about how contrasting learning systems can impede the progress of collaborations are presented. How the theoretical framework is presented appears in the theoretical chapter. The following questions are leading the reader through the text: What is collaboration?, What is organisational learning, understood as knowledge enhancing?, Which skills/activities inside the firm characterise the learning process?, Why do skills differ between firms?, How do the activities differ?, and Do the different approaches to learning impede collaborations?

Second, I wanted to explore if the theoretical framework is supported by empirical material. Five firms and one institution accepted to participate in interviews, together with an expert in the field. All of the respondents are consciously selected from the Biotechnology industry. This industry is described as existing through the close interaction between three “players”; universities, new start-up firms, and existing pharmaceutical industries. In addition, it is a relatively new emerging industry, especially in Norway. The industry is assumed to represent the knowledge-intensive new economy, and as seen in USA, the potentiality to create economic value in this industry is palpable. For reasons of confidentiality, the firms and the institution, throughout the thesis are not referred to by name. A precision of how the empirical material is presented is accounted for in the empirical chapter.

Semi-structured interview guides were used to get the respondents to speak openly about his or her experiences, working together in a collaboration. These questions can be difficult to answer by a questionnaire or a planned interview-guide.

As my empirical material is limited due to the size of this study and the limited time, it is used to illustrate and exemplify when discussing the theoretical framework. The empirical material
is not enough to represent the industry as a whole, therefore I will not conclude with any
general conclusions concerning the industry. As the thesis doesn’t focus on a specific type of
collaboration, it cannot present general conclusions concerning one type of collaborations.

2.1 The ESST approach
This thesis is written as a part of a Master of Arts study in the ESST programme. In this
relatively new academic approach, the interaction of technology and society is the research-
focus. Technological development is in this approach not social-neutral but shaped and
affected by the social structure embracing it. The thesis is connected to the field of study by
focusing on organisational dynamics, viewing learning processes as a social interaction,
affecting the organisation of collaborations. The thesis integrates literature from economics,
sociology and human geography.

3. Theoretical Framework
The purpose with the theoretical framework is to provide an understanding of how contrasting
approaches to learning affect the stability of collaborations. The theoretical framework ends
up viewing how the heterogeneity of the approaches to learning can influence the progress of
collaborations. The section starts accounting for collaborations (Part 1), followed by an
elaboration around the concept of organisational learning (Part 2), and in the end
demonstrating the variety of approaches to learning and the affect on collaborations (Part 3).

3.1 Part 1: Collaboration
Throughout this section there will be a short presentation of the concept of collaboration. The
academic field of collaboration is extensive and doesn’t invite to a full discussion of the
concept. The section is based on existing literature, elaborating around what collaboration is, and what firms gain through collaboration, providing a broad introduction to collaboration. In the end, an elaboration of the concept of collaborations in practice will be provided. As this thesis aims at discussing factors influencing the dynamic of collaborations, more space has been provided to account for the nature of organisational learning compared to collaborations.

3.1.1 The concept of collaboration:
A collaboration requires at least two actors. In this thesis, it is assumed that these actors are separated organisations. Naturally collaborations can exist between two departments inside one firm, however that is not focus for this thesis. It will be referred to collaborations as a co-operation between two separated entities. These two actors join parts of, or the whole organisation together, combining resources to create value unattainable just by one of the collaboration partners in present shape. It is common that firms attend collaborations combining their internal constellations of competencies with matching knowledge resources placed outside the firm based on a specific goal. As it is more difficult for firms holding all competencies in-house, collaborations can function as a strategy for acquiring knowledge not held by the firm. In this thesis it is applied a broad definition of the concept of collaboration, as I don’t find it relevant to define collaboration more precisely.

It is applied a definition of a collaboration as Ranjay Gulati (1998) define strategic alliances;

“…as voluntary arrangements between firms involving exchange, sharing or codevelopment of products, technologies or services. They can occur as a result of a wide range of motives and goals, take a variety of forms, and occur across vertical and horizontal boundaries.”

(Gulati, 1998, p. 293)
3.1.2 The value of collaboration

It is seldom only one reason for a collaboration to occur, however there is at least one. It has been said that there are a lot to gain form collaborations, but what exactly is the advantages? Based on literature, there are many advantages. The following section is based on the article of Barringer and Harrison (2000), which in turn is based on literature from sociology, management, and economy, and represents a broad picture of the field of collaborations. Other articles like Inkpen and Crossan (1995) and Osborn and Hagendoorn (1997) present selected types of inter-firm collaborations, however none of them account for the diversities of collaborations as Barringer and Harrison (2000) do (Inkpen and Crossan, 1995 and Osborn and Hagendoorn, 1997 in Barringer and Harrison, 2000).

Collaborations can accumulate value in different ways. As firms can’t keep all resources in-house, they engage in collaborations gaining access to external resources complementing an internal deficit of resources like machines or human capital. With access to these resources they can complement their own resources and create value not possible with own resources. Second, with help of a partner, firms can increase their volume of production to amounts not possible with in-house resources. By sharing costs and risks with another firm it is possible for firms to take new directions not yet explored. A new business endeavour is correlated with investments and costs. These costs can be shared between two partners going for the same goal. If business is failing the cost is divided to at least two.

If a firm wants to have access to a foreign market the easiest way is to collaborate. This is used by multinational enterprises to a large extent gaining access to markets in underdeveloped countries. Together with another firm it is possible to combine competencies and develop products or services not possible with in-house skills. A collaboration create a context in which members can learn from each other’s competencies. It allows a flow of
knowledge to arise between the two firms collaborating. However, when firms combine their technologies, they have to have an understanding of the knowledge possessed by the partner.

Further, firms can challenge its existing ways of acting and improve routines and procedures. The combination of skills can also be composed of one firm holding technological skills and another firm as holder of market-access. A collaboration brings the demand and the supply together, and in so, they both create value not existing when they are separated. Moreover, firms have the potential advantage to use inter-firm collaborations as a tool of power where they can hinder competitors taking marketplace and also put pressure on governments.

In other words, there are many potential advantages for firms to engage in a collaboration. However, that is not the whole truth concerning inter-firm collaborations. Naturally, a collaboration represent an intersection between two firms and respectively members, routines, goals, competencies, management structures, cultures, business secrecy, and further, which can be a source of worry. For example, crucial information can be spread to potential competitors, and imbalance in power can trigger opportunism in one firm. This results in collaborations not just representing a potential advantage, but also a challenge triggered by characteristics embedded in respectively firm. As already mentioned, the thesis address potential disadvantages caused by different approaches to learning. This will be elaborated further.

3.1.3 Collaborations in action

Collaborations take many different forms. Strategic alliances and trade associations are two examples. However, in all the relevant forms there are humans present. A collaboration is
embedded in structures of social interaction. For example, it is common that the human networks inside a firm constitute the initiative for a collaboration. People are not without relationships as they enter a collaboration. They have relations to other people and the structure in which they are a part of (Gulati 1998).

Humans are the actual intersection between firms in the collaboration, and naturally, the collaboration is constituted by their interaction. Humans shape the relationship between two collaborating firms. Even if collaborations are planed in detail and co-ordinated by rules and instructions, it is humans through daily interaction creating the space between collaborating firms. In what way people in a collaboration interact, i.e. collaborate, is influenced by prior contexts they have belonged to. Their social setting shapes actions. This implies that people bring their way of acting, their experiences, into the new setting, which is the collaboration. People are carriers of values, norms, culture, and history when they enter a collaboration.

Therefore it is relevant to claim that collaborations are embedded in firms’ internal way of acting through members present in the collaboration. A collaboration is an intersection of socially shaped patterns of behaviour, thence a melting pot of conflicts and interest. The social context in which people have been shaped before they enter in collaboration affects not just the character of the knowledge but also the competence in how to perform tasks. As will be demonstrated, learning is constituted by social interaction. These patterns of action are the learning system. In other words, this thesis addresses different approaches to learning as a dimension affecting the collaboration, as members bring their patterns of action with them in collaborations.

3.2 Part 2: Organisational Learning

This part will emphasise that there are different ways of understanding organisational learning. Furthermore, the thesis sees learning as a knowledge enhancing process. The
concept of learning will be emphasised by 6 activities. These activities are: learning from others, problem-solving, experimental activity, learning from past experience, transferring of knowledge, and storage of knowledge (Garvin 1993). This approach to the concept of learning embeds learning to individual action. Further, attention is raised to why firms differ in character, emphasising social embeddedness, path-dependency, history, social interaction, societal setting and closure-process. With these factors in mind, learning is specific for each firm.

3.2.1 Background of the concept of organisational learning

The point of departure for the concept of organisational learning is based on two other concepts: Cybernetics and The Human Brain. With these two analogies it is possible to understand the organisation as a learning entity. The analogy of Cybernetics emphasise that organisations are able to correct their actions in response to stimuli placed outside the boundaries of the organisation. It is an ongoing process of correcting deviations to the standard. The standard is decided from before and the act of correcting is a function of the deviation. Thermostats cannot value the appropriateness of what they are doing, but they can correct an error from predetermined norms. Human brains have that ability to value the appropriateness of an action and “influence the standard that guide their detailed operations” (Morgan, G. 1997, p. 92).

In that way these two analogies show that organisations can be compared to a thermostat in the way of detecting errors and correcting actions. In comparison to the human brain the organisation has the properties to assess norms and standards changing. In understanding the organisation as a brain we accept an organisation to have the ability to value and criticise its own modes of directing actions. With this background of the concept and analogies with cybernetics and the human brain, it will be easier to understand what the concept is explaining.
than just presenting definitions. It is from these analogies the literature has borrowed the ways of viewing organisational learning.

3.2.2 Organisational learning as knowledge enhancing

From the sixtieth when first publications on organisational learning appeared and until now, the field has extended and there are many approaches to the concept (Romme and Dillen 1997). Due to their base in different academic subjects, approaches have different point of departure. Romme and Dillen (1997) outline four different approaches: contingency theory, which see the learning process primarily as a adaptation process, psychology approach, where Weick (1979), in Romme and Dillen (1997) stresses the perceptions of members of the organisation which are collective to the organisation, information theory, where learning is considered as a process and the result is an “expansion and improvement of knowledge” (Romme and Dillen 1997, p.70), and last system dynamics, where learning is understood as a “cohesive, holistic process” (ibid.).

The authors do in general agree upon that organisations can learn. I want to view learning as a change in different organisational characters. I claim that it is important to understand organisational learning as a changing process, where structures inside the organisation are changing. There are different ways of viewing weather it is the knowledge it self changing, or the perceptions held by the members. Virkkunen and Kuutti (2000) present four different views on organisational learning concerning changes inside the organisation. These are “learning as change in management or the rational choice approach”, “learning as a refinement of routines”, “learning as communities of practice”, and “learning as knowledge processing” (Virkkunen and Kuutti 2000, p. 294-297). In this thesis, I will treat organisational learning as an enhancement of knowledge inside the organisation, which does not mean that I dismiss the other approaches, however it can be seen as a limitation of my
Further, to place my thesis in the field of organisational learning it is possible to illuminate the spread of different approaches by asking four questions concerning theories of organisational learning: ‘Who are learning?’, ‘How are they learning?’, ‘When are they learning?’, and ‘Why are they learning?’ (Huysman, M. 2000, p. 84).

The first question relates to the discussion whether it is individuals inside the organisation or if it is the organisation itself, learning. The third question directs the discussion in what way it is possible to plan learning. In relation to this question there are two groups of authors; one claims that there are possibilities to plan learning activities in the organisation, the other claims this view “overlook the accidental and path-dependent nature of organisational learning” (Huysman, 2000, p.87). The last question is concerned with the discussion whether learning leads to improvement, understood as increased effectiveness. Critique is directed from a group of authors stressing that this perspective does not reveal the true nature of learning. In focusing learning as a process it is possible to reveal the dynamics in the learning process. Focusing on the outcome, too much attention is directed to the result of learning. Throughout the next section the second question will be further elaborated.

3.2.3 Voluntaristic vs. deterministic view of organisational learning

The second question relates to in what way the learning activity is carried out. There is the first group of authors perceiving “learning as an activity in which a single learner learns from the environment and who is more-or-less free to choose how to learn, what to learn and from whom to learn.” (Huysman, p.85). This view is based on the assumption that learning agents are voluntaristic agents, and the assumption that learning is one-way directed. Peter Senge (1990) is characterised as an author with this view. His perspective is a rather naive view of
what determines learning. It is not emphasising any constraining aspects on the learning agent, rather it sees no disturbance to the way knowledge is received (Huysman, 2000).

Huysman (2000) presents four determining factors, claiming that path-dependency, institutional forces, and dominant coalitions influence learning, in addition to the mutual character of learning. The concept of path-dependency claims that former experience influence present actions, and this will determine what to learn, how to learn and from whom. This connects learning and organisations to their history. The present feature of the organisation and how it learns is a result of the evolution of the organisation and its adaptation to former structures internally and externally. If we don’t accept this, we assume that organisations are not able to store experience, either by their members or their routines. However it holds no doubt that humans are remembering entities. This implies that members are bringing ballast and experience from yesterday into today. As a result, approaches to organisational learning vary based on experiences from the past, assuming that all organisations don’t make the same experiences; “Learning is influenced by past learning” (Huysman 2000, p. 85).

The second factor constraining the voluntaristic view is coalitions inside the organisation. These coalitions work as gatekeepers to the organisational knowledge and have power to make personal knowledge in to organisational knowledge (Berger and Luckman, 1966 in Huysman, 2000). This view puts the power structure of the organisation on the agenda and claims its effect on the “free learning agent”. The power structure affects which knowledge is being received, from whom, and how the learning process is carried out. The structure has evolved through time and is a result of negotiations between the actors inside the firm. It is
the present power structure, that determines which knowledge is remaining as the organisational knowledge (Huysman, 2000).

Huysman (2000) presents an illuminating example from her case study of the Netherlands Railways. In the organisation there were a coalition between the “old-timers” and management. This coalition was determined not to change when “newcomers” introduced new ways and solutions. One suggestion from the newcomers was to communicate more with the users, but the “old-timers”, backed up by the management, used their power to neglect the change.

Further, institutional forces affect the organisation. This means the external environment influences the organisation. The last critique is directed to the perspective that learning is oneway directed. This implies that knowledge is flowing from an external environment to the learning entity. Learning shall be understood as a mutual process, where there is learning in both ends. Learning appears in all the units connected to the process of learning. The learning is not just connected to one unit. “In a learning situation, (two or more) learning units adapt to one another” (Huysman 2000, p. 86).

Concerning organisational learning there are many perspectives and points of departure. This thesis looks upon organisational learning as a changing process concerning enhancing of knowledge in the firm. Further the thesis is limited to emphasise how firms learn. To direct attention to this framework I will investigate how firms enhance knowledge, looking at skills and activities inside firms. The thesis is in other words focused on the process of enhancing knowledge. The process of learning is composed by activities creating a learning system specific for each firm.
3.2.4 The learning system: the activity view of enhancing knowledge in firms.

There are ways in which we can understand the organisation as a learning entity, and as already pointed out, it is crucial for a firm to have the capacity to adapt to signals outside of the organisation. It is important for the organisation to listen and look for relevant features in the environment, assess these factors to the present structure of the firm, and if it is necessary, change accordingly. If knowledge is a result of learning, learning has to be at least as important for the organisation as knowledge, assuming that knowledge is crucial to being innovative. Learning is the process leading to knowledge. Knowledge and learning are inseparable. It will be held as a general view throughout the thesis that learning can be understood as a skill. This relates to organisational characteristics and different ways to cope with the process of learning inside the organisation. According to Garvin (1993) the skill is to possess a capacity to change behaviour with the basis of new knowledge. He identifies five skills important for the organisation to be a learning organisation;

“Learning organizations are skilled at five main activities: Systematic problem solving, experimentation with new approaches, learning from their own experience and past history, learning from experiences and best practices of others, and transferring knowledge quickly and efficient throughout the organisation. Each of these activities are characterised by a mind-set, tool-kit and pattern of behavior.” (Garvin 1993 p.53).

For him, the presence of new ideas is of crucial point. He stresses that without new ideas there will be no learning. These ideas are seen as the first mover to push organisational improvements, which have its point of departure inside or outside the organisation. Garvin (1993) define organisational learning:
“A learning organisation is a organisation skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights” (Garvin 1993 p.53).

Since the purpose of this thesis is to look inside the firm and highlight the learning process as activities in the organisation, the approach set out by Garvin (1993) is useful. As a point of departure this approach makes it possible to describe the activities organised by the firm to enhance their knowledge. It will be complemented by related literature. In the next section a detailed presentation of the activities of learning from others, problem-solving, experimental activity, learning from past experience, transferring of knowledge and storage of knowledge, will follow in order. Considering the epistemology of knowledge, its explicitness and tacitness, the framework is complemented by the integration of Nonaka and Takeuchi (1995). Tacitness refers to the part of knowledge held by individuals, which are difficult to articulate and write down on a piece of thesis. This has implications to the possibility of transferring knowledge between entities. The other dimension is the easily expressed knowledge, which in contrast to its counterpart, transfers easily. Nonaka and Takeuchi (1995) expressively pay attention to the knowledge production as a social process, where the main actors in the process are individuals, holder of different forms of knowledge. This approach consciously avoids a technical deterministic perspective of the process directing attention to the interactive relationship between members inside the organisation. In the fashion of opening the black box of knowledge-creation, they view the activities, events, and actions relevant in the process of learning and producing knowledge inside the organisation.

Knowledge is created by the interaction of tacit and codified knowledge. There are, according to their model, four modes of knowledge conversions. These are socialisation, externalisation,
combination and internalisation. Figure 2.4a illustrates which forms of knowledge are interacting. These processes are activities between individuals. Nonaka (2000) claims that to understand the process of knowledge-creation, it is crucial to view the activities, strategy, structure and culture of the organisation.

<table>
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<tr>
<th>Creation of a space (trigger 1)</th>
<th>Meaningful dialogue (trigger 2)</th>
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<tr>
<td><em>Tacit to tacit</em></td>
<td><em>Socialisation</em></td>
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<tr>
<td><em>Explicit to tacit</em></td>
<td><em>Externalisation</em></td>
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<td><em>Tacit to explicit</em></td>
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</tr>
<tr>
<td>Learning by doing (trigger 4)</td>
<td>Linking, networking (trigger 3)</td>
</tr>
</tbody>
</table>

Figure 2.4a Model of knowledge conversation by Nonaka and Takeuchi (1995)

In the following section the activities substantiating the process of learning will be presented.

*Learning from others*

This is the activity of using others experiences and knowledge and integrate this into the firm. External insights can complement self-generated knowledge with new perspectives. This activity helps the organisation to look for reference points and by that assess its current structure. With these external insights they can either challenge former ideas or they can support them. Garvin (1993) calls this method or technique “benchmarking”. As the nature of knowledge can be context-dependent and tacit, it makes it difficult to use the knowledge and
experiences gained by another organisation. Therefore, benchmarking must be carried out thoroughly to be of any use.

“Benchmarking is an ongoing investigation and learning experience that ensures that the best industry practices are uncovered, analysed, adopted, and implemented.”… “It is a disciplined process that begins with a thorough search to identify best-practice organisations, continues with careful study of ones own practices and performance progresses through systematic site visits and interviews, and concludes with an analysis of results, development of recommendations, and implementation.” (Garvin, 1993, p 64)

To its larger part benchmarking is based on the idea that knowledge can be transferred from one organisational setting to another, via a “disciplined process”. In this process it is believed that the tacit dimension of knowledge is uncovered and codified. For example conversations with customers can give “up-to-date information of products, competitive comparisons, insights into changing preferences, and immediate feedback about service and patterns of use.” (Garvin, 1993, p.65) These insights are used in all levels of the organisation. Tidd et al. (1997) refer to scanning routines, dividing them up in market-related and technology-related signals, point to the fact that there are different purposes of establishing different links. Further, they mention that external links can range from universities, suppliers, R&D institutions (private and official), users, and producers.

With the process of socialisation, Nonaka and Takeuchi (1995) claim it is possible to transfer knowledge from one context to another or to learn from others even if the knowledge is tacit. They emphasise the conversion of tacit to tacit knowledge through the action of individual interaction. In this interaction experiences and tacit knowledge is shared as individuals
observe, imitate and practice, rather than through communication, as the knowledge is not possible to articulate. During this process the tacit knowledge of the interacting individuals is increased. The approach by Nonaka and Takeuchi shows that the learning of others is constituted by the nature of knowledge. If the purpose is to transfer tacit knowledge from one external individual to one internal, the activity needs to be a close interaction between the relevant individuals, as in the case of Matsushita Electric Company, where the tacit knowledge of kneading dough was transferred to engineers through watching how the baker was working (Nonaka and Takeuchi, 1995). In a broad view DiBella et al. (1996) claim it is possible to observe the learning orientation, of different organisation to which extent knowledge is developed in-house or to which extent they are seeking inspiration, knowledge and ideas from external sources.

Problem-solving
The second activity learning organisations are skilled in, is solving current problems. This activity should be understood as a systematic process, and not an ad-hoc solution. It is an activity characterised by identifying and diagnosing problems in a highly scientific way. The problem-solving process generates a result of an action by the organisation, which in turn needs to be based on facts and data, and not on assumptions. This process can in a way be understood as a limitation-process of failure, in the decision of an action. To avoid mistakes, the organisation plans a process of gathering information important to guide their action. To make the decision as rational as possible they use statistical tools to limit the source of error. Problem-solving processes facilitates the employees always staying critical to the causes underlying an action and try to challenge the conventional wisdom. In that way, members assess the organisational values, which guide their action. This is a way to implement double loop learning to the organisation (Garvin, 1993).
As an example Xerox has implemented more or less a schedule to challenge the ways the firm are acting in the problem-solving process. The purpose is to generate new solutions to survive in new structures. Xerox’s problem-solving process are divided in six steps; identify and select the problem, analyse the problem, generate potential solutions, select and plan the solution, implement the solution, and evaluate the solution.

<table>
<thead>
<tr>
<th>Step</th>
<th>Questions to be asked</th>
<th>Expansion/ Divergence</th>
<th>Contraction/ Convergence</th>
<th>What’s next to go to the next step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify and select problem</td>
<td>What do we want to change?</td>
<td>Lots of problems for consideration</td>
<td>One problem statement, one “desired state” agreed upon</td>
<td>Identification of the gap “Desired state” described in observable terms</td>
</tr>
<tr>
<td>2. Analyze problem</td>
<td>What is preventing us from reaching the “desired state”?</td>
<td>Lots of potential causes identified</td>
<td>Key cause(s) identified and verified</td>
<td>Key cause(s) documented and ranked</td>
</tr>
<tr>
<td>3. Generate potential solutions</td>
<td>How could we make the change?</td>
<td>Lots of ideas on how to solve the problem</td>
<td>Potential solutions clarified</td>
<td>Solution list</td>
</tr>
<tr>
<td>4. Select and plan the solution</td>
<td>What’s the best way to do it?</td>
<td>Lots of criteria for evaluating potential solutions. Lots of ideas on how to implement and evaluate the selected solution</td>
<td>Criteria to use for evaluating solution agreed upon Implementation and evaluation plans agreed upon</td>
<td>Plan for making and monitoring the change Measurement criteria to evaluate solution effectiveness</td>
</tr>
<tr>
<td>5. Implement the solution</td>
<td>Are we following the plan?</td>
<td>Implementation of agreed-upon contingency plans (if necessary)</td>
<td></td>
<td>Solution in place</td>
</tr>
<tr>
<td>6. Evaluate the solution</td>
<td>How well did it work?</td>
<td>Effectiveness of solution agreed upon Continuing problems (if any) identified</td>
<td></td>
<td>Verification that the problem is solved, or Agreement to address continuing problems</td>
</tr>
</tbody>
</table>

**Figure 2.4 b: Xerox Problem-solving scheme (Garvin, D.A. 1993. p. 55)**

Gareth Morgan (1997) points out the same activity, or capacity as he says. He calls this capacity “Challenging operational norms”. To be able to change and learn, members need to
be skilled with a special competence, he argues. To accomplish a change, members must be able to perceive what is guiding our present actions of the organisation. That is an assumption for learning. Organisational members have to understand conditions, frameworks and norms guiding their actions. That is the first step. When this understanding is reached, members need to be able to challenge and change, based on information they get, and to assess that information to the existing structure. If necessary changes are not carried out, there will be a chance for a “lock in” situation, resulting in organisational actions that are not in match with the surrounding techno-economic forces. Peter Senge (1990) challenge for double loop learning by putting out six questions. Without directing further attention to them, they encourage the members rethinking their current position in relationship to alternative modes of operating and solve operational problems (Senge, P. 1990 in Morgan, G. 1996).

An organisation, learning and challenging their current actions are characterised as a risk-taking organisation supporting change. It is important to understand that in these organisations problems and errors are inevitably.

“They have to promote an openness that encourages dialogue and the expression of conflicting points of view. They have to recognize that legitimate error, which arises from the uncertainty and lack of control in a situation, can be used as a resource for new learning. They have to recognize that genuine learning is usually action based and thus must find ways of helping to create experiments and probes so that they learn through doing in a productive way.” (Morgan, G. 1997, p. 94)

Nonaka and Takeuchi (1995) do not emphasise the process in detail by drawing a scheme of how problems are solved. They rather describe when problems are solved, stressing that
problems are solved in an ongoing process. In addition, they view the process of solving problems as a part of a larger process, as the organisation not just solve problems but also “creates and defines problems, generates and applies new knowledge to solve the problems and then further generates knowledge through the action of problem-solving” (Nonaka et al. 2000, p. 3). In addition, they stress that the context in which problems are solved is relevant. Sharing tacit knowledge, as done in the socialisation-process, represents a context where problems are solved, as it is a forum for interaction and thereby challenges the sharing of mental pictures. Further, many problems are solved when implicit knowledge, held by humans, is converted into explicit knowledge (externalisation process). This is the process in which individuals use metaphors in an intensive dialogue, explaining contrasting understandings of knowledge.

Experimental activity

DiBella et al. (1996) argue that learning can be focused on two different levels. Either learning is focused on improving the activities already in use, or it is focused on testing the values, norms, and assumptions guiding the actions. Here, they refer to Argyris and Schons (1996) concepts of single-, and double-loop learning. The second building block of Garvin (1993) is experimentation activity which refers to single-loop learning. The process of this activity is similar to the problem-solving process, but the purpose is to enhance the opportunities for the business by enhancing the knowledge of their work. This activity is the process of continuous improvements of outcomes, and incremental enhancing of knowledge. It could be for the purpose of increasing the quality of the product or improvements in the production process. According to Garvin (1993) there are two methods to carry out this activity on. The first is ongoing programs and the second is demonstration projects.
Successful ongoing programs are characterised by; a steady flow of ideas, an incentive-system that favours risk taking, and employees and managers skilled in evaluations and performances. These programs often generate incremental improvements, composed by small experiments, and are usually carried out on the shop floor level of the organisation. For example, the outcome of an experiment can be a quality improvement of a material used for a certain product. It can also be improvements of the production process, like new technologies used for refining metals. In addition to the in-house activity to ensure a steady flow of ideas, selected members and teams are sent out to visit other plants, where they can collect and exchange experience. These members work as carriers of knowledge for the home base as they travel around the world absorbing knowledge. They visit for example industry leaders, research units, and academic milieus. After the “Japanese miracle” of the post-war period many teams went from Europe and USA to look and learn. Experimentation correlates with risk and cost. Motivations for members of the organisation to conduct experiments needs to be supported by an incentive system which needs to favour risk-taking. Members must be rewarded if they carry out experimentation. The skills to perform an ongoing program are held by members, and are a result of learning from past programs. How to conduct a program is learned through experience. Skills required are;

"Statistical methods, like design of experiments, that efficiently compare a large number of alternatives; graphical techniques, like process analysis, that are essential for redesigning work flows; and creativity techniques, like storyboarding and role playing, that keep novel ideas flowing.” (Garvin, 1993, p. 57)

Demonstration projects are another form of experimentation, and are larger and affect the whole organisational system. They introduce new ideas on how work could be carried out in
the organisation as a whole in a later stage. With the project it is possible to test and try out
ideas and principles. Learning is acquired by the project, which is useful when new
approaches are adapted to the whole organisation. It works as a test pilot for the rest of the
organisation. Experience from the first projects generates advice about how to perform
following projects. The teams developing these projects are in general multifunctional and
composed by many different functional groups of the organisation.

The aim in both ongoing-, and demonstration-projects is to generate a larger understanding
for the underlying factors fostering the actions of the organisation. If the organisation obtain
the knowledge in why firms act as they do, it will be easier to direct focus to the root of the
problem when it occurs. “Knowing why is more fundamental: it captures underlying cause-
and-effect relationships and accommodates exceptions, adaptations, and unforeseen events.”
(Garvin, 1993, p. 60)

Nonaka and Takeuchi (1995) refer to the improvement activity as individuals interact in the
socialisation process and share their tacit forms of knowledge. Brainstorm-camps are used as
a space in which individuals can share their knowledge in an informal way. These sessions are
used for product developments, but also for managerial and corporate developments.

The strategy of generating a vast amount of ideas lays behind the success of many Japanese
manufacture firms in the post-war period. Firms like Toyota, Nissan, Toshiba and Kawasaki
Heavy Industries use the strategy of Kaizen-continuous improvements. Nowadays, successful
industries in Europe use this strategy as well. The concept is based on the belief that
everybody in the organisation, not just in R&D departments, has the skill of being creative
and generating ideas for improvements. The sum of all the small improvements generates an
overall impact. This activity have not just the advantage of generating ideas for improvements in various parts of the organisation, it also has an indirect effect. When members participate in an activity leading to change, they will be more receptive to change in their own environment as well. The activity is therefore indirectly reducing members’ resistance to change (Tidd et al. 1997).

Learning from past experience

This activity places history on the agenda. “Companies must review their successes and failures, assess them systematically, and record the lessons in a form that employees find open and accessible” (Garvin, p. 61).

Knowledge produced today can be used to guide action in the future. In remembering past experiences, firms will be able to avoid doing the same mistake over and over again (Garvin 1993). Organisations can learn from past experience through performing examination on already performed projects. The purpose is to gather experiences obtained by the organisation in action and store them for future use, with help of extensive interviews and communication with the people involved. These experiences are of considerably value for the organisation since actions are embedded in the organisational structure. Experiences obtained from others are not always easy to apply in another organisation. That has to do with the fact that not all knowledge is transferable between organisations. As mentioned earlier, knowledge is to a certain part implicit and difficult to articulate and transferred to a carrier. Therefore experience can be the core competence in future action and the competitive capability no other organisation have experienced.

With this method, the organisation can assess the performance of the project, and register crucial knowledge, important when performing similar projects in the future. The organisation
does not just gain from the success of the developed product, but even from experiences of failure and success as the project is progressing. Through a thorough examination, it will enhance the understanding of why projects failed or succeeded, which points out that it is also important to carry out these activities, even if the project not is perceived as a success. Garvin (1993) calls these activities “case-studies” and “post-reviews”.

Data banks are used to store experiences, which is of importance so that the experiences are available for members in future situations. In problem-solving processes teams can be saddled to describe the project and proposal for storage and to match this with other groups working in the same field.

Nonaka and Takeuchi (1995) integrate this activity in the socialisation-, and the combination process. Even if they don’t refer to case-studies, they emphasise that prior knowledge embedded in the organisation is used in the socialisation process when individuals have the opportunity to participate with their knowledge, regardless of their place in the hierarchy. In addition, past experience and knowledge will be challenged, as it will be compared to new explicit knowledge derived from the externalisation process.

**Transferring of knowledge**

It is important for the organisation that the knowledge gained in one part of the organisation does not stagnates but disperses throughout the company. Knowledge in one end of the company can come in handy in the other end. If there is a match with the knowledge gained in one part of the organisation and the problem in another part, time and money is saved in matching these instead of looking for other external solutions. In addition, knowledge can work as a catalyst to others in the company far from where the knowledge was generated. Action can be triggered by knowledge flowing between departments in the organisation.
Argyris and Schon (1996) claim that the organisation does not learn if just one part has obtained the knowledge. For these reasons, channels in the organisation must be established so knowledge can flow between different units in the organisation. Knowledge is spread throughout the organisation in many ways. In the case when knowledge can be articulated it is disseminated to other departments of the organisation by written documents. These documents or reports have the advantage of summarising new findings, describe processes and provide a checklist. Reports can be used for different topics ranging from marketing techniques to new technological founding. However, not all knowledge can be articulated and spread with the help of reports and documents. This kind of knowledge must be disseminated throughout the organisation with the help of other channels. Members can by oral way inform, face to face, the knowledge obtained to an interested member of the organisation, or by telephone. With the help of ICT, e-mail can be used and also chat-spaces where different themes can be discussed. The advantage is a two-way communication compared with the transferring of documents. Learning by doing and experience in an active way is according to Garvin (1993) the best way to disseminate knowledge. Rotation programs of members account for this. This method is supported by the argument that knowledge is locally embedded in different parts of the organisation. By rotating, other parts of the organisation will experience lessons obtained elsewhere. These rotation programs can be vertical along the hierarchy or, horizontal between different departments or divisions of the organisation. Other used mechanisms for spreading knowledge are education and training programs or standardisation programs. DiBella et al. (1996) refer to this as the dissemination mode, where this activity can be more or less formal and planned. The formal methods of sharing knowledge are through educational programs or written communication. “In the informal approach, learning is spread through encounters with role models and gatekeepers who actualize the insight or
method by behaving in a compelling way” (DiBella et al. 1996 p. 49). It is to which degree the organisation plan their dissemination of knowledge, that distinguish firms. The problem with this view is that the sharing of knowledge can be carried out in different ways in different parts of the organisation. Nonaka and Takeuchi (1995) emphasise expressively the dimension of nature of knowledge influencing transfer of knowledge. Actually, the essence in their knowledge creation model is sharing and transferring of knowledge. According to them knowledge has different forms, implicit and/or explicit, which influence the way in which knowledge can be transferred. Knowledge is shared in all conversion processes of their model; socialisation, externalisation, combination, and internalisation. In the socialisation process it is created a forum where tacit knowledge can be shared and result in a shared mental picture. In the externalisation process interaction between individuals is through dialogue and meetings where the use of metaphors decreases the gap of meaning between individuals. In the combination process knowledge is combined with the existing knowledge-system of the firm. In this process knowledge is explicit and knowledge is shared with the help of tools like telephones, intranet, and documents. In the last conversion process learning by doing is the activity in which explicit knowledge become implicit again. Notice that all conversion processes is representing a close interaction of individuals, as Nonaka and Takeuchi (1995) treats as the carrier of knowledge.

Storage of knowledge

It is different ways in which the organisation can store their knowledge. Storage is important for future action, as it is possible to use experience from the past to guide actions. Nonaka and Takeuchi (1995) assume, as mentioned above, that individuals are carriers of knowledge. If individuals are the only holders of information in the organisation the loss will be grate when members leave the organisation. And when the knowledge is required, it is up to the
individual what and when knowledge is being used. Therefore it will be an advantage for the organisation to store the knowledge in other ways, like in routines or in work descriptions. This requires that members describe the conditions under which the work is performed and what the result was. This assumes that all knowledge is explicit and members are able to write down what is experienced. However, knowledge has a more implicit part as well, which points to the difficulties of expressing every experience of action. In other words, it is not possible to bring all valuable knowledge out of an individual and write them down and store for future use. Some knowledge is always held in individuals of the organisation.

In addition, Romme and Dillen (1997) account for four internal in addition to external storage places. Knowledge can be stored in the culture of the organisational, like in language, collective frames and references, symbols and rituals. Secondly, it can be stored in transformations, like standard procedures, planning systems and budget systems. Further, knowledge can be stored in the organisational structure understood as in the frameworks guiding members in different activities. Last, knowledge in form of behavior values, norms and codes, is stored in the physical structure of workplaces in the organisation. Externally, knowledge is stored in former employees, competitors, official documents and journalists.

The mode of storage is also relevant for DiBella et al. (1996) when they identify different learning styles. According to their view, firms can favour a mode where knowledge is treated as an individual property, and is a result of personal education and training, or firms can treat knowledge as an objective, collective property available for the whole organisation. In the first setting less effort is directed to support the storage of knowledge in documentation and organisational archives for future use in comparison with the other.
*Three out of six = learning organisation?*

The theoretical framework described above is not used to define whether a firm is a learning organisation or not. This is a discussion not of focus for this thesis. Centre of attention is how firms are learning. In order to do that the thesis describes the processes underlying the outcome of knowledge. Therefore, this thesis does not claim that a current firm needs to organise all the activities in order to be defined as a learning organisation, nor it is stressed that a firm is a learning organisation if it only uses three out of six activities. The framework shows which activities underlying the enhancing of knowledge.

*Interdependence of activities*

The activities are not 6 independent activities separated from each other as described by Garvin (1993). For example the form of the transfer is determined by how knowledge is stored in the organisation. If knowledge is stored in individuals of the organisation the transfer of knowledge will always be constituted be the participation of the person. Therefore, knowledge is shared and transferred mostly by face-to-face interactions instead of via written text in documents. In addition, problem-solving routines are determined by the type in which knowledge are stored. If the majority of knowledge is stored in humans they will practice a more informal way of solving problems. Resource persons in the firm can solve problems in real-time.

Next section will highlight the fact that firms are different in character. The purpose is to argue that activities of enhancing knowledge can vary between firms.
3.2.5 **Learning approaches differ in character, why?**

In this section the purpose is to demonstrate different arguments claiming that firms differ in patterns of action. It is done to substantiate the assumption that firms can differ in their approaches to learning.

Present state of the organisation is a result of an evolution. The way of creating knowledge in the organisation is a result of historical experience made by the organisation. The reason for acting A instead of acting B is based on experience. An organisation is not an ahistorical entity, implying that actions in the past affect actions in the present. The reason is that organisations and individuals make up experiences of the past, assess the success of it, and use this experience when a similar event occur again. This is based on the assumption that organisations and individuals have the capacity to store knowledge and use it in another time, but in a similar context. The use of today’s knowledge tomorrow is for that reason connected to the way the members in the organisation organise to store, collect and create knowledge. With this it is argued that today’s learning routines are affected by the experiences perceived yesterday. Borrowing the concept of inheritance from biology, economists mint the concept of path-dependency describing this phenomenon.

In the evolutionary approach firms exists as a result of historical process of interaction between the firm and institutions and practices in the environment. They structure themselves as a result of negotiation in time between individuals inside the firm and act by choosing the appropriate rule for a given situation. Last, firms survival is determined by competitive advantages in a non-static and dynamic and changing environment (Augier et al. 2000).
“Firm differ because they rely on different routines and competences that are specific and that cannot be transferred (at low cost)” (Cohendet et al. 2000 p. 95).

Based on a discussion whether the neo-classical approach applies a representative view of the firm, the evolutionary approach has emerged. According to neo-classical perspectives each firm are seen as an equal entity, which acts in the same manner given the same circumstances. The existing firms have found an optimal way of organise co-ordination, control and communication. In a decision-making process firms have full information about the alternative solution and the consequences. They organise the firm to maximise profit. The destiny of the firm is a function of its competitive advantages in an environment (Augier et al. 2000). Thereby, in theory, it is supporting that firms differ in their way of acting when learning.

Moreover, when organisations, to its larger part, consist of individuals there are reasons to believe that the creation and processing of knowledge is separated between organisations. During time different individuals and different organisations might be in different phases in their organisational life, evolving in different directions even if there are centripetal forces like standards, or cultural globalisation, forcing them closer together. The historical process is building a diversity of organisations. During time individuals have co-evolved through interaction between each other and ended up with a procedure suited for the involved individuals and groups. The process of resolution how to act is constituted by the composition of individuals and supporting structure like incentive system. Granovetter (1985) illustrated with the concept of embeddedness, that networks of social relations constitute behaviour. These relations differ in character due to its compositions of individuals in a defined social network of a firm. Since we can assume that firms consist of different compositions of
individuals without further argumentation, we assume firms differ in their character. With this argument it is claimed that not just knowledge but even learning is socially constructed by interaction and negotiation inside each firm. Beijker (1995) accounts for the process of “closure” in his “SCOT-model”. Based on the concept of interpretative flexibility they argue that technological development is a result of a system in an ongoing negotiation between relevant social groups with technological frames ending in a stabilisation of the different perspectives. In the process different perspectives, options, and alternatives are gradually eliminated until the relevant groups reach a consensus. In the perspective of the firm it is relevant to argue that this process is present. Thereby knowledge creation activities are not neutral but constituted by individuals and deployments and their mutual interaction.

Actions inside the firm are socially embedded and knowledge of how to create knowledge is highly specific for the firm. Badaracco (1991) stressed that knowledge is embedded in a firm-specific context of interactive individuals, which makes it “sticky” and more difficult to transfer between different organisational settings (Badaracco, 1991 in Lam, 1998). This refers to the tacit dimension of knowledge explained by Michael Polanyi for the first time in 1962 (Polanyi, 1962 in Lam, 1998).

Further, Alice Lam (1998) demonstrates how the socially embedded nature of knowledge constrains joint work between firms coming from different societal settings. She uses the concept of embeddedness to analyse the nature of knowledge as a function of organisational and societal settings.
3.2.6 Summing up part 2

With support from the existing literature this section has viewed how firms learn by emphasising the activities inside the firm. We can call it the active perspective of organisational learning. The section explains why it is important for firms to direct focus on these activities, accounting for the features of the activities, and structures influencing them. This view emphasise that learning is constituted by activities performed by individuals inside the firm. Therefore, this perspective participates in the opening of the black box of learning in organisations. Moreover, this part provided an understanding, based on different perspective, of why organisations should be respected as different in their internal character. However, how they differ and how this influence joint work in a collaboration will be illustrated in the next part.

3.3 PART 3: Nature of Learning affects Collaboration: contrasting learning system vary in character and influence collaborations

The purpose in the following part is to account for how the activities of enhancing knowledge can vary between firms and illustrate how these contrasting activities can be a source of constrain in the progress of collaborations.

How firms cope with their way of enhancing knowledge will affect collaborations with other firms. Differences in character can, if they are to separate, hamper collaboration but it can also have a positive effect in challenging current activities. That is the reason why this section directs attention to the variations in activities.
3.3.1 Contrasting creation procedures:

The nature of knowledge in firms have been recognised as a crucial question. As noticed by Michael Polanyi (1962), Winter (1987), and Nelson and Winter (1982), the nature of knowledge can vary in its degree of tacitness (Michael Polanyi, 1962, Winter, 1987, and Nelson and Winter, 1982 in Lam, 1998). Knowledge has a tacit part as well as an explicit part. The tacit part is more difficult to express in words or written text than its counterpart. This is affecting transfer of knowledge, as a part of the knowledge is unable to articulate. However, as Alice Lam (1998) noticed, the degree of tacitness has to do in what way knowledge is produced. “It seems that the approach or method of skills formation and knowledge acquisition plays an important part in determining the dominant form of knowledge held in organisations and its degree of tacitness.” (Lam 1998, p. 12) She proposes a distinction between two different learning models: the Japanese organisational model vs. The British professional model. The former connected to the tacit dimension of knowledge and the last the explicit dimension. I will use her view to highlight contrasting creation procedures.

In the organisational model an internal process forms knowledge, in absent of an external labour market. Knowledge is formed through a process of learning by doing. Imitating experiences as another person in the organisation already have made accumulates knowledge. It is a time consuming process but even the tacit dimension of knowledge is transferred to its receiver. Through this process there are a lot of interaction between individuals in the firm. These processes are in general very firm-specific in their character as they take minimal use of an external labour market. Experiences and knowledge is shared through meetings face-to-face, by individuals of the firm and constructive conversations are applied. The emphasis in the process is in the “action” and the “doing” rather than the formal theoretical education. The knowledge of “how” is larger than the knowledge of “why”, as a result of the learning
procedure. Skills and knowledge held by the individuals are a result of an “on-the-job-training” program. The Organisational model refers to the process earlier described as Nonakas and Takeuchis (1995) approach to creation of knowledge, where knowledge is a product of interactivness of individuals inside the organisation. The result of this procedure is that knowledge becomes highly tacit in its form. In the professional model the external labour market are connected to the processes. Skills and knowledge are accumulated through formal education and training in learning institutions like universities, collages, and knowledge intensive institutions. From these institutions general and standardised knowledge is acquired with the purpose to fit in different relevant contexts. The form of knowledge is more abstract, formal and theoretical compared to the knowledge accumulated in the organisation model. Since the knowledge can be used in different situations it is not connected to different contexts and easier to transfer. The implications of contrasting approaches to learning are according to Alice Lam (1998) poor project performance and failures, diluted technological partnership, and asymmetry in knowledge transfer and organisational learning. Even if Alice Lam (1998) has integrated some of the activities of knowledge creation, it is possible to distinguish them from each other and discuss the implication separately. This is done in the rest of this section.

### 3.3.2 Contrasting modes of dissemination of knowledge inside the organisation

Even if all these methods of disseminating knowledge throughout the firm can be used by the firm, they can be used to a more or less extent, and vary if they are planned or not. Alice Lam (1998) claims it is possible to differ firms to which extent the dissemination of knowledge is “tacit and human-network-based” or if it is “explicit and document-based”. The first is connected to the earlier described organisational model and the second to the professional model. The method used by firms is a function of the “common knowledge” held
by firms, which she describes as “the level of trust and implicit shared codes which the
system is able to generate and the degree of external mobility of individual knowledge and
erpertise.” (Lam 1998, p. 15). In the organisational model knowledge is transmitted through
face-to-face interaction between individuals in groups. Nonaka and Takeuchi (1995) build
their whole theory as described earlier upon active interaction between individuals, due to the
tacit nature of knowledge. Due to the use of explicit knowledge in the professional model the
method used to disseminate knowledge in such an organisation, is via written texts in
documents and reports.

Different routines for transmitting knowledge can affect the transferability in the
collaboration. Transferability refers to the degree of friction when knowledge is transferred
between entities in a collaboration. With a high degree of friction between the entities it is
difficult for knowledge to flow. When two firms practising contrasting ways of transferring
knowledge the friction can increase. The transferability will in turn affect the capacity of
learning in the collaboration. (Child, 1997) If it is difficult to learn and transfer knowledge
between the entities in a collaboration, it will be difficult to combine them to create new
value.

The firm in favour of face-to-face transmission of knowledge tries to develop spaces in and
outside the organisation where knowledge can be shared. Nonaka (1995) defines the
organisation as a “ba” which is a space in which knowledge can be shared between members
of the organisation. The sharing and transmission of knowledge in such a place is connected
to the acceptance of tacit knowledge, which is not easily transmitted through documents.
This result in organisations develops a routine for sharing knowledge through face-to-face
interaction instead of via documents. These routines can be very specific for the firm and its
employees as it is dependent on personal relationships. On the contrary, in an organisation utilising transfer of knowledge by documents they try to build up an efficient procedure for document dissemination. Consequently, they are not used to sharing knowledge in an oral way, which is different in form compared to written texts as it is possible to add more surrounding knowledge when you converse. People used to transfer knowledge via documents, needs to practice how to transfer knowledge in oral discussions, as well as the other way around. If we have two firms collaborating, they can end up in a situation where there is misunderstanding in which knowledge should be transmitted and what is needed to be transferred for the receiver to absorb the knowledge, which further results in a lot of interactions and documents flowing back and forth for no use and a lot of time is spent.

Firms which practice oral dissemination of knowledge builds up a lot of common knowledge between the members of the organisation which is important to possess when knowledge is transmitted, otherwise it can be difficult to absorb the knowledge. It can be difficult for members of another organisation to participate in a conversation, which builds upon a vast amount of common knowledge.

Further, different settings can focus on different types of knowledge being shared and transmitted. Some focus on “know-why” and others on “know-how”.
This result in problems concerning what type of knowledge people expect when entering a collaboration. They expect different outcomes of the conversations and the joint work.

**3.3.3 Differences in storage of knowledge**

A precise description is already provided when the activity was described. The method of storage depends on which form the firm favour. Even if firms can favour both individual
storage of knowledge or collective, for analytical reason it is possible to distinguish firms favour individual vs. collective storage. Alice Lam (1998) claim the storage of knowledge is a result of its transmission mode. In the professional model knowledge is stored in individuals, compared to the organisational model where it is stored in relationships and organisational routines generated by the organisation.

The transferability of knowledge can be affected in the way knowledge is stored inside the different firms. If knowledge is stored inside humans the best way to transfer knowledge is through interaction and conversations face-to-face. However, if knowledge is stored in documents and other forms, knowledge needs to be transmitted by documents and not via conversations. This affects the absorption capacity of the receiver of the knowledge. The approach to storage of knowledge affects the transferability of knowledge because it affects the way in which knowledge is stored.

3.3.4 Contrasting improvement modes.

How firms conduct themselves to improvement activities can be a source of difference between firms. Japanese firms, for example are known to generate a steady flow of ideas for improvements. Firms can differ to which extent this is an encouraged and planed activity or if new ideas from employees are not absorbed by the managers in the organisation. Firms can practice either one of the method or the other or have amore flexible style and practice both. To carry out these activities requires training and experience, especially if firms want to gain anything from them. In theory it is possible to see the friction between firms applying contrasting approaches.

However, as pointed out earlier in the description of the activity: the activity is similar to problem-solving procedures. This implies that the same implications derived from contrasting
problem-solving routines can describe the implications derived from contrasting improvement approaches.

3.3.5 Contrasting views of problem-solving

Problem solving processes are rather obvious results of a historical process. Firms have been faced with different problems and have different experiences regarding how to solve current problems in the present based on the past. Even if Garvin (1993) proposing this process must be systematic process, all firms are not experienced and have not developed a systematic approach. If these processes are developed they can vary in their extent and in which questions asked and answered, and in which order. The way firms solve problems can be a result of the internal social interaction between the members of the organisation. Firms approach different problem-solving routines due to its internal experiences. In a collaboration these two different approaches meet and can be a source for misunderstanding of ways to confirm arguments, act in discussions, if they are too different in character. This can result in insecurity for people practising different routines. If researchers don’t behave in the same pattern the creativity can be suffering.

3.3.6 The contrasting view of learning of own mistakes and carry out case studies

Different techniques can be applied by organisations as they learn from own experience. Not all firms perform internal inquiry even if there is allot to gain from them. Inquiries are carried out in different ways. Extensive case-studies can be used, questionnaires, surveys, formal and informal interviews as well. Firms are used with different forms and advocate one in front of another, based on past experience. In addition, firms can vary in which form they store the experience and to what extent they use and apply experiences in present projects. As evaluations in many respects are sensitive, it is not less sensitive carrying
out evaluations in a collaboration. If evaluations are carried out in a collaboration it could
generate people blaming each other crossing the organisational boarders, in order to save the
face of the firm. The worst effect is that the collaboration can brake down.

3.3.7 Contrasting methods of learning from others
This activity refers to the ability to absorb experience and knowledge from others.
Benchmarking methods differ in the way they are carried out. They vary in the same way as
internal inquires do, as the techniques are similar, but they are directed to an external
environment. In addition it requires having a mechanism valuing if the experience and
knowledge of others are relevant and can be integrated in the organisation.

Some firms practice learning by doing to bring knowledge from external sources, others are
used to acquire knowledge from outside by formal education. Extracting knowledge through
participation requires naturally the same practice as it does to understand the knowledge
taught in a formal educational setting. This can result in a situation where it requires more
time for the knowledge to be absorbed by the untrained person.

There are reasons to believe that also firms with an experience in learning from others have
advantages compared to inexperienced firms. After repeated attempts, firms develop a
competence in how to learn from others. Without any experience, it is difficult to predict the
evolution of the collaboration. Knowledge in how to develop a well functioning collaboration
is build up through experience. It is not possible to plan every detail of a collaboration as the
collaboration evolves in time and reshapes as problems occurs. When unexpected problems
occur it is important for the firm to be able to handle it and have experience in solving
problems. It is a competence knowing how to absorb knowledge from another partner. This is
a crucial character when firms have joint together to create knowledge together. If the members in a collaboration don’t have the possibility to absorb the knowledge held by the collaborating partners members, it will be difficult to generate something new together.

In addition, firms do differ in how their external network looks like. In that respect, firms have different networks of collecting signals, and are in that way differently social embedded of external linkages. Different firms can have preferences for whom to contact in different issues, and to what extent it is relevant to use the personal network. Some firms can have developed an extensive exchange of information with its subcontractor, in contrast to another firm, using universities and technological institutions. If these links are contradicting it could be a source of problem affecting a collaboration. This can create problems concerning the credibility of references and affect the important factor of trust in a collaboration.

3.4 Summing up the theory section:

Firms can have a lot of advantages by collaborating with others, which is emphasised in the first part of the theoretical framework. However, even if there are many different forms to collaborate in, there are humans in interaction constituting the success of the collaboration. Based on existing central authors the next theoretical part has clarified which processes constituting a learning organisation. The learning process is described as activities inside the organisation. Due to social internal processes, history, the process of closure, path-dependency, societal setting, firms are different in their character and can in that way differ in their approach to learning.

In the last part it is demonstrated that different approaches to learning can be a source of implications in collaborations.
Contrasting approaches to dissemination of knowledge can affect the difficulties in absorbing knowledge. It can hamper the flow of knowledge between entities involved in the collaboration; it can generate misunderstanding about which knowledge should be transferred and in which way; it can put people in situations which they are not used to and generate insecurity; it can result in a time delay. Contrasting approaches to storing knowledge can hamper the transferability of knowledge as it affects different patterns of transferring of knowledge. Contrasting problem-solving/improvement approaches routines can impede the collaboration as it can be a source of misunderstanding and insecurity and constrain the creativity. Contrasting routines for evaluate and learn from own experience can, if it is not carried out with caution, trigger controversies between individuals involved in the project when saving the face of respectively firm.

If firms in a collaboration practising different approaches to learn from others it can hamper the transferability in addition to that it can affect the trust between the firms.

Taking all of the factors together they influence the possibility for the transfer of knowledge.

Based on empirical study the rest of the thesis will analyse which approach of learning, small firms in the biotechnology industry apply, and weather it supports the theoretical framework emphasising that learning can hamper collaborations.

Before proceeding to the empirical discussion a brief presentation of the key features of the biotechnology industry is provided. The empirical discussion is started with a brief outline of the empirical material and method used.
4. Biotechnology Industry

Biotechnology innovations emerged between three existing “players” in the end of 1970\textsuperscript{th} and 1980\textsuperscript{th}. The players are the scientific institutions and universities, small and medium-size firms, and large chemical and pharmaceutical companies. The development has been led by academic milieus in USA. The first firm emerged in USA in 1976 (Genetech), which was the starting point for the biotechnology industry. Even if many firms died in the beginning, during the 1980\textsuperscript{th} the industry stabilised. It is a knowledge-intensive industry doing research in the area of human health care, agriculture, and plant biology and chemicals.

The slow emergence of the small and medium size firms in the biotechnology industry in Europe has to do with the lack of venture capital, an under-developed science base, lack of existing firms, and the negative attitude of European academics towards industry, compared to USA (Sharp and Senker 1999). However, after a slow start the European biotechnology industry is catching up the gap to USA. In Norway, the industry is starting to grow stronger in recent years. This has to do with a growing interest from venture capital, according to one of my respondents.

5. Empirical Material

I have two goals with this thesis. First, I want to find out if the theoretical framework is sufficient to describe an approach to learning in organisations. Second, I want to investigate if contrasting approaches to learning in organisations can highlight constraining processes influencing the progress of collaborations. My preconceived idea derived from the theoretical discussion, is that contrasting learning system can be a source to challenges and problems occurring in collaborations in the biotechnology industry.
In order to reach these goals, I want to embed the theoretical discussion in an empirical material. Therefore I use the empirical material to illustrate and support the theoretical framework. The empirical material is collected from small firms in the Biotechnology industry experienced in collaborations.

In order to assemble relevant data, I contacted firms in the field of biotechnology. Except one firm, all firms are located in the Oslo region. Due to sensitive information, all firms expressed a request to stay anonymous, as I accommodated. To extract the relevant information from the firms in the study, I carried out semi-structured interviews. I used the material to illustrate the learning approach of small biotechnology firms and which challenges they have perceived constraining collaborations. The firms are contacted due to their convenient location, and due to limited time firms had to be easy to get in contact with. Interviews are chosen in order for the respondent to easier express their experiences of participating in collaborations. Interviews were carried out with persons close to collaborations in order to extract as much relevant information as possible.

The study is based on interviews with 5 firms, one institution, and an expert in the field. Interviews are made with research personal close to the project as well as managers. All respondents had higher education. The firms are doing business in the field of biotechnology. They are small in numbers of employees, which vary from 30 to 5. All of them are relatively new firms, working mainly with research and development.

The first firm was founded in 1997 by German and Norwegian Scientists, and is a private held biotechnology firm. Today the firm consists of 25 researchers and business professionals. They do research and development in technologies for engineering of human recombinant
antibodies useful for in vivo detection and therapeutic intervention. They collaborated with a bigger firm in a research agreement. Few researchers were engaged in the collaboration.

The second firm do research and development in marine and bio informatics. They develop vaccines, sequencing DNA of certain species. Out of 20 employees 10 work in the laboratory. The firm was founded in 1996 by a professor from Norwegian Veterinary College. For 3 years, the firm was engaged in a collaboration with Norwegian Veterinary College, initiated by a researcher at the College. The purpose was to develop a technology for detecting diseases in fishes. The project was sponsored by Norwegian Research Council and was “directed by user”. The collaboration was carried out in the laboratory at the college. Even if the formal initiative came from the researcher at the collage the contact was established before, through informal contact.

The third firm is a subsidiary to a bigger Norwegian firm doing research and development focused on extraction of products from seaweed, “TARE”, shrimp- and crab- shell. They are the co-ordinator of a research project between 4 other actors. The initiative came from the university environment and is financed by EU. In practice 20-25 people are involved. The purpose of the project is to do research in the field of Cancer, by combining the competencies from 5 different actors.

The fourth firm is located in France. This firm do research on insects for the production of drugs. It was established in 1998 by two PhD-students and has grown quickly being 20 employees today. This firm have not established a formal collaboration with a partner. Data received from interviews with this firm are mainly used for understanding of the learning activities of small firms.
The fifth firm is the smallest of the firms in the study. It is in the phase of establishing, and has only been active for a few years. The firm is at the present time involved in a collaboration with a research institution. The purpose of the collaboration is to develop the technology useably for future business. The collaboration engages 8 persons, four from the firm and four from the research institute. The firm took the first contact for a collaboration as the research institute had an interesting technology to “offer”.

Established in 1989 by the University of Oslo, the institution, consisting of 5 research-groups, work almost exclusively with gene-technology. They do individual independent research as well as commissioned research. The teams do research in fields vary from cancer to infections. Today, they are 10 employees, but at least 100 are connected to research.

This study has focused on two types of collaborations the Institution has been involved in. First, they were engaged in research collaboration on cardiovascular diseases lead by the institution, where two persons from firm X joined a group of 6-8 researchers from the institution. The collaboration failed. The other collaboration is still going on. Two researchers participate in the initial work of the establishment of the technology in small start-up firm, however with different expertise.

6. Discussion

In the discussion the purpose is to see how the empirical material, extracted from interviews of firms in the biotechnology industry, support the theoretical framework. The theoretical framework highlights the influence of contrasting approaches to learning as a factor influencing the progression of collaborations. The discussion follows the two aims of this thesis expressed earlier.
6.1 The organisation of learning inside the firms

The following section will discuss the ways in which firms organise to learn, which constitute their approach to organisational learning. The discussion is based on the theoretical framework of activities constituting learning, investigating if the framework can provide a representative understanding of the approach to learning. This section is presented in a thematic order.

6.1.1 Storage of knowledge:

As the theoretical framework demonstrated, knowledge can be stored in many ways inside a firm. In accordance to the empirical material, competencies and skills are stored in individuals, implying that knowledge is held in the human mind. It is not just knowledge in form of know-how and know-why stored in members. Knowledge concerning which to take contact with, know-who, is also stored in people. Data confirms the focus Nonaka and Takeuchi (1995) address as point of departure in their theories when they point to the fact that knowledge is stored inside humans in firms, and that knowledge can have different forms, influencing the storage.

The empirical material demonstrates that knowledge is obtained through long experience. Mainly, small firms have not carried out specific routines for storage of knowledge. However, in addition to storing knowledge in the heads of members, knowledge is stored in documents and reports, but to a lesser extent.

In the theoretical framework it is provided that firms have either the document-based approach, or the individual-based approach. That is a representative description of the firms in the study as the knowledge is mainly individualised in the firms in the study.
The empirical material show that even if it is a time-consuming activity, firms try to write down as much as possible on paper as well. If they don’t, knowledge disappears from the firm when members leave. Though, as one respondent pointed out: “even if crucial knowledge is lost when a member leaves, much is also gained from the person replacing the former members position”. This utterance points to an interesting feature not fully accounted for in the theoretical framework. Firms do not just loose valuable knowledge when members leave. They gain knowledge in hiring new. This is connected to that small firms hire experienced people and expect a certain level of knowledge as they join.

Moreover, in the empirical material it appears that knowledge stored outside the firm is used frequently as the member has a rather big network from former work and research. This point to the fact that knowledge can be stored outside the firm acknowledge in the theoretical framework, however the knowledge about whom to take contact with, needs to be stored inside the firm.

The respondents also experience the problem of codifying knowledge. One respondent expressed that a “large part of knowledge held by researchers is implicit”, and added that: ”even if trying to imitating a colleague I could not accomplish the same result”.

Moreover, respondents points to the fact that it is a demanding task writing down every little routine and knowledge on a piece of paper for future use. The time in use for firms is not sufficient enough carrying out these routines. Demonstrating that the amount of implicit knowledge in these firms is large and documentation requires allot of efforts.

6.1.2 Transfer of knowledge:

As the theoretical framework demonstrated, transfer of knowledge can be organised in different ways in different firms. Nonaka and Takeuchi (1995) emphasise the individualised
way of transfer knowledge. Moreover, the theoretical framework pointed out that knowledge, possible to articulate and write down, could be transferred via documents.

According to the empirical material in general, firms do not practice any specific method to spread knowledge internally in the firm. The methods are individualised and learned through experience. For all firms, dissemination of knowledge is correlated to the type of knowledge. The least complex knowledge is spread from person to person through documents, but as the complexity increases the use of other methods occur. The easiest form of know-why can be transferred through documents, but complex know-how disseminates in best way through learning-by-doing. Transfer of knowledge implies that the teacher and the student need to be in the same physical space. All firms have experience with imitation based on participation. However, as one respondent pointed out: “even if you did the same as she you could not get it exactly right”. This can point in the direction that the nature of knowledge influences the way in which knowledge is transferred, which stated by Nonaka and Takeuchi (1995) in the theoretical framework. Moreover, it indicates that a lot of knowledge is transferred in a close interaction between the transmitter and the receiver.

Moreover the data tells us that knowledge is transferred through oral discussion, face-to-face in real time. In these conversations all forms of tools are used to communicate the knowledge, for example drawings and illustrating symbols. The interaction of members is relatively high and as soon as a person is in need of information, he or she take contact with a relevant person inside the firm. Whom to contact, is based on experience and interest. In addition to the relevant knowledge there is a lot of “surround-knowledge” transferred in the conversations. Knowing what other persons know inside the firm can be of value as members can channel right question to right person in case they don’t hold the relevant knowledge themselves. The
structure results in people continuously conversing in lunchrooms, corridors, or offices. Transferring of knowledge perceives as a daily activity and should be a reflex, according to one respondent.

As demonstrated in the theoretical framework the establishment of planned routines for dissemination of knowledge can secure that the knowledge gained in the firm can be used in another department of the organisation. For that reason it would be of interest for the firms to establish these routines. However, as data indicates the firms that don’t practice planned internal routines to transfer knowledge could loose a lot of their capacity to solve-problems. Even if an informal procedure of dissemination of knowledge is a risky business, generating imbalance of the common knowledge inside the firm, it is perceived by the firms that as too much time is spent sharing knowledge through out the firm by formal procedures. Therefore, firms don’t emphasise formal dissemination of knowledge.

As compensation not having established routines for knowledge transfer, the empirical material show that firms practice a self regulated disseminating of knowledge, where the interested person receives the knowledge if he or she is active enough in the work. It directs attention to an interesting concept of “communities of practice”. However, as the theoretical framework has not emphasised this perspective this thesis will just refer to the concept and the authors Brown and Duguid, 1991. The concept could be integrated in a discussion of the existence of collaborations.

Moreover, the empirical material shows that the “smoothness” of transferring knowledge is in many respects influenced by the competence in how to transfer knowledge by the transmitter, the amount of common knowledge in the field, and the form of the knowledge.
According to the respondents the structure of transfer, or the anti-structure, is constituted by a bunt of factors. Oral-discussions practices due to the members close personal acquaintances with each other. Physical face-to-face meetings are natural as the discussions can be very time-consuming and complex to articulate through document, as lot of important knowledge will disappear in document flows. The unnatural way of transfer knowledge is actually through e-mail and documents as members are sitting near in distance to each other and the firm is small in numbers of persons. The way of transfer knowledge is determined by the way of storing knowledge as knowledge is held by the members of the firm.

In the theoretical framework the form of spreading knowledge throughout the firm is best described by Nonaka and Takeuchi (1995), as they emphasise the ongoing close interaction of individuals in different spaces and constituted by the form of knowledge.

6.1.3 Problem-Solving Procedures

The theoretical framework emphasised one approach by Garvin (1993), accounting for the problem-solving process as a planned and a conscious activity, described by a scheme. In addition Nonaka and Takeuchi (1995) propose a problem-solving process as an ongoing process and a daily activity characterised by continuous interaction of individuals. The empirical material showed that problems are solved as a daily activity in the firms of study. As one respondent noted: “It is like walking, an unconscious process, you just do it”.

Data demonstrated that the most common way to relate to problems is to take action when problems occur. One respondent illustrates the process:
“First, members try to solve them by them selves. If this is not enough he or she take contact with their nearest network of competencies. If they don’t reach to any resolution the question will be discussed in project-meetings. Problems not solved in project-meetings are raised in summit-meetings. Current problems in firms are logistic, scientific and human-resource.”

In addition, the empirical material showed that it is common to practice open, frank discussions with involved parts, like in brainstorming meetings. It is “good practice” in the field to document the arguments displayed. One firm has developed a scheme to follow when problems occur. Even if it’s not common with planned procedure I present one firms process of solving problems in detail. The common way is to practice individual forms of solving problems. Flexibility in routines is treated as an advantage in most of the firms.

The firm, which practice a routine for solving problems start by, analyse if there is a relevant problem as fast as possible. This leads to a definition of the problem. Secondly, it follows a selection process, as it is not possible to solve all problems. In this process the firm pick out the problem that really needs to be solved through intervention. Some problems are best left alone. In the end, they dig deeper into the nature of the problem in order to assess if they have the capacity to solve the problem themselves or if external resources are needed. This process has common features compared to what Garvin (1993) described by the example of Xerox, however it is not well established in the routines of the firm.

The procedure of solving problems seems to be influenced by sharing and disseminating knowledge internally in the firm. One respondent pointed out that it is not always the best striker who scores. Using a football-metaphor he explains that: “Depending on the game, different players will score”. Therefore, having good communication and practice for sharing
experiences and knowledge will enhance the possibility for a resolution. It is not always possible to predict who will find the best solution. This direct focus to theoretical framework emphasising that problem-solving is all about sharing knowledge (Nonaka and Takeuchi 1995).

The level of the common knowledge is also emphasised by the respondents as a factor affecting the problem-solving process. The same level of common knowledge generates the same language in discussions. This observation is in accordance to the theoretical framework of Nonaka and Takeuchi (1995) focusing on the nature of knowledge and the transfer of knowledge. It also indicates that the transferability and the possibility to learn are influenced by the form of knowledge (Child 1997).

6.1.4 Learning from external sources.

In the theoretical framework it was emphasised that learning from others is a crucial activity. Moreover, due to the nature of knowledge it requires a grate deal of effort. Due to the context dependence of knowledge the process of acquiring knowledge from outside is equal with a thorough process. Nonaka and Takeuchi (1995) emphasise the process of learning by doing as crucial to master, if knowledge is expected to be absorbed by the individuals in the firm.

The respondents admitted the importance of being able to use knowledge from outside in the development of product and processes. One of the respondents even went as far as claiming that their success is dependent on learning from external actors, as it is not possible to have all competencies in-house. The empirical material showed that all firms have more or less formal, established relations to external actors. Links have been established with research institutions, private firms, personal informal relationships, universities, and consultants, in
addition to advisory boards. Which actor the firms have established contact with, depend on
the human resource in-house as well of the purpose of the contact, implying that personal
contacts are important to establish fruitful relationships.

Moreover the material indicated that, when firms acquire knowledge from their established
external links it is common to make site visits. This makes it easier to overcome
misunderstanding of the content of the knowledge. Further, certain knowledge, as noted by
the respondents, are only possible to learn by watching and imitating. In using their already
establish contacts through their members they limit the misunderstanding and problems of
trust. In addition to visits members frequently use telephone, Internet, and e-mail as medium
for conversations, indicating the presence of explicit knowledge in work.

The empirical material indicates that learning from external actors is influenced by the nature

6.1.5 Learning from past experience

From the empirical material, not many firms expressed that learning from past experience is a
learning process in practice. According to one respondent, learning from past experience is
individualised rather than a planned activity. The firm does not plan evaluation of projects to
a big extent. This indicates that the empirical material doesn’t support the theoretical
framework. The theoretical material addresses much importance to this activity and assume
that the firm can gain a lot from using the own experiences for future use. Especially if we
accept the importance of implicit knowledge and the difficulties in transferring implicit
knowledge into the own organisation.

By individualised learning, firms assess their position continuously by presenting errors and
successes in meetings. Learning from past experience seems to be a continuos process in
progress all the time. It is dependent on the individuals of the firm and to what extent they are able to convert failure to success, if it is present.

The absence of planned evaluations can be a result of the maturity of the firms. Moreover, their core competence is not dependent on them carrying out evaluations but rather on presence of human capital.

6.1.6 Learning from experimental activity:

In a research and development, firms learning from experimental activity and continuous improvements is a daily and on-going activity. Experimental activity is what they are doing. The empirical material shows that to ensure a steady flow of ideas and solutions to problems they arrange idea-meetings in addition to the daily work.

The activity is best described by Garvin (1993) as an ongoing programs. Demonstration projects is not so representative for the experimental activity in the firms from the empirical experiment, however all the firms are, as said, research and development firms and exist by experimenting.

In addition to planed meetings the working place is a forum in itself. However as one respondent says, “sometimes it is important to get the people out of the fish tank”. By taking the members out of the working context they can get new influences in the daily activities. This relates to the socialisation process described by Nonaka and Takeuchi (1995), where they stress the importance of the brainstorming camps. Further, the empirical material pointed to the fact that experimental activity is common to carry out in the start of a project, which means that experimental activities are included in the project in itself. The pilot project makes it possible to kill or value the progression of the project.
6.1.7 Summing up

Based on the theoretical framework we can illustrate how small biotechnology firms are organised in their way of learning. The theoretical framework is supported by the empirical material and describes the features of the learning system. However, not all of the activities are relevant to describe the learning process in biotechnology firms. Even if the selected objects in this study don’t represent the whole industry, the empirical material can give an indication of the learning-system in biotechnology firms. According to the empirical material knowledge is stored mainly in the individual in the firms. Knowledge is transferred internally with the help of humans in contrast to documents. Experimental activity is an ongoing activity. Firms use external actors and practice learning by doing when necessary. It is not common to practise planned problem-solving routines. Learning from past experience is based on individual initiative rather than a planed activity. Moreover the empirical material supports the theoretical framework claiming the activities are interdependent to each other. In the next section, I will elaborate if contrasting approaches to learning hamper the progress of the collaborations experienced by the small biotechnology firms.

6.2 Challenges working in a collaborating setting.

In this section, I will discuss upon if contrasting approaches to learning can be a source of constrains in collaborations, based on the empirical material. The discussion is based on the theoretical framework presented earlier in the text. It will guide the discussion. Thereby, I elaborate around my second goal of this thesis.
6.2.1 Do Contrasting approaches to store knowledge hamper collaborations?

As viewed in the theoretical section of this thesis, contrasting approaches to store knowledge between firms can be a source of disturbance in a collaboration. It can influence the possibility to transfer knowledge and impede the flow of knowledge between firms in interaction. This can lead to time delay and increasing costs. In addition, it can result in misunderstandings. Is the empirical material supporting this argument or not?

Based on the empirical material, storage of knowledge has not been a source of big problems. The majority of the firms don’t raise contrasting approaches to storage of knowledge, as an important factor interfering with collaborations. As pointed out earlier, knowledge inside firms is stored in human minds. Researchers are involved in collaborations, as they are carrier of a specific knowledge. Combination of knowledge from two or more firms has been the purpose of many of the investigated collaborations.

According to one respondent, “the way of storing knowledge does not differ much between firms in collaborations”

and another respondent says:

“It is very common that the knowledge is stored in the minds of the researchers. However this is not a big problem as the way of communicating is based on oral discussions face to face, or by phone.”

The last quotation points at the fact that contrasting approaches to store knowledge don’t perceives as a constraining factor for collaborating firms. It will rather, as also discussed in the theoretical framework, influence the way in which knowledge is transferred, and in that
way occurring as a challenge in a collaboration. The implications of different approaches to transfer knowledge will be discussed later.

Even if the empirical material doesn’t provide a confirmation that contrasting storage of knowledge affect the collaboration negatively, the material shows that knowledge is stored in the same way by the collaborating firms. This can be the reason why they did not experience constrains due to different approaches to storing.

Moreover, the empirical material demonstrated that knowledge held in firms are embedded in the patterns of behaviour inside firm, which also is acknowledge in the theoretical framework by Nonaka and Takeuchi (1995) and Lam (1998). Firms are relatively small in number of researchers, and members are employed because they are carriers of core competence. Because of their intense conversations they build up a common knowledge-base, shared by the members of the organisation.

According to one of the respondent, they had to work intensively in the beginning of the collaboration, to raise their shared and common knowledge in the collaborating group. This respond provides an illustrating example that context-specific knowledge, generated through intensive interaction and interest, can affect the progression of the collaboration. The socialisation process described by Nonaka and Takeuchi (1995) is representable in describing the first phase of the collaborations. According to the respondents the gap of knowledge between individuals is a planned challenge to overcome. It can be connected to the fact that all in the collaborations had the same professional-interest in the field of study. Further, the empirical material notified that the extent of shared knowledge could represent a challenge to overcome. Firms do share a lot of knowledge during conversations, which generates a part of
the knowledge, which is firm specific. According to the respondents, this shared level of knowledge constrains the communication in the collaboration. It can cause as one responded experience, an underestimation of the time it required to build up competencies.

6.2.2 Do contrasting approaches to transfer knowledge constrain collaborations?

As the theoretical framework show, contrasting approaches to transfer knowledge can hamper the transferability of knowledge in collaborations, thereby affecting learning negatively. The flow of knowledge will be impeded between the entities if the approaches to transferring differ too much. Due to different approaches, different types of knowledge are transferred, tacit vs. explicit. Some firms require that the individuals hold a lot of common knowledge to absorb the knowledge others is used to absorb the knowledge through formal ways. Does the empirical material support this?

According to the majority of the respondents pointed to the fact that entities in the collaborations used the same way of transferring knowledge. However, the respondents illustrated that the approach to transfer knowledge was important for the progress of the collaboration. The empirical material showed that communication, social interaction, problem-solving, and improvements of products is a daily ongoing activity in the collaborations. In these collaborations a lot of knowledge is shared and transferred between the involved researchers. It was crucial that involved people established a natural setting where knowledge could be shared and transferred. In order for research to progress it was important to establish a setting in working order, as the goal was to combine the competencies of the firms in collaboration. The majority of the respondents supported this view. This points to the fact that the collaborations were dependent on a setting where knowledge could be transferred easily. This can indicate, even though any bigger challenge did not occurred in the
collaborations, that contrasting approaches to transferring knowledge will hamper the collaboration. One respondent refers to the challenge and says that:

“It is an advantage in the discussions and problem-solving meetings if all the involved practice the same technique of discussion. In order for the meetings and the discussions to progress smoothly, it is important that the researchers practise the same way of building up the arguments, confirming statements, or building arguments with logical reasoning. Otherwise they were not treated with respect and no one listen to their arguments.”

This statement refers to the importance of that all involved researchers acted in the same way, when they transferred knowledge, otherwise it will lead to implications like mistrust and misunderstanding.

As many of the involved researchers practise the same way of transfer knowledge, they did not experience too much of the problems described in the theoretical section. One respondent claims that “researchers in this field act in the same way as they come from the same school” referring that they have almost the same educational experience. However, respondents also claim that if there is not a match between partners approach of transferring knowledge, problems of mistrust, declining interaction, misunderstanding, knowledge flow is decreasing, as well as creativity.

In the theoretical framework it is said that the amount of shared knowledge can affect the flow of knowledge between researchers and affect the absorption capacity. This issue is reflected upon from one of the respondents when he says that:
“It is crucial that different parts in a collaboration have the same understanding about the technology, its application and what the technology is, described in professional concepts… It is not so important that everybody in the collaboration share the same knowledge in the performing of practical tasks, but they all need to understand each other. In this collaboration the common knowledge in biology were rather high in all partners of the collaboration. The common level of knowledge makes it easier to speak and discuss problems and solutions in the project. The communication flows more smoothly when the knowledge has the same level.”

The respondent further illustrates the point claiming that it is even more difficult when person collaborate with different professional background. It takes more efforts and energy from the collaborating parts if the knowledge base is separate. Even if the respondent have a certain understanding about gentechology, he could see practical problems in working together with a person with a different knowledge as they do not speak the same “language”.

In other words, he confirms that in a collaboration, it is important that involved members share the same knowledge, otherwise it will affect the flow of knowledge between the individuals. To acquire and understand concepts it requires a minimum of competence to communicate.

The theoretical framework emphasise the importance of the nature of knowledge affecting the mode of transfer of knowledge. According to the respondents they are aware of the implicit part of the knowledge and take action in accordance to that. It is relatively common that firms practice learning by doing and imitating. It is a common feature of the learning procedure in all the partners in the collaboration so it is not perceived as a problem.
According to all respondents, learning by imitating was crucial and well practised in the field. When the knowledge could not be transferred through common oral discussions in regular summit-, project-, or brainstorming meetings, they practised visits to external firms in learning and transfer of knowledge. These visits were undertaken by own initiative. Though, challenges occur when different laboratories practice different languages in how to carry out tasks. This implies that they have an internal language, which only practice, in the laboratory. The specific language is perceived as constrain to a visitor, coming to take part in the work done by a certain laboratory. He or she needs to learn the language in practice, before being able to absorb the knowledge held by personal in the laboratory.

Moreover, the empirical material illustrated that collaborations are affected by prior experience of collaborating. The researchers experienced with collaborations did a better job than inexperienced employees. Transfer of knowledge was perceived as a competence in itself. According to a respondent, it was important to be able to articulate the knowledge in practice for the collaboration to progress. This required training by the involved researchers. This is a competence, not all involved in the collaboration, mastered. In so, the progress of the collaboration was affected by the experience of collaborate.

6.2.3 Do contrasting problem-solving routines limit collaborations?

As the theoretical framework emphasise, contrasting routines to solve problems will hamper the collaboration, as involved researchers experience a new structure of people trying to figure out solutions to problems. If they don’t practice the same routines in solving problems the creativity decreases and the flow of knowledge can be directed in one way. In addition, problem-solving is dependent on communication and transferring of knowledge, however the
problematic concerning transfer of knowledge is already illustrated above. Does the empirical material support this?

As already suggested in throughout the discussion, the collaborating entities in this study are fairly homogeneous in their way of learning. Concerning the way firms solve problems they don’t differ that much either. One respondent explains why patterns of action not are a source for a lot of problems in the biotechnology industry.

“There is a professional fellowship in this field of work where the majority of researchers perform work in the same technological paradigm. Consequently, many working routines and ways of thinking are relatively equal independent of firm (company-culture) they belong to.”

However, even though contrasting approaches to solving problems has not been an issue, one respondents acknowledge the importance in handling a problem-solving process in real-time and the open conversations in brainstorming meetings. The same respondent claims that he “felt secure in the procedures of solving problems as they all come from the same school”. The quotation illustrates that they have been trained to perform and act in a certain manner based on their academic education in university environments. However, the respondents were all aware of the implications that could occur if these procedures and patterns of action were not practised by the involved researchers. One respondent points to the implications of having contrasting was of acting and behaving in discussions and problem-solving situations.

“For the collaboration to work without any delays and difficulties, it is important that the discussions is open and everybody play with open cards. To withhold information in a creative discussion results in conversations where the information only flows in one direction.”
This can result in members of the group starts to mistrust each other and the progression slows down.”

This was also acknowledged in the theoretical framework and points in the direction that contrasting patterns of behaviour in problem-solving can hamper the creativeness. According to the empirical material the implications could result in mistrust, imbalance of knowledge in the group, decreased creativity, time delays.

6.2.4 Do contrasting routines in learning from others hamper collaborations?

According to the theoretical framework there are reasons to believe that contrasting approaches to learning from others can hamper the collaboration. Different approaches will decrease the flow of knowledge and in so, represent a friction of the collaboration. Absorbing knowledge can be done by practising learning by doing or formal education. In accordance to all respondents in the study, they had not experienced any specific problem regarding contrasting ways of learning from others. One respondent can represent the rest of the respondents.

“We perceives external networks of knowledge as a positive rather than negative character with the collaborating partner. It is not a constrain in the collaboration.”

This assertion, in addition to similar responses, illustrates that learning from others isn’t a big problem and doesn’t generate implications. Rather, external networks are used to overcome problems occurring in the collaboration, and the only constrain in that setting has to do with confidentiality.
The empirical material doesn’t support the theoretical framework stressing that contrasting approaches to learning from others is a theoretical construction.

6.2.5 *Do different improvement modus impede collaborations?*

As demonstrated in the theoretical framework, it is possible to differ between two approaches of improvements inside the firm: the demonstration project and ongoing programs. In addition, it is also said that the activity is similar in its nature to the activity of solving problem.

Research and development is an ongoing activity of improvements. Improvements describe the situation researchers are embraced with, rather than describing one activity of the learning system. According to the respondents, the daily activity is similar to the ongoing program described by Garvin (1993). As already pointed out, the way of acting in this industry is homogeneous and this is also the case concerning improvement approaches. None of the respondents mention contrasting approaches to improvement as a source of constrain in collaborations.

6.2.6 *Do contrasting evaluation modus hinder progress in collaborations?*

As the theoretical framework demonstrated, contrasting approaches to evaluate performances can inhibit the progress of the collaboration as this is a sensitive project and can result in withhold of information and creativity.

According to data it turned out that contrasting evaluation approaches wasn’t a big problem in collaborations. Not one respondent found it as point of friction between the collaborating
firms. However one respondent hinted that maybe it could be a point of friction if they had more developed routines to evaluate the projects. It is a routine, which mature firms apply.

6.2.7 Other challenges

In addition to the constraining factors of the learning system, the empirical material pointed to other features impeding collaborations. These complements the picture of constrains in collaborations in the biotechnology industry and balance the focus on the factors provided from the theoretical framework. They are a result of the method used for extracting information from the respondents (semi-structured interviews). So, even if the following activities don’t correlate to the theoretical framework they illustrate the importance of the factors of focus in derived from the theoretical framework.

Differences in decision-making processes

Decisions, in the firms of this study, are taken close to the problem. It is common for the smaller firms to practice a flat organisational structure, where decisions are delegated to members close to the action. One respondent refers to problems working with a bigger firm and enclosed differences in the decision-making process. The small firm were used to quick decisions at a level of the organisation close to the project. Bureaucracy and long organisational distance to the decision-maker were a big constrain as they collaborated with a firm where decisions were taken far from the researchers doing practical work. The decision-makers based the decisions on limited and insufficient knowledge about the academic field. This resulted in mistrust from one partner of the collaboration and when the communication-flow, in addition, developed to be directed one-way, the collaboration broke down.

Goals and Interests
According to the empirical material, contrasting goals and interests concerning the research were interpreted as a challenge for people involved in collaborations. Personal goals could come in conflict with the goals set out by business partners. It was an issue when firms collaborate with institutions. Firms have long-term goals with focus on commercialisation, in contrast to people from institutional environments who have personal research short-term goals. The industry is interested in applying for patents, but the academic environment is very keen on publish their founding as soon as possible. Problems occur as the industry loose the value and the investment when research becomes public before they have applied for patent. To overcome the problem Industry tries to keep record of what the academia are doing. From the point of view of academia, this perceives as if industry is sucking all valuable information out of the academia and supervising the work done by academia. Contrasting goals results in withhold of information regarding the collaboration, which in the long run can result in mistrust and hamper the creativity. This can also affect the communication between the partners as one partner don’t understand the purpose of continue with the development of the technology.

*How to handle documents*

In accordance to the empirical material difference handling with documents was present in collaborations between industry and academia. Industry is saddled by the authority and their interest in commercialisation of research, to handle their documents in testing with highest caution. The procedures in testing are commonly standardised. ISO 9000 and GMP (Good Manufacture Practice) from FDA (Food and Drug Administration in US) are two examples of standardised routines affecting ways of handling with documents. If the industry does not
document how they have done in smallest detail, when applying for patents, they jeopardise their possibility to convert investments in research into revenue. Further, the authority do check-ups of the firm, which can result in bad publicity.

In the pharmaceutical industry it is important that everybody speak the same language. This implies that all have to practice the same system of guarantee of quality. In practice this imply reporting of the procedures and ways of doing and how they carried out certain tasks, into the smallest detail. In University environments it is not common to practice the same procedures of reporting and documenting in every step of the research. They don’t have specified “working-lists” in how they are supposed to do and work in the laboratory.

The different results in industry have to follow up the way in how the universities are doing and working. One respondent claims that by controlling and checking and learning the academic milieu, they sustain the value of research with the mind on future possibilities in commercialisation. By following up, it means checking and controlling every single work academia do in the collaboration. Industry supervising academia often results in decreasing communication. This contrasting ways of handling of documents and routines of working, results in a challenge to overcome when they work together. One respondent explained how they needed to do all the tests all over again after the partner finished their part. In other words, contrasting ways of handling with documents resulted in time delay.

6.2.8 Summing up

A common challenge for the firms and institution in this study was to organise the transfer of knowledge. Constraining factors in this setting could be contrasting routines in sharing and discussing alternative solutions to problems, personal mismatch, and one-way flow of knowledge due to confidentiality and handling of documents. If it is not match between
partners approach to transfer knowledge problems of mistrust, declining interaction, misunderstanding, knowledge flow is decreasing, and creativity decreasing will be the affect. The empirical material demonstrate that, even if not any big problems occurred as a consequence of contrasting problem-solving routines, it was important to establish a shared common understanding in how to act when problems occur, otherwise the implications could be mistrust between the collaborating researchers, imbalance of knowledge in the group, decreased creativity, or time delays. The empirical material supports the theoretical framework. Contrasting approaches to store knowledge is not seen as a constrain, based on the empirical material. However the amount of shared knowledge was expected to hamper the communication between the entities. The empirical material did not support the theoretical claim that contrasting approaches to learning from others can hamper collaborations. Neither, the empirical material illustrates that contrasting evaluation modus, or contrasting modus of improvement, hampered collaborations.

In addition to the factors outlined in the theoretical section the empirical material broaden the picture of challenges pointing at contrasting ways of handling documents, contrasting goals and contrasting decision-making procedures. These features balance the focus on the factors provided from the theoretical framework.

7. Concluding remarks

Based on an empirical discussion of collaborations in the biotechnology industry, this thesis illustrates how contrasting approaches of learning can hamper collaborations. The empirical material did not provide a full confirmation of the theoretical framework described in the first part of this thesis, even though it illustrates some of the processes of learning which hamper collaborations.
The Industry from which the empirical material is derived from, is a rather homogeneous industry. During the study it was obvious that all firm practice the same approaches to learning, with minor differences. Even if the objects of the study aren’t representative for the whole industry they can provide a indication of the applied approach in the industry. Moreover, the empirical material will illustrate some of the problems occurred in collaborations in the industry and point to the important structures constituting collaborations.

The industry was relatively flexible in their approach to learning and had not to a major part applied rigid routines for learning. The approach to learning was relatively individualised. The empirical material supports the theoretical material by illustrating how learning can by applied in firms and organisations, even if “experimental activity” was an activity more explaining what is going on inside the firms, than pointing to a factor, which could differ.

Incessant oral discussions characterise the daily activity to improve knowledge, solve problems and spread knowledge inside the firm. Each member in the organisation not just support the firm with their know-why, but their know-who is crucial in research and development. It is also common to imitate, look and participate in sharing internal knowledge. In addition the study confirms what is claimed in the theoretical section: that learning is composed by at least 6 *interdependent* processes.

The empirical material supports the claim that contrasting approaches to learning can hamper collaborations. This is especially true regarding the way in which firms transfer knowledge. This can create misunderstanding and hamper the creativity on which the collaboration is built upon. The study demonstrates that the empirical material cannot support all activities, derived from the theoretical section. It did not support that contrasting evaluation approaches constrained the collaboration. Neither, did it support contrasting improvement modus, or
contrasting approaches to learn from others. Regarding the last factor, the empirical material illustrated that it was rather a positive character of the collaborating partner. Further the empirical material confirmed that contrasting approaches to solve-problem hinder the progression in collaborations. Implications derived from contrasting problem-solving routines could be mistrust between the collaborating researchers, imbalance of knowledge in the group, decreased creativity, or time delays.

All taken together, the study confirms that storing of knowledge, transfer of knowledge, and contrasting problem-solving routines represent a constrain to joint work. In the theoretical section it is also showed attention to the nature of knowledge and its affect on collaborations. The empirical material illustrated how the way of transfer knowledge was affected by the nature of knowledge. Challenges occurred when they needed to practice learning by doing in the collaboration.

The study also indicated that the attention to the factors derived by the theoretical framework wasn’t too representative for the biotechnology industry. The empirical material complemented the picture of constrains in collaborations in the biotechnology industry and balance the focus on the factors provided from the theoretical framework.
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Appendices:

Appendix 1: Interview-guide used in interviews with biotechnology firms.

Appendix 2: Interview-guide used in interviews with biotechnology firms.
Appendix 1:
Interview-guide used in interviews with biotechnology firms.

Information about the firm:
1. What is the firm doing?
2. What is the purpose of the business?
3. Who established the firm?
4. How many employees are hired in the firm?
5. When was the firm established?

Knowledge enhancing activities:
1. Based on R&D: Which forms of transferring knowledge is practised inside the firm? Is one approach applied in front of another? Why is so?
2. How do you store knowledge? Where in the firm is the knowledge? Do you practice any forms of storing knowledge and is one approach applied in front of another? Why do you practice one approach in front of another?
3. Do you practice procedures to solve problems? If you do, can you describe the routine?
4. How do you learn from former experiences?
5. To what extent do the firm use external actors to learn? Which links are established and how are they established? Which type of knowledge is received from external actors?

The Collaboration
1. Please, describe a collaboration you have been involved in?
2. How was it established?
3. Who took initiative to the collaboration?
4. Which type of collaboration is established?
5. What do the collaboration aims at?
6. Which function do your firm have?

7. What do you mean is the gain in collaborating?
8. Did you experienced specific challenges in collaborating with a different firm? If you did which challenges did you experienced and what was the result?
9. What do you think is the reason that friction between the firms occurred?
10. Which internal routines did you have to adopt to be able to collaborate during the collaboration?

11. In what degree did contrasting problem-solving routines result in misunderstanding and friction in the collaboration?

12. Did contrasting approaches to transferring knowledge resulted in negative progression in the collaboration? Did the involved firm store knowledge in different ways?

13. Did the involved firm applied different approaches to learn from prior experiences which influenced the collaboration?

14. Did former experience in learning from external actors result in problems and misunderstandings in any way?

15. Which is the biggest challenges in collaborating?

16. Why did the collaboration run smoothly according to you. Which factors was most important for the collaboration to progress?
Appendix 2:
Interview guide for use in interviews with biotechnology firms.

Introduction of the biotechnology firm:
- Introduction of the firm; history, what the firm is working with, how many employees, how it started, what his position is in the firm.
- Can you, in a broad view, explain how the innovation process is, in the firm?

Learning from others:
1. Is it common to acquire competencies from external resources?
2. If you do, with whom are the firm in contact with?
3. How do you establish these links?
4. If you do not acquire competencies from external sources, why?
5. How are you doing when knowledge is acquired in to the organisation from other resources than internal?
7. Is the transfer of competence a ongoing process with daily contact or is it more common to set out specific programs?
8. Is this a planed activity or is it carried out by individuals by them self?
9. Is it a specific type of knowledge that is brought in or are external sources used in the whole innovation process?
10. Why do your firm use other competence rather than the internal?
11. Have you experienced some obvious limitations in the process of bringing in competence to the firm?
12. Is benchmarking a method you practice when bringing in competencies from external resources. If yes, can you explain how this is carried out?

Experimental activity:
1. How are the firm ensuring a steady flow of ideas from the members of the firm?
2. Do the firm arrange special forums where ideas from the employees, like chat-rooms, idea-meetings, if yes can you describe how they are carried out?
3. Is the firm arranging creativity forums, have planed time for new ideas, arrange a site on the intranet for new ideas or...?
4. How do the firm evaluate new ideas from members?
5. Where do the firm look for new inspirations and ideas? Inside or outside?
6. Do the firm arrange “pilot projects” inside the firm, to learn from?
7. Do the firm have continuous improvements programs?
8. Is the experimental activity a individual activity or is the improvement projects arranged in groups?
9. Are improvements a daily activity?
10. Is the firm sending out its member to participate in conferences and make site-visits to external firms?
11. How do the firm give members incentives to generate new ideas?
12. How do the firm absorb and convert these ideas, realize, implement, put into practice? Is this a formal a procedure where managers are incorporated or is it a process done at the time?

**Problem-solving process:**
1. What types of scientific problems are common in the firm?
2. Do the firm have specific problem-solving procedures to carry out when problems occur, like a special scheme or a plan to follow? If you do have one, can you explain it, step by step? If you don’t, why is it not necessary?
3. If yes:
4. Where in the firm do they occur?
5. How are they identified?
6. Are scientific problems solved directly when it occurs by the individuals identifying it, or is it channelled up in the hierarchy? Informal, contra formal solving procedures.
7. Is the process of solving problems a result of teamwork, and joint efforts or do is it individuals working autonomous solving problems?
8. In what way do members interact when problems are solved? Face to face imitating and participating in each other’s work? Via transferring of competence via documents or other tools?
9. Is the process of solving problems an internal process or to what extent are external resources being used?
10. Do the firm use any statistical tools to find the best solution limiting the potential error?
11. Who are participating in the process of solving the problem?
12. Which forum is used to solve the problem? Meetings, Internet, dialogues, mm?
13. In what way are top-managers involved in the process.
14. Is the interaction to solve problems on a unplanned interaction or…?
15. If knowledge is needed from “outside” is it any problem to absorb the knowledge from external sources?

**Learning from past experience:**
1. Do the firm arrange specific projects examining lessons learned from finished projects in the past?
2. If you do, how are they carried out? Can you explain the way in which the firm is evaluating performed projects? What are often the lessons learned?
3. If you don’t, why?
4. Is evaluation a ongoing activity or do the firm arrange specific programs after the projects are finished?
5. How does the firm store and treat experiences from the past. Are the experiences stored in individuals or is this gathered in big databanks or the like?
6. For what purpose do you evaluate projects? In what way is the experience gathered, used for future projects?
7. Is this a priority activity to enhance competence in the organisation?
8. How is the lessons learned treated afterwards? Are they implemented as routines or…?
9. Are they carried out often?
10. Who in the organisation is carrying them out? Or is it a self-organised activity?

**Transferring of knowledge:**
1. Which channels are used to communicate competencies between individuals in the organisation? Documents, Internet…?
2. Is there some or one way of transferring competence, which is preferred in between members of the organisation?
3. Which type of competence is transferred between individuals, know why, know what, know who? Does the type of competence affect the way it is transferred inside the firm?
4. To what extent, is this a formal activity? Meaning using planed meetings for transferring and sharing or documents
5. Is there some way of transferring knowledge, which is preferred by members in front of others?
6. To what extent is the transfer of knowledge between individuals characterised by watching, participating and imitating in a close interaction?
7. Does the problem of articulating certain competencies affect the way the competencies are transmitted?
8. Is rotation programs of members in different functions of the research?
9. Is knowledge spread inside the organisation in an educational setting with a teacher, or is it spread in a more informal way?
10. Is there any gatekeeper in the organisation working as a channel through which knowledge is spread?

**Storage of knowledge:**
1. Who are the holders of competencies? OR Where in the organisation are competencies stored?
2. Why do, or not, the firm store competence?
3. Are the competencies stored in individuals, archives or…?
4. What type of competence is stored where?
5. To what extent is the competence in use stored outside the organisation or inside?