Technology Scouting in China

For identifying cost reduction and opportunities for innovation

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Abstract

Title: Technology Scouting in China
For identifying cost reduction and opportunities for innovation

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Issue of Study: Tetra Pak is facing increased competition and shrinking market shares in China, in order to meet these challenges they are investigating how to establish a technology intelligence function in China. However, only identifying intelligence is not enough. Companies are more likely to identify opportunities for innovation through collaboration with external associates. Moreover, when the intelligence is identified and acquired, companies need to overcome the knowing-doing gap and find processes for turning knowledge into action. Further, coping with the increased competition from emerging markets, companies need to identify new product, process, and service innovations in order to cannibalize themselves, thus staying competitive.

Purpose: The purpose with this thesis is to examine (1) with whom companies are collaborating in order to identify different types of intelligence and (2) how companies are turning knowledge into action, thus creating organizational understanding and innovation impact.

Method: During this thesis the abductive framework has been used, where the induction framework is used for handling empirics from the cases and the deduction framework for getting inputs from the theories. Together with the action research framework, these are the frameworks used for completing this master thesis.

Conclusion: Throughout this thesis, the technology intelligence process has been discussed in accordance with the purpose of this thesis. Initial research indicates that external collaboration and digestion might be prerequisites for creating and finding low end disruptive innovation, thus facilitating reverse innovation from emerging markets.

Two academic contributions have been developed by this thesis; the theory about listening posts is extended through the addition of knowledge brokers, which are entities spanning application, trends, and technology knowledge. Further, the theory about digestion was created, which is a compounded process that fills the knowing-doing gap, thus enabling action from knowledge.

Key Words: technology intelligence, technology scouting, digestion, knowledge brokers, collaboration, intermediaries, listening posts, reverse innovation, reverse knowledge transfer, packaging industry

Acknowledgement

In your hand, is the result of our master thesis, a master thesis that has been more interesting, fun, and challenging than we ever could have imagined. This thesis is not the result of a two-man show; instead, it is the effort of a joint collaboration with both internal and external partners. First of all, we would like to thank the Technology Intelligence group at Tetra Pak and the entire organization that has provided us with the tools and resources needed at any time which has been inestimable for our work.

Further, we acknowledge and are truly grateful for the inspiration, feedback, and discussion that we have received from our academic tutors Bengt Järrehult and Sigvald Harryson. You have not only supported us through the process, you have also inspired and pushed us further, thus taking the thesis and us as professionals forward.

During this thesis, we have had our ups and downs, but throughout the process we have had our opponents to fall back on. You have provided us with insights and inspiration, guided us through the work and helped us to perform better. Without you this thesis would not have become what it is today. Thank you Janne and Sjölund!

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Lund, May 12th 2010
Oscar Örtendahl and Tor Blomdell

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Abbreviations and frequently used terms

D&E	Development & Engineering, research department at Tetra Pak
Digestion	A process for incorporating and enhancing identified intelligence into the organization, thus creating action
Intermediary	An organization spanning markets, organizations, and industries, thus enabling transfer of knowledge, products, and innovation
Knowledge broker	Companies and departments crossing multiple markets and technology areas for creating innovation
Knowledge gatekeeper	Knowledge interface between an organization and other organizations
Listening posts	A peripheral element of a decentralized R&D configuration with a specific strategic mission and sophisticated mechanisms for knowledge sourcing
Reverse innovation	Innovation from emerging markets that, when proven successful, are taken to the global market
Reverse knowledge transfer	Transfer of knowledge from subsidiaries to headquarter
Technology intelligence	Capture and delivery of technological information for developing an awareness of technology threats and opportunities
Technology scouting	A systematic approach to gather information

1 Introduction

In this section the background to the master thesis is described. First a global description of R&D and China's development is presented followed by the processing and packaging industry. Later follows issue of study together with purpose and delimitations.

1.1 Background

> "*Many of globalization's most vocal supporters have justified the loss of manufacturing jobs in the West on the ground that the rich world will maintain an edge in innovation. Emerging economies are not merely challenging that lead in innovation. They are unleashing a wave of low-cost, disruptive innovation that will, as they spread to the rich world, shake many industries to their foundations.* "
> **Source**: The Economist, 2010-04-17

Globalization describes an ongoing process by which regional economies, societies, and cultures have become integrated through a globe-spanning network of communication and execution (Bhagwati & Jagdish, 2004). Hence, globalization will lead to emergence of production markets worldwide and access to foreign products for customers and consumers. Also, globalization will lead to companies being faced with increased competition from foreign companies entering their core market. New technology and innovation will arise worldwide, leading to increased competition and a need for companies to create a global awareness for technology development. (www.wikipedia.com, 2010A)

As a result of globalization, new technologies and innovations are arising from new technology clusters, in emerging markets. Due to this, the economic power is transferring from developed to emerging markets, whereas China is one of these powers. At the same time the western world is struggling with the economic downturn, which is a hindrance for countries to develop and staying competitive. One of Europe's leading economic powers, Germany had in the first quarter of 2008 a gross domestic product (GDP) growth of 4.5 percent, compared to China, which has a GDP growth rate well above 10 percent. (www.chinastockdigest.com, 2010) According to an analysis from the International Monetary Fund, China's GDP totaled $7.8 trillion, making China the second-largest economy in the world. Also, the income per capita is increasing very fast, in 1990 the average income per capita was around $350 reaching an amazing $3000 in the end of 2008. If China's national incomes continue to grow with an annual growth rate of 8 percent, they will qualify for an OECD (Organization for Economic Co-operation and Development) membership by 2030. (www.economywatch.com, 2010) Today, Chinese institutions of higher education are according to a report from Reuters, "powerful for knowledge development, exploitation and innovation" and today more than 25 million people in China are students of higher education. Also the contribution, in term of published

papers, from Chinese universities is increasing, see Figure 1; in 2008 they were the next largest publisher after the USA. Most of the publications from China are in the area of Materials Science, Chemistry, and Physics, which is correlated with China's industry concentration towards heavy industry and manufacturing. (Adams, King, & Ma, 2009)

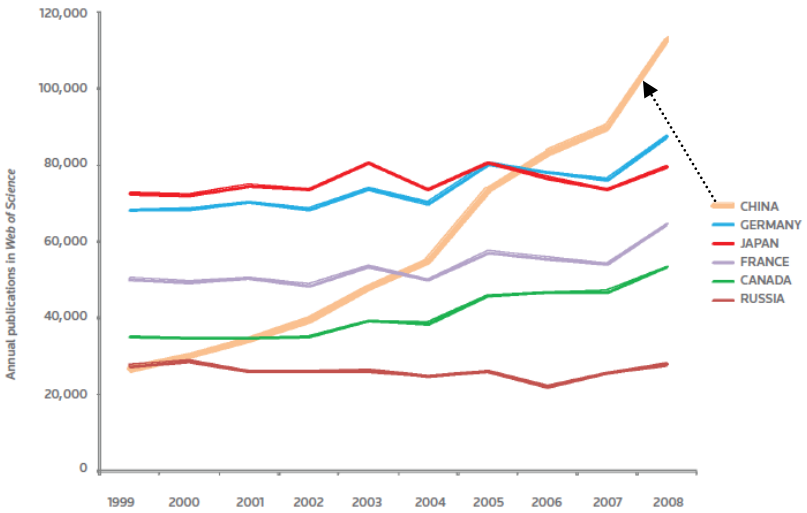


Figure 1China's research output from 1999 to 2008 has increased dramatically, source: Reuters 2009

To keep up with development in science and technology, organizations are finding new forms for creating value. One of these is commercialization of internal as well as external ideas. Hence, R&D departments need to broaden its collaboration, searching for ideas, expertise and skills outside the boundaries of the firm. (Chesbrough, 2003) In May 2004, Corporate Executive Board published a paper where they explored companies' performance and priorities in different R&D areas. The paper concluded that companies' greatest challenges are collaboration with people outside the R&D unit, such as partners and other business units. Further, they identified managing university partnerships as over served, meaning that companies are putting a lot of resources in this area but the importance of this in relation to its output is low. (Corporate Executive Board, 2004) This experience was also acknowledged in IBM's CEO Study 2006, where the most significant sources for innovative ideas were studied; see Figure 2 (IBM Global Business Services, 2006).

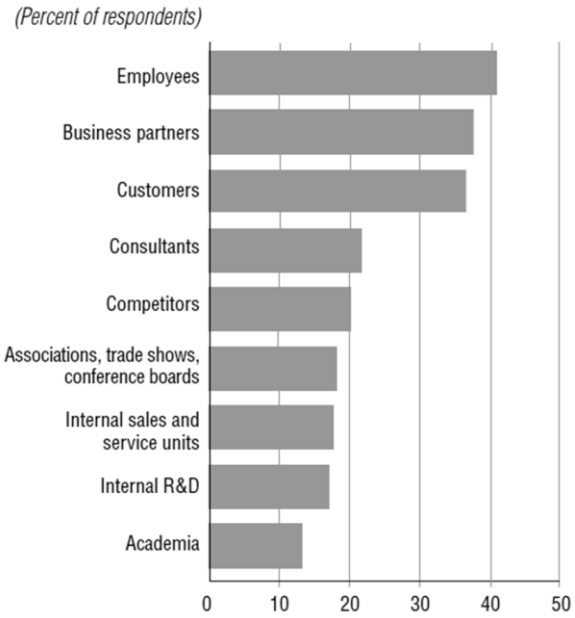


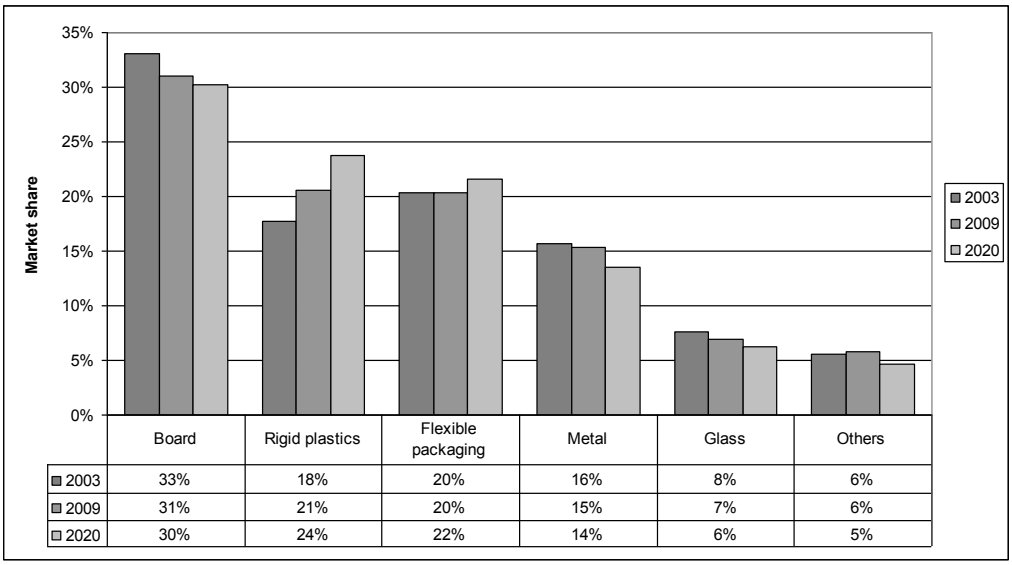
Figure 2 Most signifcant sources of innovative ideas come from external collaboration, source: IBM CEO study, 2006

The study illustrated the importance of external collaboration, especially with business partners, customers, and consultants, and most CEOs argue that it is much harder to conduct in practice, acknowledging a gap between importance and performance. The main reasons for collaboration and partnering are according to the study reducing costs, higher quality, and access to skills as well as products. (IBM Global Business Services, 2006) Thus, companies collaborating with the external environment can not only become more innovative they can also access new knowledge and technologies, further gaining cost advantages creating future competitive advantages.

1.2 Packaging Industry

The food-packaging market was valued to $193.6 billion in 2009, representing 30.5 per cent of the total packaging industry, and projected to reach $248.5 billion in 2020. Growth rates are projected to be staggering in Asia-Pacific, South America, Middle East, and Africa until 2020 while Europe and North America will grow slowly. During the economic crisis consumer demand for non-food products, thus packages for non-food products, slowed down while food and beverage packages managed to hold their shares. However, due to the economic downturn and an unpredictable energy market the food-package industry faced a more cost-driven customer. They required simpler products, thus more cost-efficient, offering material savings. However, the customers did not want to deteriorate consumer convenience or environmental impact. The beneficiaries have been plastic pouches and similar solutions that offer low-cost products with low environmental impact.

Consequently, addressing customer and consumer demands, packaging companies are changing their businesses and products. (Pira International, 2009) Packagers are looking for new ways to lower waste, increase recyclability, and developing sustainable packages (Nyström interview 2010-02-03). Technology trends are dependent upon customer and consumer demands, thus new trends have emerged as consumers are becoming more cost and environmental aware. Barrier technologies, for instance protecting package content from oxygen, light weighting material, enabling lower material cost, and nano composites, for changing package's attributes and cost structure, are new trends identified to become important for packaging companies. (Pira International, 2009, Sickert interview 2010-01-28)



	Board	Rigid plastics	Flexible packaging	Metal	Glass	Others
2003	33%	18%	20%	16%	8%	6%
2009	31%	21%	20%	15%	7%	6%
2020	30%	24%	22%	14%	6%	5%

Figure 3 Board material are facing decreased market shares due to increased competition from rigid plastics, source: Pira International 2009

Packaging materials is a huge market, the global value is according to Pira valued at $663.7 billion in 2009 and is estimated to reach $841.4 billion in 2020, see Figure 3. Boards, defined as different types of papers and cartons that are coated, possess the largest market share within packaging materials. As competing materials are growing, manufacturers of boards are moving their manufacturing to low-cost regions. Rigid plastics material, such as trays, disposable and replaceable cups, containers, and bottles, is the fastest growing category in Pira's report from 2009. The growth is driven by an increased demand for single-serve packaging, better performance, and improved processing technologies. For flexible packaging, plastic packaging is growing, especially in China and India due to a developing retail infrastructure, a larger disposable income, and replacement of more rigid packaging materials, see Figure 4. Moreover, the benefit from having a material that is cost efficient and easily tailored to customers' needs improve the growth rate. (Pira International, 2009) Thus, different types of plastic pouches have come to challenge

the board industry in developing countries and are rapidly gaining market shares (Immelborn interview 2010-02-01).

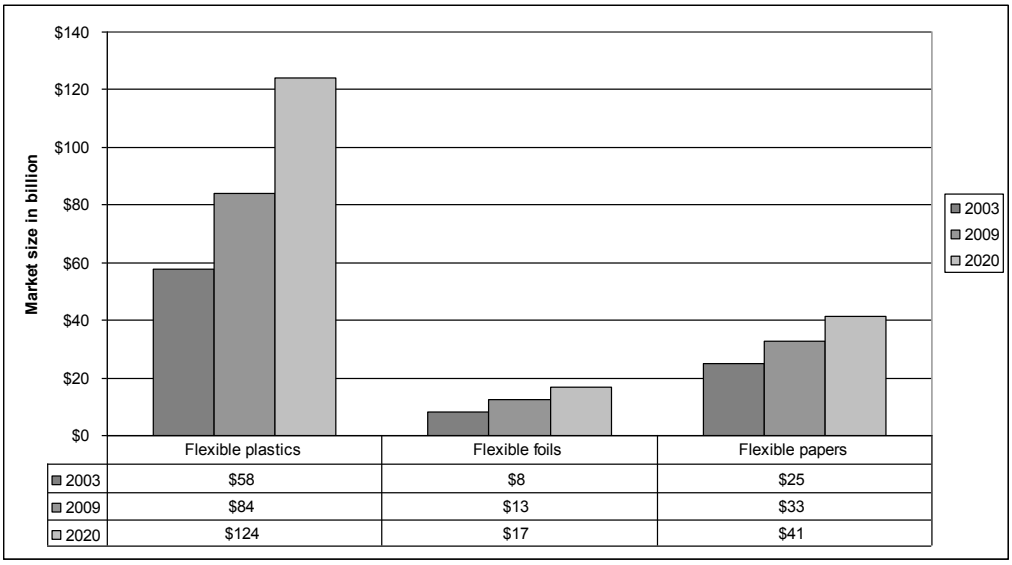


Figure 4 Flexible plastics is growing into a large market in 2020, source: Pira International 2009

The board industry has a few large players; Tetra Pak, SIG Combibloc (Combibloc), and Elopak (Sickert interview 2010-04-22). In 2009, Combibloc achieved a turnover of Euro 1260 million, with 4250 employees present in more than 40 countries (www.sig.biz, 2010). Further, during 2009 Combibloc faced a stable market in Europe and strong growth in emerging markets which enabled them to perform well, even though the economic downturn (Reynolds Group Holding Limited, 2009). Elopak, a Norwegian company, realized a turnover of NOK 5 billion in 2008 through having 3000 employees producing more than 12 billion cartons (www.elopak.com, 2010). As China develops, board producing companies arise and enter the global market, challenging established players. During the beginning of the 21st century, Tralin Pak was established as a Chinese challenger for supplier of aseptic packaging material. The company has gained market shares in China, and has even been acknowledged by foreign investors such as Bain capital in 2006. Today, Tralin Pak employees more than 700 people in five countries, distributes up to 4 billion aseptic cartons each year and aim to be the world leader of packaging solutions within 20 years. (www.tralinpak.com, 2010)

1.3 Issue of Study

The purpose of technology intelligence is to capture and deliver technological information, as part of the process whereby an organization develops an awareness of technology threats and opportunities. Increased globalization and technology complexity enhances the need for increased identification, understanding, and usage of external sources. (Rohrbeck, 2007) However, as information is captured it is

of utter importance for companies to use it in their strategic planning to identify technological development and trends (Lang, Mueller, 1997). China, one of the largest economies in the world is also a large player within the globalization of research and development. Even though most of R&D investments are in basic research and development, China is still gaining pace further challenging developed countries and research facilities. (Adams, King, & Ma, 2009) Hence, it is important for companies to have a strategy for how they are going to establish themselves in China and how to collaborate with Chinese partners, identifying opportunities for cost reductions and product, process, and service innovation.

There are some scholars that are looking into the toolbox and needs for building technology intelligence systems (Mortara et al. 2009). Meanwhile, there are other researchers that are investigating how technology scouting is being conducted and how scouting networks can be created (www.scribid.com, 2010). However, most of the research is focusing on processes and overall performance of technology intelligence and scouting (Rohrbeck, 2007). There is little research in the field of information handling and incorporation of information into the organization. Furthermore, the process for creating action from knowledge is scarcely covered, see Figure 5. For creating action, companies need to identify the value of knowledge, thus using this pool of knowledge for creating valuable products and services (EIRMA, 1999).

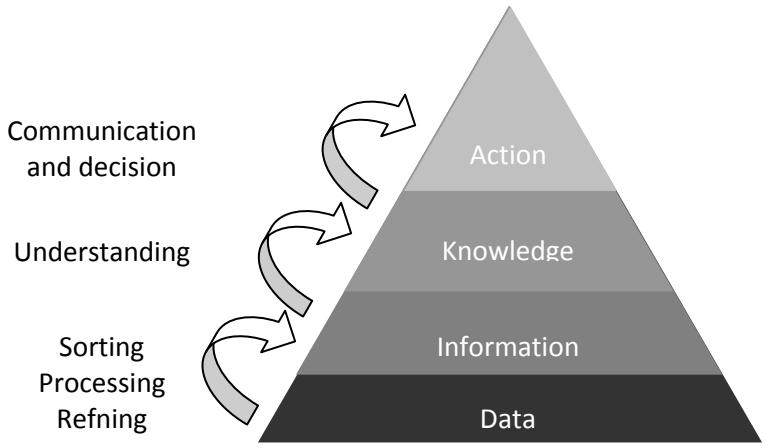


Figure 5 The knowledge pyramid describe how to transform data into action, source: EIRMA 1999

The barriers for entering mature industries are decreasing due to the development of technology. Hence, companies need to address this issue. Further scholars are investigating the option for companies to disrupt themselves for gaining competitive advantages (Christensen & Raynor, 2003, Immelt, Govindarajan, & Trimble, 2009). In order to stay competitive, companies need to identify cost reductions as well as opportunities for innovation. Thus, fostering an environment where they cannibalize their own products before their competitors do so. Furthermore, using technology

intelligence as a tool for creating internal competition, where internal R&D is challenged by external technologies, can help to identify cost reductions and opportunities for innovation. Companies are more likely to identify innovative ideas through collaborating with the external associates (IBM Global Business Services, 2006), thus companies need to open up for external collaboration in order to become innovative. Moreover, when the intelligence is acquired and turned into knowledge, companies need to find processes for turning knowledge into action.

1.4 Purpose of the Thesis

The purpose with this thesis is to examine (1) with whom companies are collaborating in order to identify different types of intelligence and (2) how companies are turning knowledge into action, thus creating organizational understanding and innovation impact.

1.5 Delimitations

This thesis is performed at a packaging and processing company for liquid food and beverages, and will focus on the research and development process where technology intelligence is both needed and used. The thesis will not go further into the area of development and commercialization of existing products. However, the authors recognize that these areas of business may well have an interest in and impact on technology intelligence. Nevertheless, the authors argue that when setting up a new network in another country for technology intelligence, this should mainly be driven by the R&D organization; hence, this is the focal point of this thesis. However, as the organization and system for technology intelligence develop, there will be some interesting aspects in the rest of the organization that could be explored through future research.

Regarding external case studies, this thesis will focus on companies that are collaborating with intermediaries, partners and universities. There are more networks and collaborators that are viable for establishing technology intelligence in China. As these three are well-used in China, they make a good input to this master thesis. Further, this master thesis is one part of a bigger project where another master thesis is conducted in China with the purpose to identifying technology areas and networks that could be of importance when collaborating in China. These networks are in first hand universities and that is why industry university collaboration is one part of the empiric's chapter in this thesis to bridge over to the Chinese master thesis. Hence, industry university collaboration will not be studied in the theory.

The scope of this thesis from Tetra Pak's point of view is to examine how to set-up a technology scouting organization in China. However, as the authors see it, there is a gap in the academic research of today for how to create action from scouting and intelligence. Also, the authors identified that there is a need from Tetra Pak's employees for more intelligence on China. Hence, the scope of this master thesis will also include a broader discussion about technology intelligence and then in the

conclusion, theory and analysis will be applied to the Tetra Pak case for clear recommendations on how to set up a technology scouting network in China.

1.6 Key Learning from Introduction

- Paper board packages are facing decreasing market shares
- Established markets are facing increased competition from developed and emerging markets
- The most signifcant sources of innovative ideas come from external collaboration
- There is a need for intelligence and process for turning knowledge into action
- Innovation of new products, processes, and services is needed for sustaining competiveness and technology leadership

2 Methodology

The methodology chapter describes how the authors have managed the master thesis, which results that are expected from the thesis and finally a criticism of the sources used for drawing conclusions. This chapter aims to explain what the authors have done during the thesis, why it was done, and how these actions have affected the outcome of the thesis.

2.1 Working Process

The scope of the thesis, provided by Tetra Pak, is to evaluate establishment of technology scouting in China for Tetra Pak. The scope is covered by two master theses, one Chinese and one Swedish master thesis. The Chinese master thesis is focusing on identification of technology areas and networks that could be of importance to Tetra Pak, and how Tetra Pak can use these. The Swedish master thesis is to focus on evaluating benchmark companies and identifying Tetra Pak needs and suggesting processes and deliveries. Close collaboration between the master theses is established to get a good symbiosis effect and use each other as feedback partners. A weekly update-template is used during the working process to ensure the collaboration. To ensure that the thesis would fulfill Tetra Pak's scope and the purpose, meetings and continuous feedback was provided between the authors, and academic as well as Tetra Pak tutor. Empirics and theory have been altered during this master thesis, thereby creating an iterative process. The theory provided the authors with areas to look into when gathering the empiric data and findings from the empirics provided the authors with new areas of theory. Thus, both empirics and theory guided the authors through this thesis, identifying new academic areas to research.

2.2 Research Methodology

The abductive framework used in this thesis stems from the insight that most great advances in science neither followed the pattern of deduction nor of induction (Kovacs & Spens, 2005). Rothchild's definitions of these are: "induction is the formation of a generalization derived from examination of a set of particulars while deduction is the identification of an unknown particular, drawn from its resemblance to a set of known facts". (Rothchild, 2005) Furthermore, the interaction between theory and empirical data is necessary in order to enhance the overall understanding of interaction between technology and society (Alvesson & Sköldberg, 1994). This study uses the induction framework to handle the information from the case studies and the deduction framework to get input from the theories. Together they create the abductive framework.

The working process has been iterative, where the cases have provided the authors with insights further leading to reflection. These insights have lead to new actions in the following cases, thus creating new insights. This methodology is called action research (Lewin, 1946). Case studies and action research are used with abduction

reasoning very commonly. This occurs, due to simultaneous data collection, theoretical development, and theory building element in both methods. (Alvesson & Sköldberg, 1994 Dubois & Gadde, 2002) The theoretical framework and initial findings are used as guidance for the empirical research. Subsequently, they are applied to the information from the investigation for identifying improvements to the framework, see Figure 6.

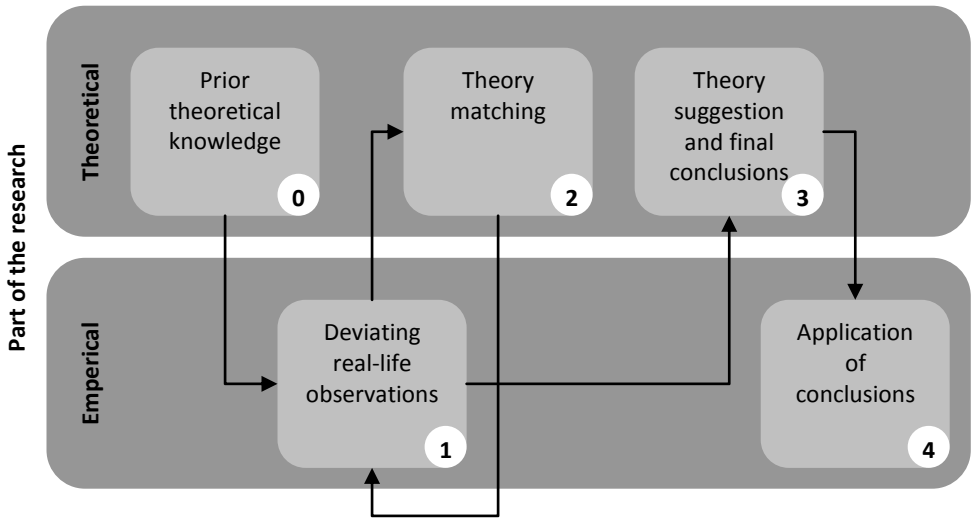


Figure 6 The Abduction research process used for this thesis, source: Kovacs and Spens, 2005

2.3 Empirical Gathering

Gathering of empirical material for conducting this thesis has been performed in numerous ways for validating the authors' findings as well as being able to draw both academic and managerial conclusions. By using different sources, with different knowledge, at different times during the process, reliability and validity could be secured while still delivering a thesis fulfilling the scope, see Figure 7.

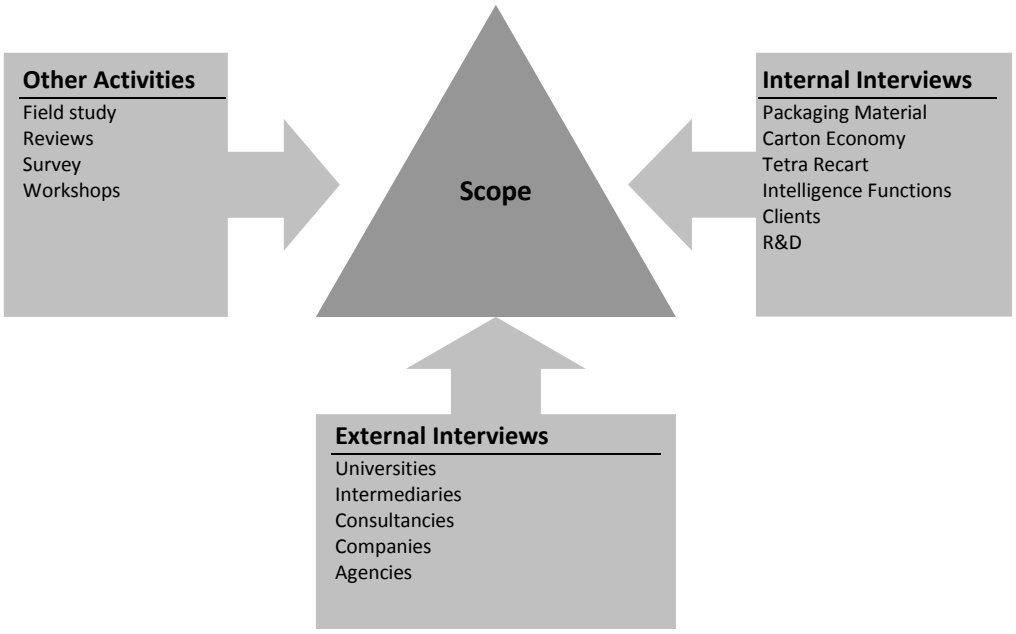


Figure 7 External and internal interviews as well as other activities were used for fullfiling the scope of this thesis

2.3.1 Interviews

More than 26 semi-structured interviews (www.wikipedia.com, 2010B) have been conducted with internal stakeholders and employees, as well as external interviews with companies, universities, and consultancies. These have been performed for establishing a good understanding for the subject being researched in this thesis. The interviews has been conducted in a semi-structured way; securing that each interview has a clear purpose, while still providing the interviewers with the possibility to change the questions for matching them with the competences and experiences of the interviewee. Both of the authors have been present during the interviews, and when this have not been possible transcripts and briefings have been presented for securing transfer of knowledge from each interview.

The purpose with the interviews has been to understand the subjective environment that each of the interviewee is acting in. This increases the risk for biased answers, however as many interviews are conducted with distinguished actors somewhat objective conclusions can be agreed upon. The initial persons interviewed were introduced by Tetra Pak, for getting a better understanding of their business as well as the subject. As the knowledge for the subject increased, new persons were identified for interviews. Further, the initial interviews provided new connections to people with information regarding the thesis. This also increase the risk of biased answers, as the persons recommended might have been chosen to give a refined picture. However, this is a risk identified and handled. Regarding external interviews, these were chosen with regard to companies and contacts with a long

understanding of the subject and from different industries. This enabled comparison between industries and experiences, improving the reliability and validity of the thesis.

2.3.2 Benchmark Companies

In order to understand with whom companies are collaborating, four benchmark companies were identified and investigated during this thesis. These companies are different in their set up in term of what type of intelligence they are looking for, and how they are working for capturing this intelligence. Nevertheless, merely capturing knowledge is not enough, thus delivery of intelligence was investigated in order to understand how companies can transform knowledge into action. Furthermore, the benchmark companies were selected from different industries and experiences, facilitating and enhancing the understanding of technology intelligence and its impact on innovation. Thus, selection and collaboration with the four benchmark companies increased the reliability and validity of this thesis analysis and conclusions and gives a vast understanding of the topic.

2.3.3 Experience Sharing Workshop

During this master thesis two experience sharing workshops have been conducted; one in Shanghai regarding industry-university collaboration, and one in Gothenburg regarding collaboration with intermediaries. In Shanghai industry peers, Tetra Pak employees, and consultant firms participated. During this workshop, experiences from collaborating with universities and usage of technology intelligence were discussed. The workshop started with a short presentation of this master thesis and the participating companies, providing the big picture and industry understanding for all participants. Later on, a few pre-selected companies presented their own cases and key learning from these, followed by an open discussion forum steered by a moderator. It is acknowledge that there might be a risk that during these open forums that people tend not to present all relevant fact. However, the workshop provided the authors with new possibilities to conduct deep-interviews with some of the participants.

A similar structure was used in Gothenburg where SCA's collaboration with InnoCentive was the overall topic. An open discussion with employees responsible for innovation, sourcing and InnoCentive collaboration was arranged. The workshop was moderated by the master thesis students, who had prepared semi-structured questions for managing the workshop. Later on, as the workshop progressed, it turned into an open discussion where key learning and experiences from intermediary collaboration were discussed.

Both of the workshops might have been affected by people not wanting or daring to share information due to different hierarchical structure and fear for sharing sensitive information. Also the risk for interviewees giving biased answers for showing their companies and organization from a better perspective has been

acknowledged. Nevertheless, both of the workshops provided good input to the thesis and new opportunities for interviews and analysis.

2.3.4 Survey

For creating an understanding of Tetra Pak's organization and their relationship to technology intelligence and scouting, a survey was sent out to a total of 60 persons, a total of 31 persons responded. The survey questions were adopted from a technology intelligence publication and their framework for identifying the needs for technology intelligence systems in the organization (IfM, 2007). Due to input from the organization the questions were altered. Even though, the survey did provide the thesis with quantified data of organizational performance and needs, as well as qualitative data. This data could not have been gathered in another way, due to problem with setting up meetings and organizing interviews. Further, surveys provide the respondents with anonymity enabling them to share experiences in a more open way. However, surveys have the drawback that it is not possible to ask attendant questions which might aggravate the interpretation of the results. Nevertheless, all of these risks and possibilities were analyzed and taken into consideration when the data from the survey was used. The results from the survey provided good input to understanding the needs and wants of Tetra Pak concerning technology intelligence.

2.3.5 Field Study

For creating an understanding for the Chinese culture and business environment a field study was conducted during two weeks. Visits to universities, businesses, consultancies as well as markets were carried out both in Shanghai and Beijing. The study enabled a deeper understanding of the market and provided new contacts that have been helpful during the creation of the master thesis. Due to the short time spent in China it was harder to draw conclusions applicable to the entire market and the results could be biased because of this. As interviews were performed with professionals with a long experience from both China and developed markets a better insight could be created within a short time period. The interviewees were identified through discussion with Tetra Pak, academic tutors and between the authors for securing that relevant material was gathered during the field study. After the field study was conducted, follow up sessions were arranged where supplementing questions were asked to assure the relevance and validity of the information acquired. Even though the time in China was short it provided essential input to the master thesis and deepened the understanding for prerequisites for establishment and conduction of business in China.

2.3.6 Reviews

To secure that the results from the thesis coincide with the scope and needs of the hosting organization, a half time review was conducted during a half day together with one person from the steering committee, one academic tutor for the master thesis, and Tetra Pak employees. This provided both the authors and Tetra Pak with the opportunity to present the finding as well as guidance in what areas to focus

during the thesis. It was also a good opportunity for creating a better understanding and communication between the authors and the steering committee. The review meeting was held in Shanghai and was co-located with presentations of the other master thesis, and a PhD review, within the area of industry-university collaboration. This provided good input to the thesis and improved the knowledge transfer between the groups and the steering committee. Especially it gave good inputs to universities, how they are working and what implications this have for companies aiming for collaboration.

2.3.7 Secondary Data

During this thesis much of the collected information has been secondary data acquired through written reports, third party research, and subjective thoughts from interviewees and discussions. The authors have kept in mind that the secondary data has been gathered with another purpose than that for this thesis, which might have biased the data. (Jacobsen, 2002) During the thesis this data has been validated through comparing it with other sources as well as the authors performing their own research. However, the time limitations as well as both the area of technology intelligence and packaging industry being completely new to the authors has increased the importance of secondary data.

2.3.8 Tutor Meetings

During this master thesis there have been frequent tutor meetings, with the two academic tutors and the Tetra Pak tutor. These have been conducted individually, together with both of the academic tutors, and all tutors together. A master thesis is a long project with a lot of potential pitfalls and external influences. The tutors did not only provide guidance throughout the process, they were also a great inspiration providing new innovative thoughts, both from academic and managerial point of view. This has truly taken the master thesis one step further. Moreover, without the support and resources from Tetra Pak this thesis would not have been what it is today.

2.4 Expected Result

The expected result of this thesis is to analyze and deliver a framework for establishing technology scouting in China. This thesis is a part of a bigger project where another master thesis also contributes to the overall scope, through examining establishment of technology intelligence and scouting networks in China, for Tetra Pak. Furthermore, the authors aim to explore how companies can use technology intelligence for cost reductions and identification of opportunities for product, service and process innovation.

2.5 Criticism of Sources

Most of the sources used in this thesis are employees at Tetra Pak, however to get at picture of how technology intelligence can be managed, external sources were used. Nevertheless, these were quite few and the number of sources from each company was few and identified through contacts and alumnae networks. Thus, the validity of

these sources could be questioned both in terms of the absolute number and their relationship to each other. However, by using secondary data for validation the validity could increase. Further, the interviewees, both internal at Tetra Pak as well as external, are professionals with a long experience in their businesses and they have discussed each issue with an opened mind trying to explain both advantages and disadvantages with their work.

Regarding the experience sharing workshops these provided the thesis with great input, however it is acknowledged that the information was in some form biased. For example, SCA's collaboration partner InnoCentive was not attending during the workshop, instead the challenge owner responsible for the collaboration from SCA presented their work. This can in some fact have influenced the thesis view on collaboration and what makes it successful. Even though, it provided the thesis with parameters to have in mind for collaboration with intermediaries. The advantage with these group activities is that an open discussion was created giving good input, however open discussions might decrease people's willingness to share information and especially information with negative impact on their business. It could be argued that it would have been better to have individual interviews instead for improving the openness of the interviews. However, for getting access to these sources this was not a viable option, thus it was better to conduct follow through the workshops.

For pleasing both academia and Tetra Pak some changes have been made in the survey, interviews and the research process. This might have affected the results as questions were altered for suiting internal nomenclature. On the other hand, by adopting the framework to the organization, the questions and language were recognized by the organization facilitating that they understood the purpose with the survey. Further, the respondents to the survey were selected by Tetra Pak which might have biased the result, but as the survey reached clients, managers, and different departments it can be argued that this still provided reliable information.

3 Theory

This chapter presents how technology intelligence can be divided into capture of information and delivery of intelligence. Further, it presents how companies can identify intelligence depending if they know or do not know what intelligence they are looking for and where to find it. Later, follows theories about how listening posts can be used for identifying intelligence and how knowledge can be transferred in companies. The chapter ends with a short summary of innovation and how external associates can act as knowledge brokers, increasing companies' innovativeness.

3.1 Technology Intelligence

> *"Technology intelligence is capture and delivery of technological information as part of the process whereby an organization develops an awareness of technology threats and opportunities"*
> **Source**: Kerr et al. 2006

Technology intelligence is not only used for capture and delivery of technological information, it is also important for strategic planning to identify technological developments and trends in time (Lang & Mueller, 1997). By establishing successful technology intelligence processes, companies can quickly respond to radical trends, which are prerequisites for coping with technological change (Lichtenthaler, 2004). Technology intelligence focus on technical attributes of technology, and the complete spectrum of social, legal, economic, political, and environmental attributes of technology. Moreover, it illustrates how companies captures technological information and delivers intelligence, see Figure 8. The verb *Capture* focuses on collecting, categorizing, storing, and retrieving information. Whereby, the verb *Deliver* explains the process of analyzing, interpreting, disseminating and turning information into intelligence. (Kerr et al. 2006)

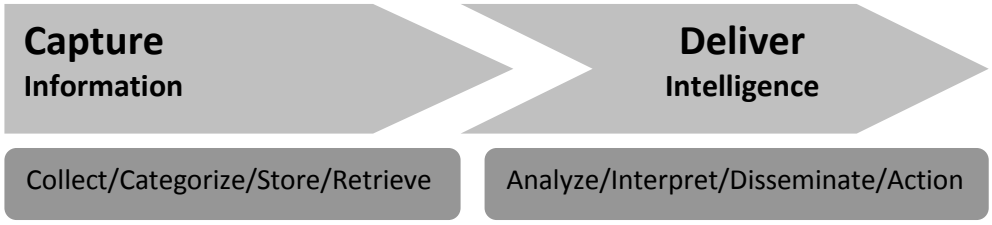


Figure 8 Process for capture of information and delivery of intelligence, source: Kerr et al. 2006

Selection of important and relevant information when creating intelligence can be a challenge, because the information must be relevant to the business without missing information in other related areas. Systems that highlight the most important data and trends in a large quantity of information are enabled by efficient search methods. (Mortara et al. 2009)

Dissemination of intelligence to the right people in the organization enables action and the impact is depended upon communication in the organization. How the intelligence is communicated varies between industries and companies, and is dependent upon the receiving organization. Technology roadmaps, reports, newsletters, and innovation retreats are four, often recurring examples of how to create understanding and spreading information within a company (IfM, 2009). Technology roadmaps are used to link anticipated future technology, market, and product trends together with identified opportunities to technology solutions. Reports consist of the latest development on areas of interest for the organization. Newsletters are often sent by a central technology group to interested parties and stakeholders throughout the business. Furthermore, meeting in person is of importance and innovation retreats can be arranged where people with different backgrounds meet and discuss. This does not only help build a common language across different departments, it also fosters cross-functional communication as a part of the company culture.

Often information gathering is conducted separately by the technology, competitor, and market intelligence groups. (Brenner, 1996) This increases the need for coordination and communication, for enabling sharing of information, creation of intelligence, and synergies. To be able to coordinate these three areas cross-communication should be encouraged by the organization to maximize the exchange of valuable information, thus facilitating decision making, see Figure 9. (Kerr et al. 2006)

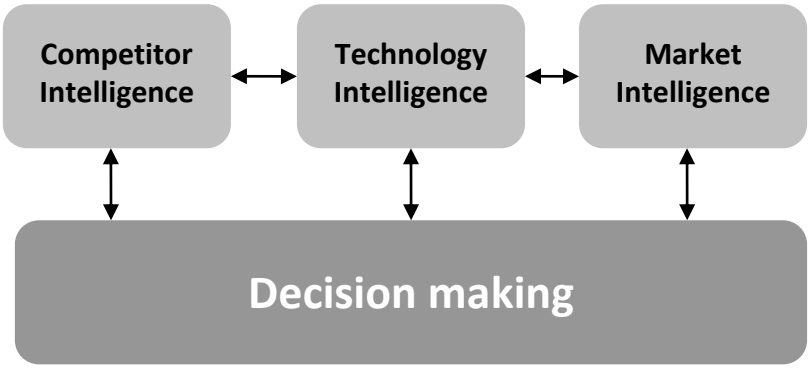


Figure 9 Collaboration between Intelligence functions enable effective decisions making, source: IfM Briefing, 2009

3.1.1 A Conceptual Model for Technology Intelligence

An organization needs to identify how to search for information to stay competitive and come up with different search modes depending on the information needed. Kerr et al. presented a three tiers conceptual model consisting of three different steps on how to absorb and process information. (Kerr et al. 2006) The first step is the framework which highlights the relationship between decision makers and information providers. It maps the information requirements and knowledge gaps of

the decisions makers, linking them to actual data sources through intelligence activities. The framework explains technology intelligence as a part of, and depending upon, a bigger intelligence system where Competitor Intelligence and Market Intelligence groups are included. (Brenner, 1996)

The second step is the system, which describes how a company can work with technology intelligence. In Figure 10, this system is visualized in a matrix where the vertical axis is the intelligence awareness dimension which reflects the actual awareness of the organization's intelligence needs. The horizontal axis is the intelligence provision dimension, reflecting whether the organization already has the necessary information in-house or must go outside the organization and search for it. The *Trawl-mode* is for finding information which is in-house but not formalized. *Scan* is used to keeping abreast with technology developments that can have an impact on the business. *Mine* is extracting explicit intelligence information from an internal source and *Target* is monitoring the development of new technologies identified as relevant for the future. (Kerr et al. 2006 Lichtenthaler 2006)

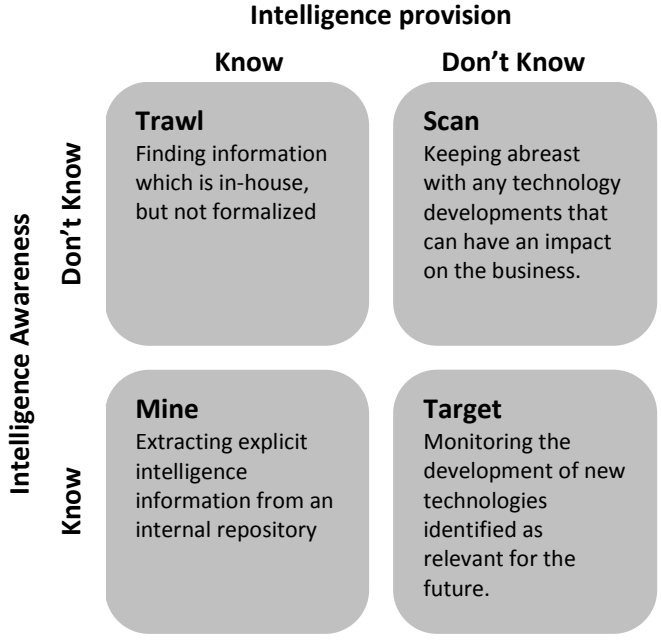


Figure 10 System modes for technology intelligence divided in Intelligence awareness and Intelligence provision, source: adapted from Kerr et al. 2006

The mine and target modes can be seen as reactive modes. Thus, the organization is already aware of the need to take action and search for information. They are thereby reacting to circumstances and the search is directed. On the other hand, trawl and scan are proactive in nature in the sense that intelligence is being sought for before it is identified as needed by the organization. This is performed, in order to pick-up unforeseen issues that could have particular relevance or potential impact on an organizations business. Thereby it's an exploratory and open-ended search.

(Kerr et al. 2006) Directed searches aim at extracting intelligence in areas predefined by the organization for answering expressed needs. The antonym is the open-ended approach where companies are searching for trends and developments that can influence their business. For identifying important information and creating intelligence, internal and external focus is needed. Internal focus is searching for the information from sources and networks available in-house and external focus is using networks and sources available externally for understanding technology development.

The process is the last tier in the process, suggested by Kerr et al., consists of the processes necessary to operate a technology intelligence system, see Figure 11. This process consists of six different phases. In the *coordination* phase, tasks are assigned and generate ideas for sources and refine the search goals for the decision makers. *Search, Filter* and *Analyze* are phases that form a subordinated cycle within a process that is repeated until a satisfying level of information is acquired. After these phases are completed, the researchers and intelligence employees *Document* their findings and *Disseminate* the intelligence throughout the organization. (Kerr et al. 2006 Mortara et al. 2009)

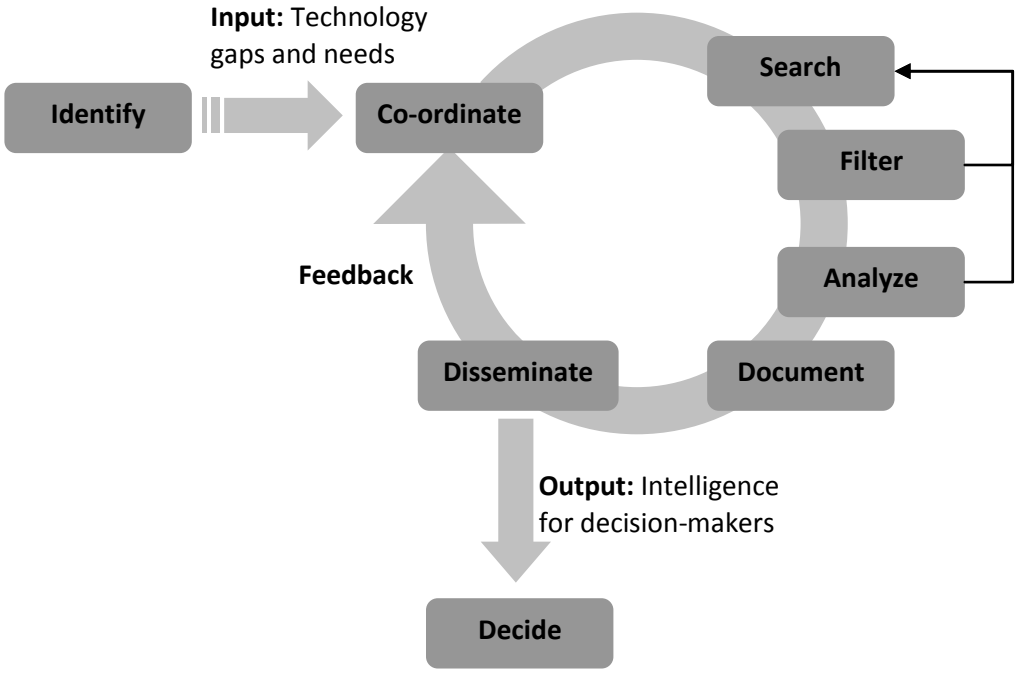


Figure 11 The technology intelligence process is iterative, thus enabling intelligence for decision-makers, source: Kerr et al. 2006

3.1.2 Technology Scouting

Technology scouting is a systematic approach by companies, whereby they assign part of their staff or employ external consultants to gather information. Technology scouting relies on formal and informal information sources, including networks of

experts. (Rohrbeck, 2007) Further, it is a search and intermediation process, which enables companies and organizations to find new technologies. (Shohet, 2005) To begin with, technology scouting identifies advances in science and technology that can be useful for companies and improve their competiveness. This activity might be directed, technology monitoring, which means to search in specific technological fields. (Lichtenthaler, 2006) Or it can be an undirected activity, technology scanning, which mean searching for new technological opportunities in white spaces not yet covered by the present technological scope of the company. (Rohrbeck, 2007)

Technology scouting can be categorized in four different areas. (1) First is early identification of technologies, technological trends, and technological shocks followed by (2) raising the awareness of threats and opportunities due to technological development. Furthermore, (3) catalyze innovation by combining technology intelligence with business potential assessment. (4) The fourth area is facilitating sourcing of external technologies by reaching through the network of technology scouts to their sources of information. This makes the role of technology scouting twofold; identifying new technology development and facilitating technology sourcing, see Figure 12. (Rohrbeck, 2007)

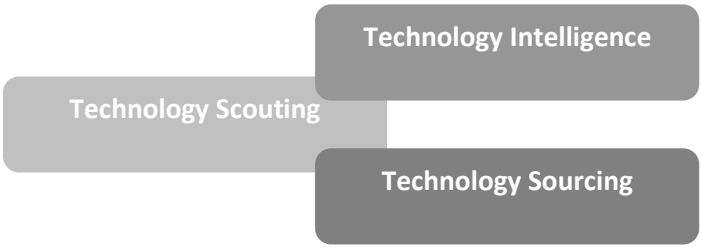


Figure 12 The role of technology scouting in relation to technology intelligence and sourcing, source: Rohrbeck, 2007

3.2 Listening Posts

> "*A listening post is a peripheral element of a decentralized R&D configuration with a specific strategic mission and sophisticated mechanisms for knowledge sourcing*"
> **Source**: Gaso, 2005

According to Gassmann and Gaso, there are three different organization forms of listening posts; technology outpost, trend scout, and matchmaker. Listening posts can be classified by type of processed knowledge and alignments of the listening post, see Figure 13. Type of processed knowledge is categorized by *trends and application knowledge*, referring to both micro and macro trends, and *technological knowledge*, referring to complex and sophisticated tacit knowledge which is harder for competitors to imitate. On the other axis, alignment of listening post can be categorized by *direct knowledge sources*, which are a first-hand process for acquiring information and knowledge of changes in the technical environment. Using *indirect knowledge intermediaries* is sourcing of knowledge assets through exchange of

information on a market basis, with partners or with specialized firms. Depending on the alignment of the listening posts and what type of processed knowledge they are handling, different capabilities are needed. (Gassmann & Gaso, 2004)

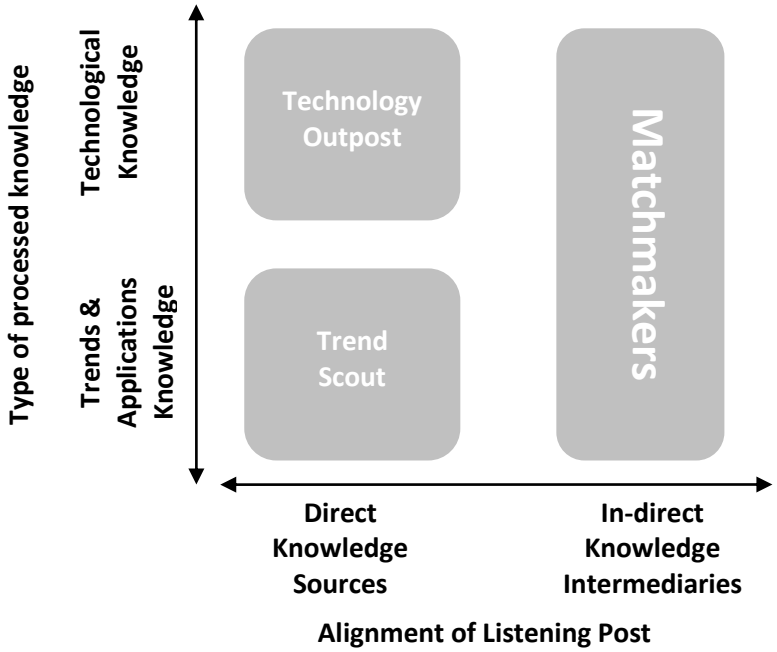


Figure 13 Classification of Listening Posts, in relationship to alignment and type of processed knowledge, source: Gassmann and Gaso (2004)

3.2.1 Technology Outpost

The mission for technology outposts is to collect advanced technological knowledge, later transferring it to the home-base R&D. Often, technology outpost are located in regions of technological excellence, for example of an academic institution or in innovative regions. Advantages with technology outposts according to Gassmann and Gaso are that they are highly enmeshed in the scientific community, and autonomy towards the central R&D unit. However, there is a risk that technology outposts become “engineer playgrounds” not delivering value to the organization, and that central directives from top management can lower creativity and flexibility of the technology outpost. (Gassmann & Gaso, 2004)

3.2.2 Trend Scout

Trend scouts are responsible for technological megatrends, new application areas and future trends due to a changing society. This is often accomplished through presence in lead markets and innovation clusters. Their mission is to collect and transfer trends to the company’s R&D center. Trend scout setup is often coordinated and resources are often allocated centrally. Furthermore, programs for job rotation with company central R&D units are common for efficient transfer of tacit knowledge. According to Gassmann and Gaso trend scouts have some advantages,

namely, low investment costs and high domestic market sensitivity. However, there are also some disadvantages especially with local market integration barriers and the not-invented-here-syndrome with the home base R&D. (Gassmann & Gaso, 2004)

3.2.3 Matchmaker

The matchmaker, the final listening post described by Gassmann and Gaso, is responsible for both trends and technological knowledge and are often located in a specific regional scientific community. The matchmaker possesses a large informal network and accomplishes their mission through being an intermediary between technology suppliers, research institutions, and other partners. According to Gassmann and Gaso, matchmakers' biggest strengths are that they give access to new and complementary areas of knowledge, they enables sharing of costs and risk, and finally that they often find breakthrough and radical innovations. The largest weaknesses for a company using matchmakers are that they not have any control or ownership of the knowledge assets, and moreover, that knowledge might be lost through externalization. (Gassmann & Gaso, 2004)

3.3 Reverse Knowledge Transfer

According to Buckley et al. knowledge transfer to and from subsidiaries can be classified into three different types; primary, secondary, and reverse, see Figure 14. Where primary knowledge transfer is from headquarter to subsidiaries, secondary between subsidiaries, and reverse knowledge transfer from subsidiaries back to headquarters. (Buckley, Clegg & Tan, 2003)

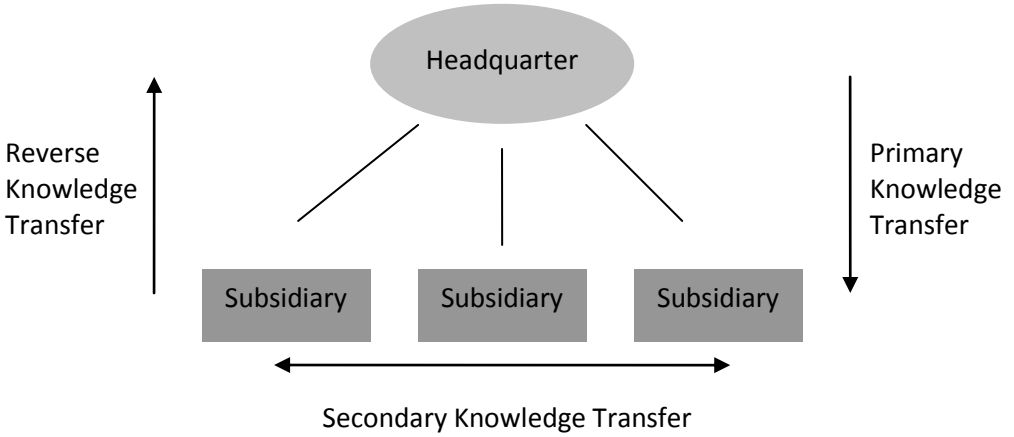


Figure 14 Knowledge transfer can be in different forms, depending on direction and recipients, source: Buckley, Clegg & Tan, 2003

As companies, and mostly Multi National Companies (MNC), are establishing themselves globally the role of headquarters is changing. Headquarters are no longer the single source of knowledge and competencies; instead they are more and

more dependent upon information received through foreign subsidiaries. (Ambos, Ambos & Schlegelmilch, 2006) Further, cross cultural adaption and learning may nowadays transfer from the previous learning subsidiaries back to the expert headquarter. By recognizing the importance of foreign subsidiaries and their knowledge, a greater value can be extracted from these. (Napier, 2006) Ambos et al. argue that MNC are benefiting from reverse knowledge transfer, and primarily from subsidiaries located in highly developed countries. Furthermore, they argue that for headquarter to benefit from subsidiaries, these must be integrated in the MNC network. Filters between headquarter and subsidiaries might be a barrier for reverse knowledge transfer, hence, it might be of importance to unwind some of the hierarchical relationships between the two of them. (Ambos, Ambos & Schlegelmilch, 2006)

Reverse knowledge transfer is dependent upon the organization's receptivity to knowledge. Moreover, repatriates might be a good source for creating reverse knowledge transfer, because they tend to have knowledge of importance for the business. Creating efficient knowledge transfer of highly tacit and specific knowledge can be accomplished through frequent communication between repatriates and organizational members. By involving repatriates in strategic teams, their knowledge and experience can benefit the organization. (Lazarova & Tarique, 2005) These, key persons that are facilitating information transfer are called gatekeepers (Allen, 1977). Moreover, Knowledge gatekeepers are persons acting as knowledge interfaces, enabling knowledge transfer between their own organization and other sources for knowledge. Knowledge gatekeepers enable transfer of knowledge through two important roles; as interpreter and translator. The knowledge gatekeeper is interpreting the organization's agenda and needs, later translating it into problems and assignments to be addressed for solving them. Having a committed employee throughout the process, the organization can benefit from receiving knowledge that is adopted for the organization and disseminated for suiting the organization. This dissemination can be managed through informal socialization, for example manager-to-staff interaction, and formal communication, such as circulation of documents and reports. Either way, the knowledge gatekeepers are important for enabling transfer of knowledge and secure that the knowledge is interpreted and transferred for suiting the organization. (Cranefield & Yoong, 2007)

3.4 Innovation

In 1934, Joseph Schumpeter defined innovation as new combinations of existing and new knowledge, resources, and equipments (Schumpeter, 1934). Later in 1959, Drucker stated that there is a constant change in the external environment, thus companies need to co-operate with it. Through evolving with the industry, and also becoming innovative companies can change these conditions (Drucker, 1959). This thought was developed when Bower and Christensen identified two types of technology development; sustaining and disruptive. Where, sustaining technologies are those that maintain a rate of improvement in attributes that customers already

value. Disruptive technologies, offer a different set of attributes to customers, and often worse than existing products in some dimension valuable to the customers in the beginning of the lifecycle. Hence, customers won't be willing to adapt disruptive technologies at a start. However, as disruptive technologies develop, they will eventually threaten leading technologies in existing markets. Furthermore, Bower and Christiansen argues that any business or market will inevitable disappear and that disruptive technologies is a part of this. If managers want to sustain competitive advantages they may have to compete with and further kill their main business, otherwise competitors will. (Bower & Christensen, 1995) Disruptive innovations can be divided into two; new-market disruption and low-end disruption. New-market disruptions are products that firstly attract new customers in a new niche market and then, as it develops, attract customers from existing markets. Low-end disruptions attract customers at existing markets by attracting price sensitive, low-end customers. (Christensen & Raynor, 2003) Identifying these disruptive innovations, companies sometimes tend to focus solely on new technologies. For avoiding the negative effects of disruptive technologies it is of great importance to also focus on customer and operational needs. (Paap & Katz, 2004)

As companies from developed markets establish themselves and invests in emerging markets, unexpected consequences might arise, defined as innovation blowback. The rise of innovation blowback has increased as companies from developed markets are becoming more global, and emerging markets are increasing their effort to create new disruptive products and processes. One common strategy for companies turning to emerging markets is to lower the cost of their existing product portfolio; however this is not a feasible strategy. Instead, companies need to redesign their products and processes for coping with increased competition. Hence, companies need to build capabilities in emerging markets for sustaining competitive advantages and handling increased competition from emerging markets. (Brown & Hagel III, 2005) Further, companies from developed markets need to expand beyond its home market for coping and preventing domestic companies from creating competing products, further disrupting the companies' products. Hence, companies should develop products in emerging markets for emerging markets, and once verified and proven successful, bringing them global. This phenomenon is called reverse innovation. Reverse innovation might eventually disrupt and even cannibalize existing high-margin products, although if companies do not explore this option other companies will, thus disrupting the industry. (Immelt, Govindarajan & Trimble, 2009)

3.5 Firms as Knowledge Brokers

Knowledge brokers are companies that cross multiple markets and technology areas, using knowledge in one area to become innovative in another one. These are often firms that consult to other companies. Also larger multi-divisional companies with cross-functional units can act as knowledge brokers. According to Hargadon, there are a few activities that enable this; spanning, recognizing, and transferring ideas across multiple industries, linking past knowledge to current problems, and, finally,

realizing these into new products and processes. One problem, that Hargadon address is lack of communication between divisions, which could be overcome by knowledge broker according to the author. Access to disconnected knowledge and technology domains are an initial condition for knowledge brokering and, further, continuous innovation. Using this knowledge, firms need to address three activities for acting as a knowledge broker, namely; *learning*, *linking*, and *implementation*. Knowledge brokers need to learn from many industries, to be able to identify synergies between industries and units. For example by using benchmarking, inviting technology suppliers and customers, participating in academic workshops, and going on field trips. This cross-industries search for knowledge is one way of overcoming the not-invented-here syndrome. (Hargadon & Sutton, 2000) However, knowledge solely does not initiate innovation. Hence, companies need to link their past knowledge with existing problems and projects, quoting, a manager at Boeing's Operations Technology Center "*It's all a matter of getting the right knowledge into the right hands at the right time*". Hargadon's research points out the importance of internal communication and problem solving for creating interaction between employees. Finally, a good idea is worthless if it is not implemented into the organization's practices and processes. (Hargadon, 1998) In 2000, Hargadon and Sutton explored what implications knowledge brokering has for companies, and how companies can build their own internal knowledge brokers. One common problem in large companies is that specialization of business units often leads to more complicated communication between units. Moreover, internal competition can prevent business units to share knowledge between each other, hence, amplifying the problem. To foster this silo effect, companies can build their own knowledge brokers such as internal consulting groups focusing on bridging knowledge between different business units. (Hargadon & Sutton, 2000)

3.6 Key Learning from Theory

- Technology intelligence can be divided into two sub processes; capture of information and delivery of intelligence
- Intelligence, in term of open-ended trend searches or directed technology assignments, can be found either internally or externally
- There are three types of listening posts for identifying technologies and trends; technology outposts, trend scouts, and matchmakers
- Knowledge can be transferred to, from, and between subsidiaries and headquarter, thus enabling knowledge transfer and innovation impact
- New sources for identifying innovation are available in emerging markets, hence there is an opportunity for companies to establish themselves and tap into these markets

4 Empirics

This chapter describes the benchmarked companies, Tetra Pak, Vestas, Ericsson, and SCA, as well as how industry-university collaboration is conducted in China. For each section; organizational structure, how information is captured, and intelligence is delivered is presented. Through this, an understanding for how companies can collaborate with external associates for capture and deliver of intelligence and what advantages it has is described.

4.1 Tetra Pak

Tetra Pak's history begins in the early 1950s when they were one of the first companies working with packaging of liquid milk. In the beginning of the 1990s, Tetra Pak expanded their offering by entering into liquid food processing equipment, plant engineering, and cheese manufacturing equipment. Due to this expansion, Tetra Pak now also provides their customers with an integrated processing, packaging, and distribution line as well as plant solutions for food manufacturing. Today, Tetra Pak is one of the world's largest suppliers of packaging systems for milk, fruit juice as well as drinks, and many other products. (Internal Documentation, 2010) In 2003, Tetra Pak's most important patent for folding of carton based products expired, since then they have faced increased competition from existing and new competitors (Sickert interview, 2010-04-22). Thus, during the latest 10 years, Tetra Pak has expanded their offering by starting to use their existing knowledge when challenging other industries, such as the canning industry. By introducing Tetra Recart, a carton based can product, they are now trying to gain market shares in the canning industry. (Arvidsson interview, 2010-04-15)

Almost all of Tetra Pak's research and development is conducted in Europe. Tetra Pak's R&D has previously focused on development of more cost efficient machines, lowering the manufacturing cost for their customers. However, as the marginal utility is decreasing in this area, Tetra Pak is putting more research in the area of material science (Rahbe interview, 2010-04-26). Further, companies in emerging geographical areas are developing their knowledge and know-how about processing, packaging, and distribution technology. Thus, Tetra Pak needs to address these areas for securing a sustainable growth and competitive advantages. (Internal documentation, 2010) In China Tetra Pak is facing competition from competitors who are using existing technology and developing it into products with low cost-structure and good performance which is seen as a threat. For Tetra Pak to be able to preserve their technology leadership it is important to acquire and use information from developing areas and not to neglect future competition.

4.1.1 Tetra Pak's Products

Tetra Pak's products span a wide range of carton packages and processing systems for serving the food manufacturing industry. In 2009, Tetra Pak sold around 145

billion carton packages worldwide and the number of packages sold has increased each year since 1980, see Figure 15.

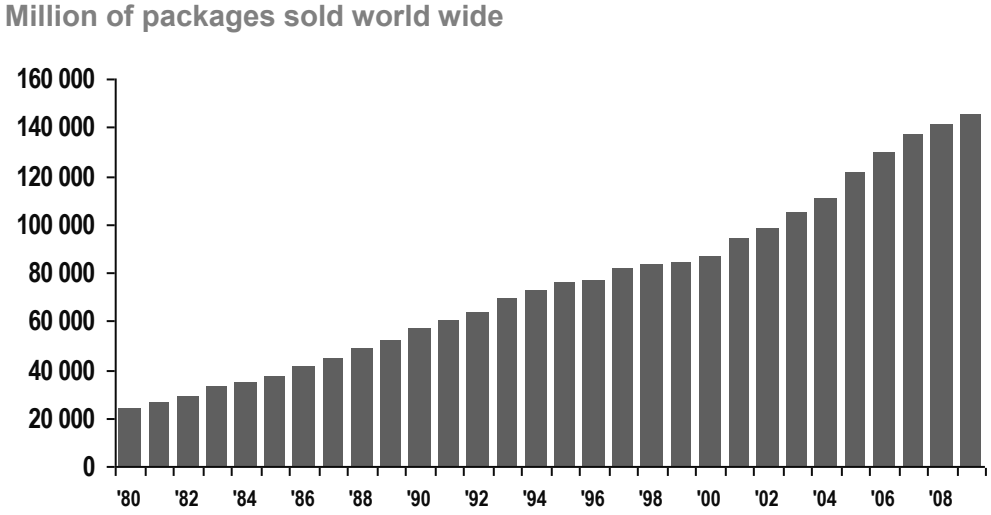


Figure 15 Number of million Tetra Pak packages sold each year has increased since 1980

The packaging systems consist of two categories; ambient and chilled. Ambient packaging systems target liquid food products that can be distributed and stored in ambient temperature without any more protection. Chilled packaging systems work with liquid food products that are distributed and stored in a chilled environment. Tetra Pak's largest market for packages is China, reaching almost 21 per cent of worldwide deliveries. (Internal documentation, 2010)

4.1.2 Tetra Pak's Organization

Tetra Pak's is a global organization consisting of 41 market companies, 78 sales offices, 42 plants for packaging material, 11 factories for assembling of packaging machines, and roughly 21.700 employees. They are divided into two businesses, Packaging Solutions and Processing Solutions; see Figure 16. Packaging Solutions are divided into Commercial Operations, Development & Engineering and Supply Chain Operations. Processing Solutions consists of Processing Systems. (Internal Documentation, 2010)

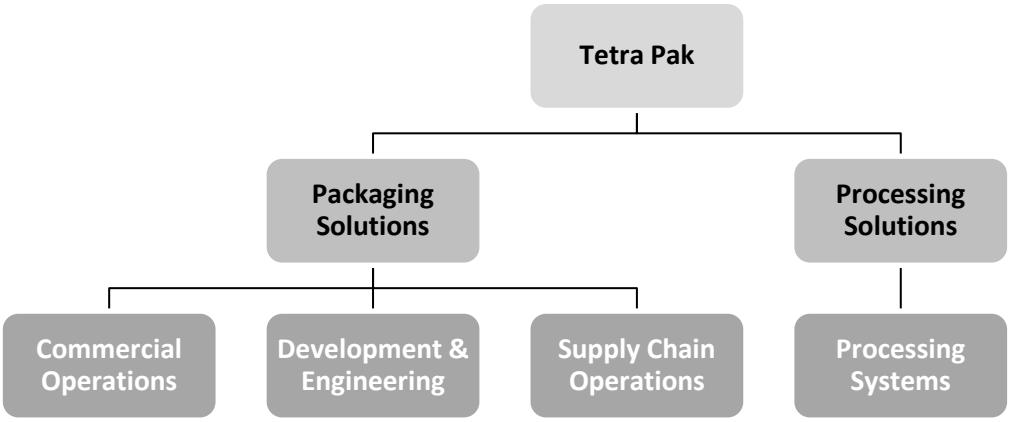


Figure 16 Tetra Pak are divided into two organizations; Packaging Solutions and Processing Solutions, source. Tetra Pak, Internal documentation

Commercial Operations are responsible for the core business and leader of business intelligence, manager of product lifecycle as well as overlooking the product profitability. Development & Engineering (D&E) is Tetra Pak's research and development organization responsible for delivering cost driven innovation within packaging technology, material, and platforms. Supply Chain Operations are accountable for operational performance within Tetra Pak, enabling a cost efficient supply chain. Processing Systems are working in projects in production facilities and service with food manufacturers all around the world. (Internal Documentation, 2010)

4.1.2.1 Development & Engineering

Development & Engineering are responsible for sustaining technology leadership through delivering cost driven innovation, thereby creating winning solutions to achieve sustainable profitable growth. D&E are divided into four organizational groups, see Figure 17. (Internal Documentation, 2010)

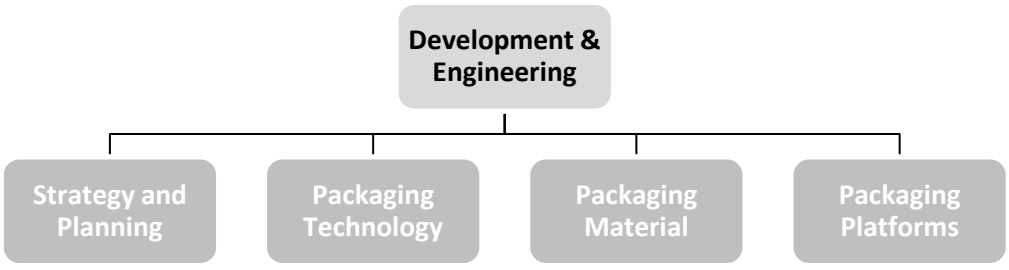


Figure 17 Development & Engineering are divided into four departments, source. Tetra Pak Internal Material

Strategy and Planning are responsible for defining and prioritize the strategic focus of D&E, further translating this into new product and technology development projects. Packaging Technology's mandate is to scout, develop and secure future technologies and packaging concepts; they also support the platforms through securing key competencies for today and the future. Packaging Material develops and innovate new packaging material as well as converting solutions within Tetra Pak's core technologies. Finally, Packaging Platforms is divided into different platforms aimed at serving different customer and consumer segments. (Internal Documentation, 2010)

4.1.2.2 Packaging Technology

Packaging Technology is responsible for securing future technologies and packaging concepts as well as supporting the platforms with competencies sustaining long-term growth and profitability. Packaging Technology is divided into nine sub-groups where the Technology Intelligence group is a part of Front End Innovation & Design (FEI), see Figure 18. (Internal Documentation, 2010)

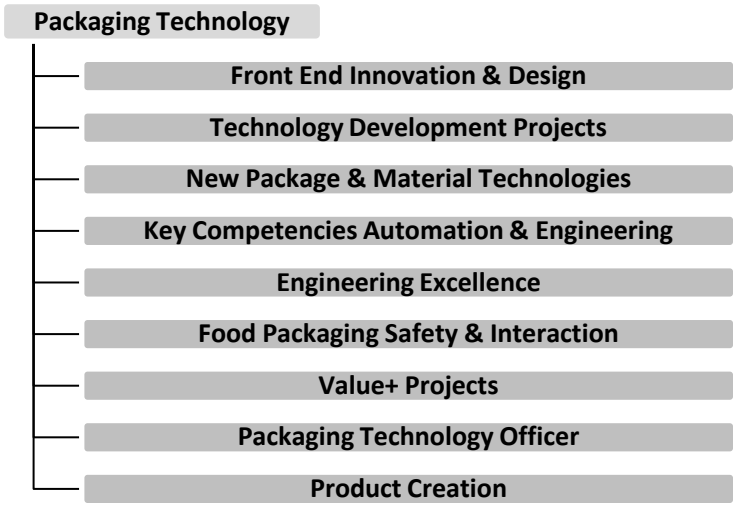


Figure 18 Packaging Technology have nine departments, source: Tetra Pak Internal Material

4.2 Technology Intelligence at Tetra Pak

> *"Technology intelligence means creating insight in external technology opportunities and threats that could affect a company's current or future business."*
> **Source**: Technology Intelligence Group, Tetra Pak

4.2.1 Organization

The Technology Intelligence group is working in different areas, among them are; support and guidance to technology databases, information research, and as leaders of intelligence studies. (Internal Documentation, 2010) They are responsible for providing intelligence to FEI and to provide Tetra Pak globally with accurate technology intelligence. Through this, they aim at providing important and accurate intelligence that can create innovation. (Sabouné interview, 2010-02-23) The need for technology intelligence and scouting is increasing within Tetra Pak. The biggest challenges for the group, according to themselves, are to prioritize what areas to engage in, and to decide what level of engagement that is appropriate for the business. Further, they want to be a driver of innovation, and their mission is to fill the innovation funnel with new ideas, and new technology opportunities and threats. (Internal Documentation, 2010 Hertzman interview, 2010-04-23) Tetra Pak has identified some key competence areas where they are pursuing intelligence work for monitoring the technology landscape. In each of these areas, there are experts (scouts) responsible for technology scouting. These scouts are often senior employees with long experience from Tetra Pak as well as the industry, which grant them access to large internal and external networks. Furthermore, there is a close cooperation enabling information sharing when the scouts identify opportunities and threats, and when the Technology Intelligence group needs information regarding the experts' technological domains. (Hertzman interview 2010-04-23)

4.2.2 Technology intelligence process

> *"[Technology Intelligence can be the] driver of technology development through creation of business opportunities"*
> **Source**: Johan Rabe, Portfolio Strategy Director, Tetra Pak, 2010-04-26

The Technology Intelligence group and the scouts work with both research and analysis for capturing technology information. When captured, this information is used for creating a common picture within Tetra Pak. This is later connected to ongoing strategies, projects, pre-studies and technology development. The Technology Intelligence group determines, on a case by case basis, how deep into the analysis stage they will go. They have during the last three years provided a consolidation of external technology opportunities and threats, which is now a part of the technology strategy process. (Hertzman interview, 2010-04-23) Further, the group has contributed to Tetra Pak's global scenario as well as strategy work, and given input in Tetra Pak's roadmap-work. Their contribution can become even greater, through creating business opportunities from identified technology trends (Rahbe interview, 2010-04-26).

4.2.3 Capturing Information

Tetra Pak is using both external and internal sources for capturing information, hence providing answers to their assignments. Sources for capturing of information can be networks, databases, internet, patents, magazines, external partners,

conferences, trade fairs, and university collaborations, depending on the assignment. According to some employees at the Technology Intelligence group, almost 80 per cent of the external information needed can be found direct within the walls of Tetra Pak and through the Tetra Pak network. (Sjöberg interview, 2010-02-01) Hence, by addressing internal scouts, the Technology Intelligence group can get access to a large network both internally and externally. Thereby, enabling an efficient process where important sources are identified, and collaboration facilitated. (Hertzman interview, 2010-04-23) Development Reports, that is research papers conducted within the Tetra Pak, are also an important internal source for finding new technologies and opportunities. These, secure that information and knowledge created in the company can be reused, enabling knowledge sharing. Tetra Pak is also using intermediaries and consultancies, such as LUX Research (Hartshorn telephone interview, 2010-03-24), Pira and Tappi. These are mostly used for gaining knowledge and solving specific assignments. (Sjöberg interview, 2010-02-01)

4.2.4 Delivery of Intelligence

For delivery of intelligence and scouting throughout the organization, Tetra Pak is using an internal intelligence portal, Crystal, and a push strategy. Meaning that, the employees of the Technology Intelligence group and the technology scouts use their personal networks and distribute intelligence through it for enabling usage of it. Further, some reports and information is forwarded to employees via mail, which has proven to be a viable channel due to the organization's working process and the employees' needs. Presentations are held at different departments for creating organizational understanding and enabling forums for discussions. The Technology Intelligence group communicates with different stakeholders via different channels; some reports are widely distributed and discussed, while other are only read by a few employees, depending on their purpose and impact on the organization. Further, the group is focusing on creation and provision of methods as well as procedures for increasing the understanding of the delivered intelligence, thus enabling business impact from their findings. (Sickert interview, 2010-04-22, Hertzman interview 2010-04-23)

4.2 Technology Scouting in Japan

Each month, Tetra Pak's subsidiary in Japan, Nihon Tetra Pak, delivers a written report about the technology environment and insights from the Japanese market. These reports have evolved over time, nowadays they consist of competitor's activities, new packages, materials, technologies, and other areas of interest for Tetra Pak global. The reports are written by one employee at the Intellectual Property Department in the Research and Development Division Tetra Pak, Japan. The mission for this report is to collect and distribute information regarding technology trends, opportunities, and threats. The employee was chosen due to his interest in technology, understanding of the culture and speaking of native language

which, according to the interviewee, is a prerequisite for working in Asian cultures. (Bengtsson telephone interview, 2010-02-16)

4.2.1 Capture of Information and Delivery of Intelligence

The work process for technology scouting in Japan is ad-hoc, completely monitored and driven by the employee in Japan. Input data to the process is collected from personal networks, internet, investigations of available products in the market, e.g. available at supermarkets, and patent databases.

The data selected and presented in the Technology Scouting Report is the one found suitable, from the employee's point of view, for Tetra Pak's global business. However, the report does not cover any trends or further implications for Tetra Pak. The report is shared as a presentation in either word or pdf- format, published on Crystal, and distributed to the Product management and Supply Chain team. (Bengtsson telephone interview, 2010-02-16) According to Crystal, Technology Scouting Reports from Japan had 2010-02-11, 113 unique visitors since 2008 and the total numbers of hits were 549. (Internal Documentation, 2010) Even though the low hit-rate, the report is highly visible within the organization and managers are recognizing them as important for their work (Hartman, 2010-03-03).

4.3 Tetra Pak in China

Tetra Pak has been present in the Chinese market for almost 30 years; however, it is just recently that they have established R&D in China (Internal Documentation, 2010). Tetra Pak established market offices early in China, today China is Tetra Pak's largest market and some of the largest customers are Chinese. Tetra Pak possess a large number of market offices all over China, enabling closeness to the market and gathering of customer as well as competitor information. For many years the focus was primarily on marketing, sales, and some production in China. However, as China continued to grow and Tetra Pak's customers demanded a faster and more market accurate development of products, the need for local R&D increased. Hence, in 2007, D&E established an office in Shanghai, Pudong where some product development and market support is being conducted today. (Immelborn interview, 2010-03-09)

4.3.1 Shanghai

Tetra Pak has two offices in Shanghai, one market office in downtown Shanghai and one production site, where they also have some R&D, in Pudong. The market office is a sales office, with 19 employees, responsible for serving the local market with sales of new products, customer support, and service. The market office mostly employs Chinese staff due to the importance of language and understanding of the Chinese culture. Further, there are some employees who are responsible for customer, consumer, country, and competitor intelligence. These intelligence functions gather data not just from Shanghai but from regional offices within Great China, later aggregating this into reports showing Tetra Pak's progress in China.

Thus, they are able to coordinate their intelligence work from one site enabling a more efficient process. (Internal Documentation, 2010 Yu 2010-03-11)

The production site in Shanghai is based in Kang Qiao in Pudong, 30 minutes outside Shanghai, close to Pudong International Airport, and has more than 450 employees. The site is working within areas such as technical service, processing, and research and development. The site was completed in the end of 2009 and has the capacity to serve Tetra Pak for five years, if the Chinese growth continues in the same pace. (Djalali interview, 2010-03-12) The intention of the office was primarily focused on production and service of equipment being sold in China. However, as the market expanded so did the need for lowering time-to-market which enhanced the decision to establish a D&E subsidiary in China. Today, the R&D being conducted in Shanghai is managed by Swedish managers and employees are recruited both from China as well as employees being transferred to and from other offices. (Binder interview, 2010-03-29)

4.4 Competitor Intelligence in China

4.4.1 Organization

The Competitor Intelligence department in China is responsible for identifying new products and technologies that competitors do or in the future might possess, that can turn out to be a threat against Tetra Pak's core business. As the competition in China is increasing, especially from domestic players, the importance of intelligence has increased. Setting up the Competitor Intelligence function was a process reaching over two to three years. Tetra Pak started with using existing networks and consultancies for finding information and trying to realize if there was a need for establishing their own intelligence function in China. Later, when proven successful and needed, employees understanding the local culture and language were used for finding appropriate information on the internet and magazines. Finally, after a couple of years, when the importance of the Competitor Intelligence function was proven Tetra Pak established their own network, thereby getting a better control and performance of their competitor intelligence. Today, the group is located at the Shanghai market office which they have a close collaboration with. (Yu interview, 2010-03-11) They report to the global Competitor Intelligence function located in Modena, Italy. However, this has proven to be somewhat difficult due to that it is easy for the local organization to be biased by the domestic threats and not always to realize global issues. (Enhol telephone interview, 2010-03-29) In contrary, the local organization explains that they sometimes find it hard to communicate and prove their findings from the local market. (Yu interview, 2010-03-11)

4.4.2 Capturing Competitor Intelligence

Capturing of competitor intelligence in China is enabled through usage of internal and external networks for gathering of competitor data and trends. The group is using exhibitions which have proven to be a good place for capturing new information about competitors' products. Furthermore, industry magazines are used

for identifying articles regarding new technologies and products. The employees state that usage of networks have proven to be an important source for capturing intelligence, this is also the activity that demands the largest number of employees. The number of employees involved in competitor intelligence in China is approximately 36 people, where three of them are working at the market office in Shanghai, 25 working at regional offices in Great China, and finally around eight external consultants. Employees from regional offices are responsible for gathering local information including competitors' movement, sales in the region, and market trends. The information gathered from consultants is primarily focused on market shares and growth trends. By using consultants, Tetra Pak can lower their cost as well as compare their own estimates, further they can get access to a larger network of informants and thereby accessing a greater deal of data. They have also learnt that consultancies can provide different type of data and find synergies with other projects that they have performed with other companies. However, this also makes it more of a risk to use consultancies, because the information is then available outside the company. After finalizing the capture of data, the information is transferred to the Shanghai market office where the Intelligence group gathers and analyzes all data for creating a picture of the competitor landscape. (Yu interview, 2010-03-11)

4.4.3 Delivery of Competitor Intelligence

Delivery of Chinese competitor intelligence to Tetra Pak Global is enabled through written reports, and during the last years some efforts have been made into trying workshops for enabling cross-functional knowledge transfer between different departments and external associates. Captured information is transferred to the competitor intelligence manager who selects which information that might be of interest for the organization and passes it to the management team of China. Then, they try to supplement their overall picture of trends in China and send this report, where some parts are from competitor intelligence, to Tetra Pak global management. As a parallel session, Competitor Intelligence is offering their information, to those who has been granted the privileges and access, on their website on Tetra Pak's intranet as well as using mailing lists. On this webpage there is a lot of information available; databases of competitors, reports of competitor trends and worksheets. Some of the reports chosen to be of biggest importance are also provided to decision makers via email; however the group seldom receives feedback. Thus, according to some employees the biggest challenge is to find a proper communication and feedback channel. They also state that it is hard to convince the global organization about some of the information provided by the Chinese organization as well as the challenge in communicating between market and technology functions. As a solution for the communication challenge, a local Chinese group was established in June 2009, where market and technology functions are gathered for sharing of information as well as coming to conclusion about the Chinese market by using information from both functions. There are also some successful trials with using workshops where customers and different corporate functions are gathered for a two-day workshop, where they discuss competitors and

how to handle the increased competition that they face. This has proven to be very appreciated both by the Chinese organization and the customers. (Yu interview, 2010-03-11)

4.5 Industry University Collaboration in China

> *"The ability to commercialize knowledge at an accelerated pace induces firms to identify new sources of knowledge production, and this in turn implies participation in a broader collaborative effort whereby industry-university relationships emerge – not as substitute of internal corporate R&D but as a complementary activity"*
> **Source**: Know-Who Based Entrepreneurship, Sigvald J. Harryson, 2006

There are mainly two different forms in which Chinese universities collaborate with external partners; (1) projects initiated and funded by authority institutes and governmental organizations, and (2) projects where industrial companies approaches university with a clearly defined task. Projects initiated by institutes and governmental organizations, usually covers topics in edge cutting frontier of an academic discipline. These projects are focused on basic research and are theoretically oriented, with the purpose to solve certain problems by applying relevant theories. The second type of collaboration is when a company approaches targeted universities with one or several clearly defined tasks. These projects are often assignments that companies themselves cannot solve or does not have the resource and capability to delve into. (Han & Zhang interview, 2010-03-10) Further, the projects are more pragmatic with a clear purpose for development of applications and the process for the collaboration is jointly defined by the company and the university. (Han interview, 2010-03-10) However, first and foremost it is important to identify the right individual at a university that can provide the information and contacts needed. (Wagner interview, 2010-03-19). In Table 1, the most common types of industry university collaboration and their purpose is visualized.

Table 1 There are different types of and purposes with Industry University collaboration source: Workshop, 2010-03-12

Type	Purpose
University recruitment days	Screening of new students that might be of interest for hiring, and branding of the company
Internships	Getting to know the students and see if they fit with your organization and access to state of the art knowledge and technology not yet adopted or identified by the organization
Professors	Access to students, networks, and new technologies and information
University Chair	First access to professors and their network, also possibility to provide guidance towards the university's research areas
Alumnae network	Getting access to technology and people. Usage of employees' alumnae network not only increases their status it also facilitate recruitment of new employees
Employees with access to societies	Access to interesting knowledge and technology, used to establish new connections with networks
Student projects	Students are not biased by company history, further they are creative and have access to new theory and technology
Master thesis	Access to new technologies, cheap work force in comparison with own employees, and can be used after the thesis is finished for building technology intelligence networks

Companies collaborating with universities and engaging in student projects can seize several benefits apart from transfer of knowledge. Initially, students are not biased by companies' organization and history, which otherwise would have blinded them from finding some innovative solutions and usage of technology. Some organizations are collaborating with master students for building effective technology intelligence networks, incorporating new knowledge, and for supplying the company with an extensive alumnae network. (Shanghai workshop, 2010-03-12) Moreover, identifying top students and offering them industry experience through internships, collaborations, competitions, and projects, students can apply their knowledge at live cases giving companies access to new tools and technologies. Students benefit by getting the opportunity to practice their knowledge at live cases with real data and information, thus creating a win-win situation. (von Zedtwitz interview, 2010-03-11)

There are some factors facilitating industry university collaboration in China, and companies that address and sustain these are more likely to succeed with their collaboration. Universities are evaluating potential projects by comparing these with ongoing research at the university. Hence, it is of utter importance to find universities engaging in research adjacent to the companies' knowledge and needs, thus enabling a mutual exchange of knowledge. (Zheng interview, 2010-03-10)

Furthermore, industry university collaboration is encouraged by giving university employees access to real data and problems, thus allowing them to use their knowledge and competencies for creating a better understanding of how theory can be applied in real life. Companies benefit from this by getting a better understanding of how theory supplements applications. Moreover, they get access to new technologies and competencies, enabling them to find more cost efficient and identify new products, processes and services. (Shanghai workshop, 2010-03-12) Experiences from collaboration with Chinese universities illustrate that they sometimes lack the experience of handling equipment and conducting project management for efficient use of resources. However, they are often well aware of edge-cutting knowledge and put a lot of effort into their work. Hence, companies participating in industry university collaboration can set up joint research centers, where companies provide industry know-how and equipment experience, whereas universities are providing resources, new theories and technologies. Most of these joint research centers are established at China's top universities, such as Vestas Joint Research Center and Toyota Joint Research Center both at Tsinghua University, in Beijing. (Shanghai workshop, 2010-03-12)

4.6 Vestas Wind Systems A/S

> "*…in some cases we sponsor a significant research programme, which can include a Vestas professorship and Vestas staff on site at the university. China is of particular interest at the moment and we are ramping up R&D activities in a number of locations.*"
> **Source**: Simon Stacey, Vestas' new Innovation Network department (www.vestas.com, 2010)

4.6.1 Organization

Vestas Wind Systems A/S (Vestas) is a global company engaging in development, production, sales, and maintenance of wind technology. Vestas' headquarter is in Denmark and they have about 20.700 employees worldwide. The company delivered their first wind turbine in 1979 and since then over 40.000 wind turbines in 65 countries on five continents has been installed. R&D is one of the most important functions for Vestas in order to stay innovative and to reduce the cost for energy, thereby creating customer value. Vestas have for that reason established R&D hubs in technology clusters all over the world. (www.vestas.com, 2010) In 2008, Vestas announced that they were to open a R&D hub in Singapore, to create one of Vestas' largest R&D centers outside Denmark. Further, they established partnerships with Nanyang Technological University in Singapore and National University of Singapore. In China they established a partnership with Tsinghua University in Beijing, and in Australia with the Cooperative Research Council in Melbourne. (Vestas Wind System A/S, 2008)

Through their establishment Vestas showed commitment in the region, this was recognized not only by their competitors but also by governments and universities in

the region enabling future collaboration. Through their presence and collaboration in China, Vestas learnt about the Chinese market and was able to establish a R&D center in Beijing in less than two year after the decision was taken. Today, Vestas have not only established an efficient R&D center, they have also developed their first wind turbine in China for the Chinese market. This product will further be transferred and sold in the rest of the world during 2010. (Laursen interview, 2010-03-17) Vestas have established an Innovation Network responsible for coordinating all of Vestas' external collaborations. This network has the objective to become a central source for internal knowledge, assist R&D departments to find strategic partners, and creation of joint research collaborations. (www.vestas.com, 2010)

4.6.2 Capturing Information

Vestas have a strategy for capturing information from both internal and external sources, however they are more focused on the external environment due to that global rules and regulation are the main driver of technology development. (Laursen interview, 2010-03-17) For acquiring information of interest in China, Vestas is using a number of different sources. Universities are of big importance, since they provide access to the best brains in the world (www.greentechfocus.com, 2010). By collaborating with professors, Vestas gets first-hand access to new technologies and new companies being spun-out from Chinese universities. These supply Vestas with the opportunity for technology sourcing and intelligence. Scanning public media and patents, and visiting external exhibitions have also proven to be good sources for capturing industry movement and trends. Additionally, Vestas are working across the value chain for identifying new information, where both suppliers and customers are good sources for realizing the needs and also for identifying what products are available from their competitors. However, competitor collaboration is unusual in China. Vestas collaboration with consultancies is aiming at capturing specific numbers and information for being able to draw conclusions about industry and technology trends. (Laursen interview, 2010-03-17)

4.6.3 Delivery of Intelligence

For delivery of information and intelligence, Vestas is using a system where functions are collocated, repatriates are working at different sites, and extensive communications is encouraged between R&D hubs, domestic subsidiaries and headquarter. Collocation of market and technology departments is one enabler of innovation and knowledge spill-over between Vestas R&D center in Beijing and their adjacent departments. Collocation makes it easier to discuss important topics and to find informal communication channels that facilitate innovation throughout the organization. Repatriates and expatriates are used for knowledge transfer not only from headquarter to subsidiaries, but also in the reverse direction. This permits a good understanding of cultural differences and similarities. Further, through encouraging and recognizing them within the company, international experience has become an important factor for promotion and has made it more interesting for employees to work abroad. Vestas' R&D hubs are important for identifying and matching synergies between domestic subsidiaries. By establishing themselves in

innovation clusters, the R&D hubs can have close communication with the subsidiaries enhancing information sharing. Further, they span many markets and technologies areas which enable them to bridge and transfer knowledge between different technology areas and units. This has improved Vestas ability to find new technologies, furthermore improving their ability to become more cost efficient and innovative. (Laursen interview, 2010-03-17)

4.7 Svenska Cellulosa Aktiebolaget

4.7.1 Organization

Svenska Cellulosa Aktiebolaget (SCA), founded in 1929, is a global consumer goods and paper company with presence in more than 90 countries. SCA has 52.000 employees reaching over 60 countries, in 2008 sales reached EUR 11.5 billion, and they are divided into four business areas; Personal Care, Tissues, Packaging, and Forest Products. SCA's largest market is Europe even though they are present worldwide. (www.sca.com, 2010) In Asia, SCA are present in 11 countries, with roughly 5.500 employees working with manufacturing, marketing, and sales of SCA's consumer brands and packaging solutions. (www.sca.com/asia, 2010) Today, SCA is conducting R&D in the many areas worldwide. The location of the R&D centre enables SCA to have a close contact with their large customers close to the site, as well as academics from the university. Further, it creates the possibility for SCA to get access to qualified competencies and ease the recruitment process. (SCA company presentation, 2007) Universities and professors are used as consultancies in areas where SCA does not possess competencies; however, they are not the only sources for finding new innovative ideas, sometimes it is more convenient to use consultancies, and other partners such as customers and suppliers. (SCA Workshop, 2010-04-20)

4.7.2 InnoCentive

> "*We believe in the power of open innovation, bringing together creative minds to create breakthrough solutions that touch every human life.*"
> **Source**: InnoCentive's homepage

InnoCentive, founded in 2001, is a company connecting *seekers*, organization wanting to solve a problem, with *solvers*, organization, and individuals that solves a problem or specific question. This means that they connect companies looking for breakthrough innovations with other companies, academic institutions, public sector, and non-profit organizations that find solutions to these problems. When a solution is provided by a solver and approved by the seeker, a pre-determined reward is paid to the solver. Today, InnoCentive have over 160.000 solvers in 200 countries connected to their network and they are active in numerous disciplines. In February 2010, 1008 Challenges had been posted in the InnoCentive network, 17.548 solutions have been submitted, and from them 641 awards have been given to solvers from seekers. (www.innocentive.com, 2010)

InnoCentive offers three kind of products to their customers; InnoCentive Challenges, InnoCentive ONRAMP, and InnoCentive@Work. InnoCentive Challenges is a request from a seeker to find a solution to a pre-determined problem that they are facing. InnoCentive then connects the solver with their Open Innovation Marketplace, managed by InnoCentive, for finding a solution within the solver community. InnoCentive ONRAMP (*Open iNnovation Rapid Adoption Methods and Practices*) are services and technical resources offered to seeker companies for an easy adoption of open innovation practices and collaboration with InnoCentive. Finally, InnoCentive@Work is an internal community, developed for seekers that have not yet adopted open innovation, and want to create an internal network for collaboration and innovation. (www.innocentive.com, 2010)

4.7.3 Capturing Information through InnoCentive Challenges

During 2005, an internal group at SCA decided to start to work with external intermediaries for finding new technology and solutions. After scanning the intermediary market they decided to co-operate with InnoCentive (SCA Workshop, 2010-04-20). In 2006, SCA started to work with InnoCentive for finding new solutions to business problems facing the organization (SCA Hygien, 2009). During the same year, SCA engaged in InnoCentive Challenges for solving problems facing the Research & Development department in the division for Personal Care (Johansson interview, 2010-04-20). This was a first step to develop an own open innovation program and acted as a pilot-project. If it was proven successful, this would be the start for expanding the use of Challenges into other departments. According to Forrester Consulting's report, Personal Care has a culture that encourages and even expects that the employees collaborate with external partners (Forrester Consulting, 2009) which is a prerequisite for collaboration with intermediaries; this is also confirmed by Bengt Järrehult Innovation Director at SCA (Järrehult interview, 2010-04-20).

SCA's managers have acknowledged that there is a scarcity of internal resources; consequently they had to turn to the outside for solving their business problems with the given amount of resources. The Challenges SCA posted were technical problems which the organization did not hold competencies in, neither did they have the resources needed for completing them by themselves. (Forrester Consulting, 2009) The result from the collaboration with InnoCentive was very satisfying for SCA, over 50 per cent success rate according to Kerstin Johansson, responsible for the InnoCentive collaboration at SCA. Through the collaboration, SCA found new solutions and the work conducted was of greater quality than what they could have accomplished on their own, given the same resources. By collaborating with InnoCentive, SCA has become better at defining and identifying the actual problem which has a spill-over effect in the entire organization. They have also established an internal process before submitting Challenges to InnoCentive, where employees need to look internally for information and knowledge. Thus, communication and knowledge sharing is fostered between employees and

departments improving the understanding and awareness of the organization. (Johansson interview, 2010-04-20)

4.7.4 Delivery of Information Acquired through InnoCentive

"*InnoCentive is not a plug-and-play process, after finding a solution you need to align it to absorb the knowledge."*
Source: Kerstin Johansson, responsible for InnoCentive collaboration, SCA, 2010-04-20

Delivery of information to SCA's organization, acquired through InnoCentive, is conducted through a series of activities throughout the collaboration, see Figure 19.

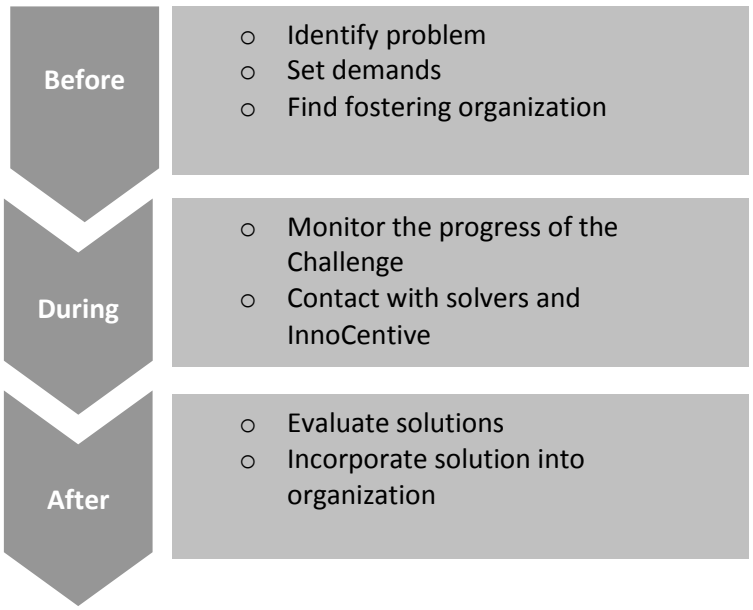


Figure 19 SCA's collaboration and activities during InnoCentive Challenges can be divided into three sub-processes

SCA has an employed champion who drives and is the responsible contact for the InnoCentive collaboration. This person works as the key contact person between the companies, enabling and improving their long term commitment and collaboration. Furthermore, when a new problem is identified, a SCA challenge owner is selected for taking it through the Challenge. The challenge owner is responsible not only to clarify the problem, but also to setting up the demands for the problem and finding a hosting organization if the problem is solved. During the process, InnoCentive answers most of the questions that solvers might have. However, if some clarifications or questions arise that they cannot handle, the challenge owner handles these. It is also the challenge owner's responsibility to monitor the Challenge and communicate the progress to the organization, securing the organization's commitment to the Challenge. After the Challenge is completed, and solutions presented for SCA, the challenge owner evaluates these in comparison to

the demands set before posting the Challenge. As a solution is provided to the organization this does not guarantee success, instead the challenge owner and organization need to align the solution to incorporate it into the organization. Thus securing that the knowledge and technology gained from the Challenge is adopted by the organization. (Johansson interview, 2010-04-20)

4.8 Telefonaktiebolaget LM Ericsson AB

"*Our mission is to describe trends and new emerging technologies, thereby sustaining technology leadership, by taking an outside-in view on identifying technologies and trends that can affect Ericsson's performance.*"
Source: Dag Helmfrid, Technology Intelligence, LM Ericsson AB, 2010-03-25

4.8.1 Organization

LM Ericsson AB (Ericsson) is a world leading provider of telecommunication equipment and services to mobile and fixed operators worldwide. They are divided into four business units where each of them is responsible for sustaining technology leadership and competitiveness within its own niche. Moreover, Ericsson has group functions spanning across their business units responsible for identifying synergies and supporting Ericsson's business; one of these group functions is the Technology Intelligence group. (www.ericsson.com, 2010) The group is responsible for capture of information and delivery of intelligence and trend reports, through scouts in the organization. They are focusing on technology areas defined by Ericsson's directors and transfer new trends and opportunities to recipients across the organization, see Figure 20. (Helmfrid telephone interview, 2010-03-25)

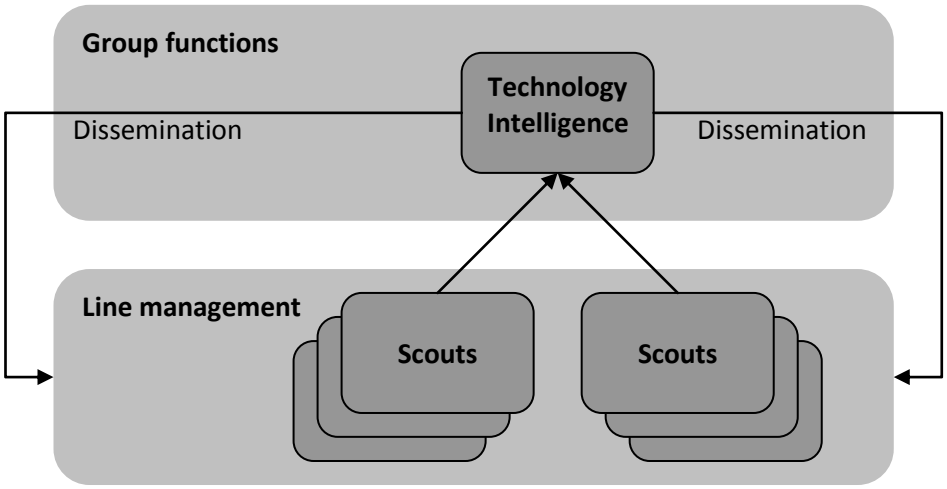


Figure 20 Ericsson have dedicated scouts in the organization responsible for identifying technology trends and opportunities

These areas are identified as crucial for sustaining technology leadership and are linked to Ericsson's long term strategic goals. Finding and providing answer to directed technology questions is not a task for Technology Intelligence instead it is a

task for the business units. However, they can help to match clients with experts, thereby facilitating cross-border collaboration. The Technology Intelligence function is a part of Ericsson's technology department, which enables a close collaboration and understanding of Ericsson's technology roadmap and future strategy. Further, by collaborating with other intelligence functions the organization can benefit from a better understanding, hence contributing to Ericsson's business. (Helmfrid telephone interview, 2010-03-25)

4.8.2 Capture of Information

For enabling capturing, communication, and sharing of knowledge across business units, Ericsson has employees responsible for scouting activities at different functions, organizations, and locations, see Figure 21. Some of the scouts are located at Ericsson's headquarter in Kista, Sweden whereas others are located in technology and innovation clusters of importance. These scouts are often senior, full-time or part-time, employees with prior knowledge about both Ericsson's business and technology which enables a better understanding of newly found information and its potential impact on the business. Due to their seniority most of them have a large network, consisting of experts from both the industry and universities, which they can tap into. (Helmfrid telephone interview, 2010-03-25)

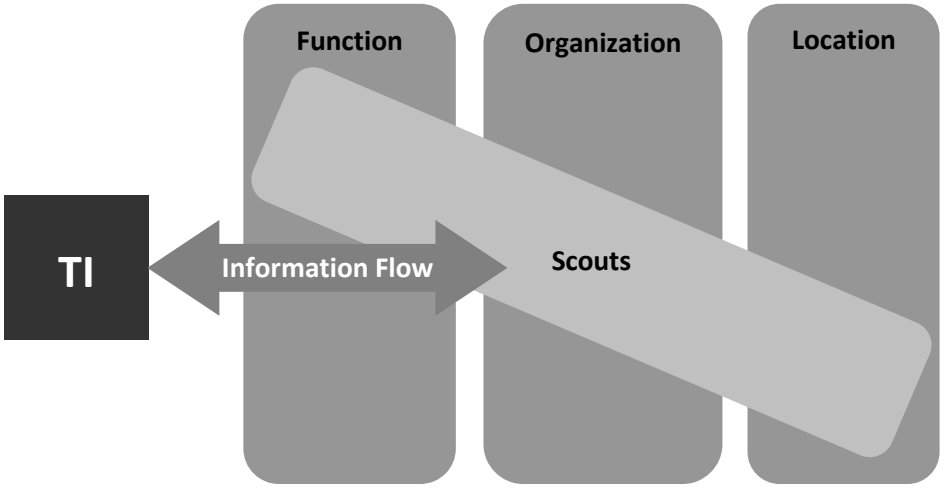


Figure 21 Scouts are available at different functions, organizations, and locations within Ericsson enabling information flow to and from Technology Intelligence

The scouts are focusing on capturing external information and then providing it to the Technology Intelligence function. The scouts are scanning published media such as internet searches and magazines for identifying trends and industry progress. Furthermore, Ericsson collaborates with external actors, primarily intermediaries and universities; however, these two are used for different reasons. Intermediaries are used for finding new information, and describing and simplifying problems already identified by Ericsson. They are also used for performing trend assessments

outside Ericsson's roadmaps or within technology domains where Ericsson is not present for the moment. Regarding university collaboration, this is mainly performed in different projects empowered by either Ericsson or the universities. Often these collaborations are identified by university alumnae working at Ericsson. The collaborations focus on application development and the purpose is to give university students the opportunity to learn new technology straight from the source, to get hands-on experience, and to learn about trends in the communications industry. An example is the cooperation with researchers at Beijing University of Posts and Telecommunications (BUPT) with the purpose to develop innovative applications. Moreover, the feedback and contacts created by collaborating with universities are useful for the company and the intelligence process. (Helmfrid telephone interview, 2010-03-25)

4.8.3 Delivery of Intelligence

For delivery of analyzed and value-added knowledge, Ericsson has chosen a systematic approach where they are delivering intelligence reports in three different formats and with different purposes, see Table 2.

Table 2 Deliverables from Ericsson's Technology Intelligence department to the organization

	Frequency	Sources	Delivery	Purpose	Time span
Newsletter	12 times / year	Open information	Written reports to stakeholders	Information about latest trends at important technologies areas.	Short (<1 year)
Trend Analysis	1 time / year	Open information and analysis	Written and oral presentations at seminars, and start-up activities for new projects	Used as a platform for discussion at management meetings, also input to Ericsson's planning cycle	Medium (1-5 years)
Technology Outlook and Speculation Report	1 time / year	Open information, analysis, and guesstimates	Written and oral presentations to Ericsson global management meeting	Creating opportunities for innovation outside Ericsson's roadmap and strategy (either in time or in technology)	Long (5-10 years)

Newsletters are summaries and analysis, focused on areas identified as interesting to Ericsson, where the Technology Intelligence group gathers open information and provide it in a short and visualized format to stakeholders. These stakeholders are either identified by the Technology Intelligence group or stakeholders are actively asking for the information. Trend analyses are larger documents and presentations provided to start-up activities and seminars for creating an important input and foster innovation in new businesses. These are presented at management meetings and other cross-functional discussion forums, which facilitates discussion about how technologies can turn into opportunities or threats for the business. Technology outlook and speculation report is an analysis delivered once a year to Ericsson's global management meeting where the top 300 executives from Ericsson global gathers for discussing the future, company strategy. The report is produced from the information and analysis obtained from the other deliveries, and contains future trend assessments and speculations about how technologies can influence Ericsson's business. These reports have a long term perspective and reaches outside Ericsson's technology roadmaps. (Helmfrid telephone interview, 2010-03-25)

4.9 Key learning from Empirics

- Technology Intelligence departments get different scope and alignment depending on their organizational position; either as a part of line management or as a part of a group function
- Capture of information is conducted through internal scouts, open information, and collaboration with external associates, such as intermediaries, universities, and partners
- Delivery of intelligence is enabled through meetings, reports, and dissemination of opportunities and threats to the organization
- Successful companies incorporate technology intelligence and collaboration into their organization, thus enabling action out of knowledge
- A summary for how Tetra Pak, SCA, Ericsson, and Vestas are working with technology intelligence is presented in Appendix.

5 Analysis

This chapter describes how the benchmarked companies are organized, how they capture information, deliver intelligence, and create opportunities for digestion. Where, digestion is a process for incorporating and enhancing identified intelligence into the organization, thus creating action. Later follow how companies can become more efficient with their technology intelligence process through scouts and collaboration with knowledge brokers and partners. Finally, this chapter identifies how technology intelligence can be used for cost reduction and identification of new product, process, and service innovation.

5.1 Organizational Structure

Concerning organizational structure of Technology Intelligence, it can either be a part of line management, as in the case for Tetra Pak, or it can be a group function, as for LM Ericsson AB.

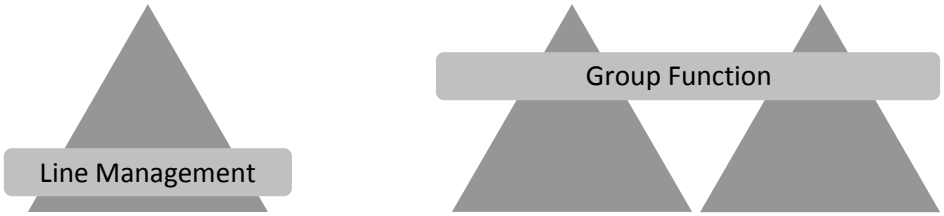


Figure 22 Organization of Technology Intelligence functions as either Line Management or Group Function

Depending on organizational structure, organization gets different priorities and it is easier for the organization to feel commitment to either line management or group function. Meaning that, organizations closer to the operational part of the company tend to have a closer commitment and also to focus on tasks important to the fostering organization. This is the case of Technology Intelligence at Tetra Pak and also for the competitor intelligence department in China at Tetra Pak. However, this also makes the commitment for acquiring important information and data to the organization stronger. Moreover, it becomes easier for the organization to understand the needs and wants of the acquirer. On the other hand, if Technology Intelligence is a part of a group function, it becomes easier to identify large trends and also to acquire information from different business units and see synergies between departments. In the case of Ericsson, Technology Intelligence is a group function, responsible for providing the organization with technology trends. Collocation with other intelligence functions tends to be an important factor for organizing intelligence departments; this fosters intelligence spillover and ease adoption as well as communication of intelligence. SCA do not have a Technology Intelligence group, they rather use Business Intelligence managed through a network in the organization and Customer Research and Understanding department. These are SCA's sources for intelligence and further researchers are used as scouts in their

areas of interest. Thereby, SCA can have a organization that enables them to work with technology intelligence even though there is no Technology Intelligence department in the organization.

5.2 Capturing of Information

Depending on organization set-up, which is dependent upon the company's industry, companies tend to use different strategies and sources for capturing technology intelligence, see Figure 23.

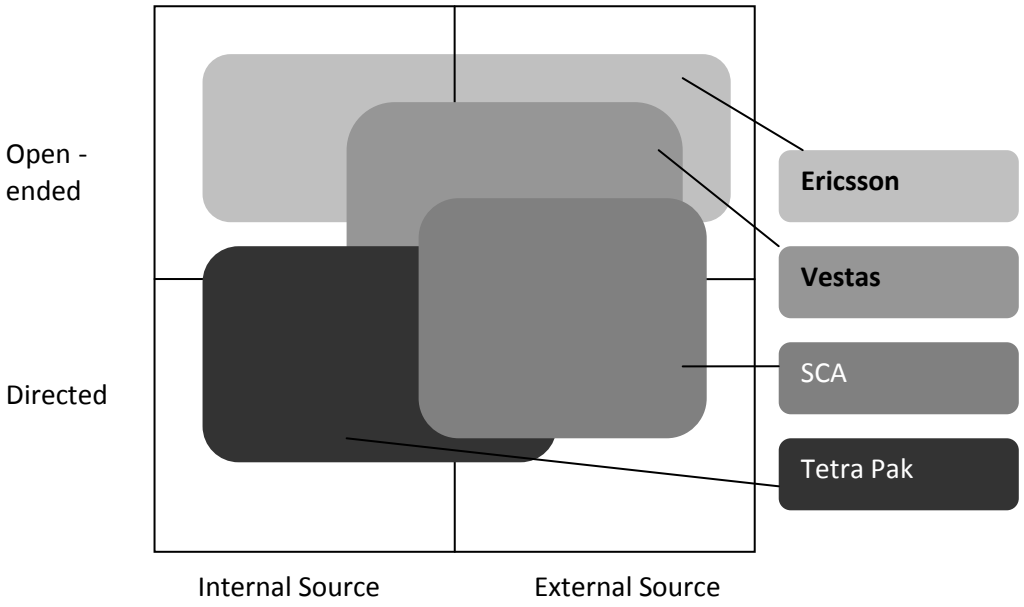


Figure 23 Strategy for Capturing Technology Intelligence differes between Companies, source: own estimations

As Kerr et al. (2006) stated, different strategies are needed depending on where it is most likely to acquire the information needed for fulfilling the organization's needs. According to employees at Tetra Pak, up to 80 per cent of the information needed for the Technology Intelligence group is available in-house, hence most of the search for information is be focused on identifying internal sources. However, these internal sources have external networks that they can tap into, granting them access to a wider network. Tetra Pak is organized for directed projects, due to that most of the assignments they are working with is closely tied to D&E. The knowledge from directed searches is important when creating trend reports such as material trends and opportunities and threats report. Ericsson is taking an open-ended approach where they are directing their search into different technology areas. They are solely responsible for identifying major technology trends. Instead, different departments and experts within Ericsson are responsible for working with directed search. Ericsson has dedicated scouts employed at different locations, organizations, and with different areas of expertise globally for broadening their search for new

technology. By having a close collaboration with these scouts, Ericsson's Technology Intelligence function can identify trends internally and externally from a central function.

Vestas is using a more dynamic approach for capturing intelligence, they have identified that technology trends and technologies are driven by global market forces. Thus, Vestas is focusing most of their time externally, after identifying that there is a large external community working with these trends. Establishment of R&D hubs in important clusters, collaboration with important research institutes and universities in these clusters enables Vestas to tap into these knowledge repositories. SCA is using directed search for technologies close to their technology roadmaps, through collaborating with intermediaries but they are as also conducting some open-ended searches to keep up with technology trends. Internal scouts and employees identify topics and problems that they are not able to solve by themselves. These are then summarized and developed into generic questions, suited for intermediaries, and distributed to the InnoCentive network. This process gives the organization a greater ability to tap into the knowledge repository of a large external network of experts, providing them with a solution rather than just matching them with someone who could solve it.

5.3 Delivery of Intelligence

Delivery of knowledge throughout the organization is highly dependent upon the organizational structure and the stakeholders' preferred communication channels. Enabling knowledge transfer from, to and between subsidiaries companies can benefit from a greater business understanding and knowledge of their core business. Allowing and enabling transfer of knowledge between subsidiaries and headquarter is not a trivial question and might be seen as a risk due to leakage of information. Tetra Pak did not use to see China as a viable source for new technology or innovation; hence, they did only focus on transfer of market data back to headquarter. Nevertheless, as China is growing, both in term of market size and competition, their relative importance is increasing, thus Tetra Pak is looking for establishing intelligence functionality in China for transferring knowledge in reverse direction. (Buckley, Clegg & Tan, 2003)

Vestas is enabling close collaboration between their departments, subsidiaries and R&D hubs; they are encouraging a culture of information sharing which has led to knowledge spillover, further fostering an innovative culture. Expatriates and repatriates are used for transferring knowledge both to and from subsidiaries (Lazarova & Tarique, 2005, and Gassmann & Gaso, 2004), enabling a good understanding of different cultures, promoting not only primary but also reverse knowledge transfer. Vestas are keeping an open approach to the information and granting employees access to most of the information, by doing so it is easier to find important information internally. Furthermore, they have a structured alignment between their R&D hubs and strategy process, enabling strategic decisions to adopt the latest technology trends.

Through using a structured format for delivery of intelligence into the strategy and business processes, technology intelligence enables Ericsson to sustain technology leadership. The purpose of and the sources for the deliverables varies; newsletters aim at sharing public information within the company and help to distribute knowledge regarding technology trends and innovations (Kerr et al. 2006). Trend analyses are used as a catalyst for management meetings and Ericsson's planning cycle. These are dependent upon the information from the newsletters and by utilizing Ericsson's knowledge about the market and analyzing the impact on Ericsson's business from the technologies, Technology Intelligence can deliver suitable intelligence to the organization. Technology outlook and speculation report is a document affecting Ericsson's long term strategy and technology roadmap. The purpose of the report is to draw conclusions and implications for Ericsson in the technology domain outside their ordinary roadmap; in term of technologies, threats and opportunities. The report is a summary of the newsletter and trend analysis and also uses the intelligence and knowledge within and outside the company for finding new opportunities for Ericsson's business. SCA approach delivery of knowledge in a slightly different way enabled through a structured process and dedicated resources for handling their collaboration with InnoCentive. One of these dedicated resources is one employee acting as a champion responsible for driving the collaboration. This facilitates SCA's collaboration with InnoCentive and enhances their long-term relationship. Further, for each Challenge, SCA commit one employee as a challenge owner, responsible for delivery of knowledge to the organization. Thus, the challenge owner is acting as a knowledge gatekeeper (Cranefield and Yoong, 2007). Being an interface between InnoCentive and SCA, the challenge owner secures that the acquired information disseminates throughout the organization.

5.4 Digestion of Data for Creating Knowledge

> *"[Digestion is] providing opportunities for chance, hence creating business opportunities"*
> **Source**: Wolfgang Wagner, interview, Beijing, 2010

Digestion[1] meaning analysis and incorporation of data is, according to the authors of this master thesis, one of the key processes for creating knowledge, hence enabling action from the data gathered from the technology intelligence process, see Figure 24. For avoiding information overflow and creating an intelligence function where data is transformed into intelligence and not just passed out in the organization digestion is needed. By digesting data, the most important information for the business is delivered to the company in the most suiting way for the company's stakeholders.

[1] Developed by this master thesis; a process consisting of refinement, enrichment, alignment, and finally reflection whereby organizations create an understanding for captured information, hence creating opportunities for turning knowledge into action.

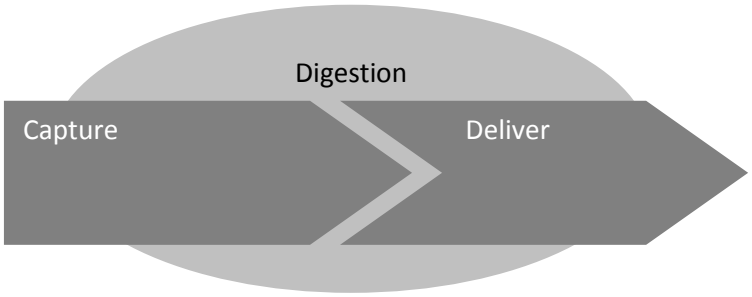


Figure 24 Digestion of data for creating action from knowledge

Digestion varies between companies and organizations, and is highly dependent upon the company structure and the stakeholders' needs. Ericsson is using cross-functional scouts that have experience from both business and technology which enables them to digest data into information. The Technology Intelligence department can then use this for trend assessments. Enabling discussions between scouts and Technology Intelligence, synergies can be identified, enabling delivery of information throughout the organization. At Vestas there is a dedicated strategy team that is working with data collection and digestion, these are working on a global basis which enables them to get access to and understand the entire business. This does not only create a large knowledge base within the team, it also enables them to span silos and identify opportunities for technologies and innovation in different areas. Digestion also occurs at Vestas' R&D hubs where data from university collaborations and different market and technology offices is transferred. By gathering data from different technology clusters and tapping into both inside and outside information, they are able to get business relevant knowledge at a very low price.

SCA's process and culture for collaboration with InnoCentive is an enabler for effective digestion. The company is organized for external collaboration, which enhances the cooperation with InnoCentive; furthermore, it triggers knowledge sharing with internal and external partners. Long-term commitment is secured through dedicating resources to both an InnoCentive champion and challenge owners. Thus, the employees can secure quality of the work and create an understanding for both how InnoCentive works and how SCA absorb new technologies and knowledge. The impact from individuals throughout the digestion process is not only clear, in the case of SCA it is a prerequisite for successful collaboration. Hence, digestion is dependent upon not only processes but also dedicated and inspiring individuals that act as knowledge gatekeepers.

Digestion and communication is enabled at Tetra Pak through co-location of intelligence functions. Further, tightness between intelligence functions fosters close collaboration and understanding of how intelligence supplements each other. This

understanding facilitates digestion and foster more accurate delivery of intelligence. Another important success factor is Competitor Intelligence's dedication to connect findings to business impact. Through the transformation of knowledge, they acknowledge impact on the business which raises the sense of urgency while it becomes easier for the organization to understand the findings.

As argued by Cranefield, Yoong, 2007 there are different forms for disseminate knowledge to an organization. Hence, the authors of this thesis argue that there are different forms for digestion of data, thus creating knowledge into action; informal, intermediate, and formal, see Table 3.

Table 3 Formalization of Digestion, adpoted from interviews, own analysis and inspiration from Wolfgang Wagner

Informal	Intermediate	Formal
Informal discussion	Frequent top management meetings	Data mining
SME communication	Congresses	Forced information exchange
Communication areas	Structured meetings	Silos
	Focused topics seminars	Alumnae
	Workshops	Reports

By enabling different types of digestion, companies can encourage a culture that enhances knowledge transfer between employees and departments. Informal digestion is where data is transferred and shared between employees in an informal way. This is often the case in small and medium size enterprises, where employees speak on a regular basis and share information; this is then the driver of business transformation. Larger organizations create this kind of environment by providing areas for communication and encouraging informal communication between departments and employees. Employment of people with similar background, such as alumnae from the same business school, enhances digestion of knowledge between employees and organizational levels.

On the contrary side of the digestion spectrum is formal digestion. Formal digestion is the most structured process where companies use tools as data mining for gathering and transformation of important data into knowledge. SCA's Customer Research and Understanding department is using this approach when they gather data from different sources and then turn it into knowledge about their competitors' businesses and customers' behavior. Ericsson is using their alumnae network for accessing and digesting information. Utilization of established network in a structured way enables them to control their digestion. This does not only grant Ericsson access to top universities, it also gives them a filter for finding sources that are more likely to contribute to Ericsson's business.

In all benchmarked companies and departments, communication is conducted within their own departmental organization or silo. Through newsletter, management meetings and information meetings communication is formalized, which helps to share information and create knowledge within the department. Finally, pushing information between departments and employees, such as posting on internal homepages, newsletters, and bigger meetings is another form of formalized digestion. These approaches might not always foster innovation; nevertheless, they help information to transfer between silos and employees, which can create a more open environment for sharing knowledge, thereby increasing understanding and informal networks between employees.

Between the two extremes of digestion is intermediate digestion, a structured approach used for creating discussion and knowledge spillover. At Tetra Pak, Competitor Intelligence in Shanghai is conducting workshops and discussion with different departments, suppliers and customers for creating an environment for knowledge sharing. Through these, new input to projects is created; moreover, it enhances informal networks between Tetra Pak and external associates, thus facilitating communication and understanding of identified opportunities and threats. At Ericsson, input from technology intelligence's trends are used on their big executive meeting each year, this is used for creating the company's new strategy and also as a subject for fostering new, innovative discussions. Hence, utilization of intelligence in an efficient approach that helps organizations to create actions, thereby taking advantage of it.

5.5 Enabling Technology Intelligence through Collaboration

A prerequisite for coping with technological change is to enable identification of and respond to trends, concerning technology, market and competition. Establishment of technology intelligence that takes both internal and external collaborations into account enables this. An organization that manages capture of information, digestion, and delivery of intelligence enhance the awareness of technology threats and opportunities. Furthermore, it secures that important intelligence is transferred to concerned stakeholders, thus creating possibilities for action.

All companies benchmarked in this thesis are collaborating with external partners, such as scouts, universities, intermediaries, suppliers and customers, enabling efficient technology intelligence. The purposes with the collaborations vary depending on organization structure, industry properties, and what kind of information and innovation organizations are looking for. Further, the relationships with the collaborations and the tightness between the organizations differs, see Table 4.

Table 4 The role for different actors and closeness to the organization in the technology intelligence landscape

	Role	Purpose and benefits	Tightness
Scouts	**Scout**	• Controlled scouting process • Internal gatekeeper enabling knowledge transfer • Understanding of both business and technology • Creating contacts with industry and tapping into universities knowledge repository • Utilizing informal and formal networks	Tight
Knowledge Brokers	**Intermediary**	• Spanning different industries and technologies • Huge network of contacts and experiences from similar projects and assignments • Access to large amount of reports and data otherwise hard to capture	Loose
Partners	**Suppliers**	• Access to feedback and cases • Understanding of technological development and future opportunities • Building long-term relationships • Access to competitor movements • Access to network of contacts and experiences from similar projects	Medium
	Customers	• Understanding of market and technological needs • Building long-term relationships • Access to future perception of trends • Access to end user	Medium
	University	• Informal networks consisting of professors and students • Reaching state-of-the-art technology and theory • Applying theory on real business problems • Spanning industries and/or competencies • Good for branding and recruitment of new talents	Medium

Scouts are employees with tight relationship to the fostering organization enabling close coordination of scouting activities. The tightness enables close contact and

communication between the organization and the scouts, hence scouts can act as an internal gatekeepers facilitating and promoting information gathered during scouting activities. *Knowledge brokers* are organizations, divided into directed intermediaries, open-ended intermediaries, and matchmakers, working with different industries and companies, enabling transfer of knowledge and technologies between organizations and industries. Due to their organizational structure knowledge brokers are loosely connected to the employing organization, thus making their knowledge harder to adopt for the hosting organization. Universities, suppliers and customers are categorized as *partners.* They have a longer relationship with the hosting organization and provide good access to information and knowledge that might not be available elsewhere.

Knowledge brokers, scouts and partners are used for finding trends and new technologies, enabling companies to identify and act upon identified threats and opportunities. Through collaboration with the external environment, companies can tap into knowledge that is kept in internal and external networks by directed or open-ended search methods. Nevertheless, different types of collaboration are suitable depending on organizations' desire to identifying technologies or trends see Table 5. Further, if the knowledge needed is available internally or externally companies need to address different sources and types of collaboration.

Table 5 Usage of knowledge brokers, partners, and scouts for capturing trends and technologies

		Usage	
		Trends	Technology
Type	**Knowledge Brokers**		
	• **Directed**		X
	• **Open-Ended**	X	
	• **Matchmaker**	X	X
	Partners		
	• **Universities**		X
	• **Suppliers**	X	X
	• **Customers**	X	
	Scouts	X	X

5.5.1 Technology Intelligence through Collaboration with Scouts

Through employment of scouts, responsible for identification of trends and finding solutions to directed questions, companies keep a tighter control on what they are scouting for and how they are working, see Figure 25. Further, scouts are often well aware of the company's business and technology, facilitating identification of information and data of importance for sustaining technology leadership. Employed scouts are often participating in internal networks at the company, thus acting as a gatekeeper (Allen, 1977) for information and knowledge, easing information sharing

and communication between employees and scouts. Hence, through the scouts' knowledge about both business and technology, they can improve the digestion process, creating an environment for knowledge spill-over and transfer of knowledge and innovation to, from and between different regional areas.

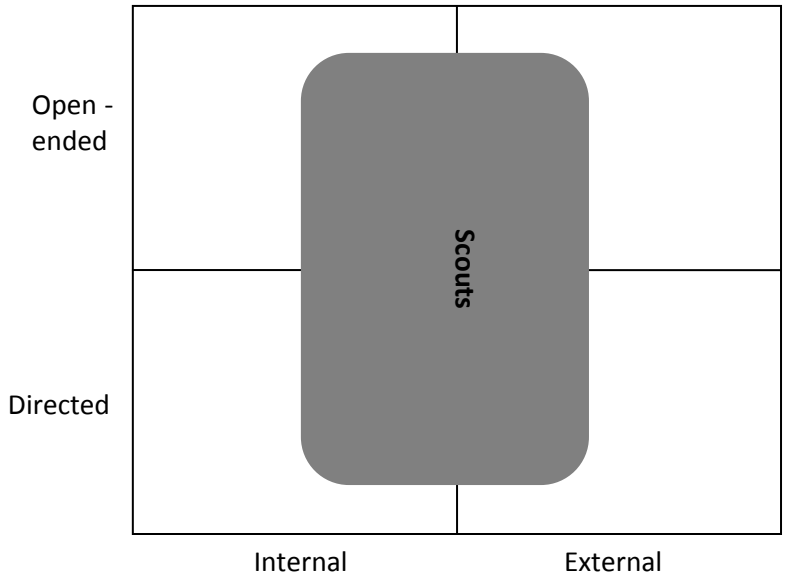


Figure 25 Technology intelligence through collaboration with scouts

5.5.2 Technology Intelligence through Collaboration with Knowledge Brokers

Collaboration with knowledge brokers has different objectives; (1) finding solutions to a specific assignment, (2) getting access to industry reports and trends and in some cases (3) both, see Figure 26. These assignments are often time consuming and dependent upon know-who knowledge, thus they can take a long time and often a lot of resources to acquire. Knowledge brokers are working across industries, companies, and technologies enabling them to find synergies and transfer information. Working with knowledge brokers, grant companies access to networks and information that they otherwise would or could not get access to. Moreover, it creates opportunities for companies to focus on their core competences and dedicate resources to assignments where most value is created.

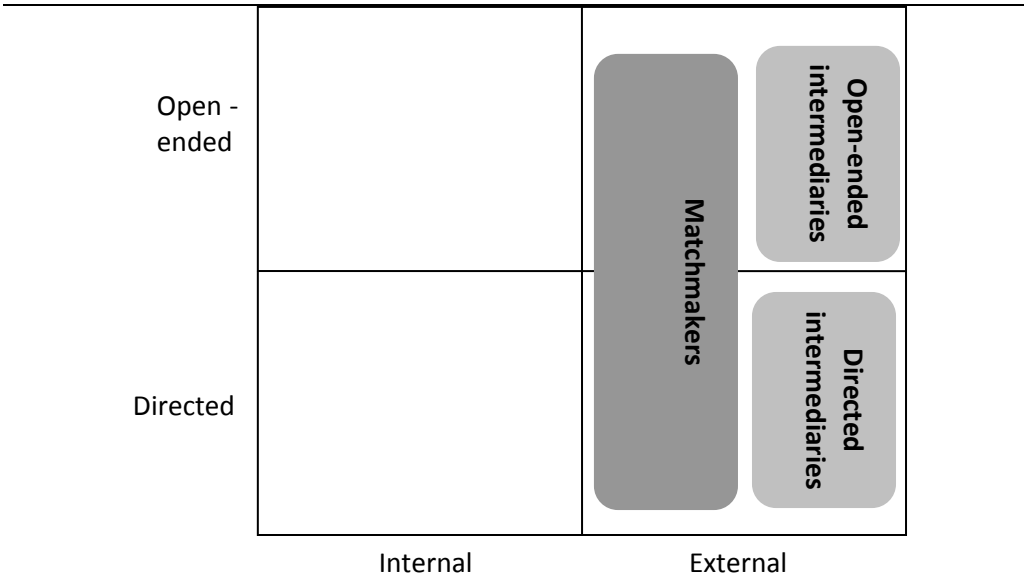


Figure 26 Technology intelligence through collaboration with knowledge brokers

Nevertheless, collaboration with knowledge brokers is not a plug-and-play process as stated by SCA. The information captured is loose; thus, companies need to set-up a good strategy and process for enabling absorption of the information and turning it into intelligence and action. For companies, it is therefore important to enable digestion throughout the collaboration for securing usage of the information acquired through the knowledge brokers, thus creating a better understanding for the technology landscape.

Knowledge brokers are quite different depending upon their scope. Hence, this thesis argues that knowledge brokers should be divided into three different roles; open-ended intermediaries, directed intermediaries, and matchmakers. Open-ended intermediaries, such as Pira, are companies and institutes granting access to networks and delivery of macro trends to organizations. Directed intermediaries, for example InnoCentive, are enabling companies to solve explicit assignments by tapping into their large networks and usage of know-who knowledge. Matchmakers are companies performing both open-ended trend assessments and find solutions to directed questions. Their broad scope allows them to draw benefits from both their deep technology experience and their trend assessments. Thus, companies collaborating with matchmakers can benefit from receiving both strategic information as well as technology assessments. However, collaboration with intermediaries comes at a certain price. The more information granted access to, the more costly it becomes. Hence, companies need to identify what information they need in order to enable identification of good intermediaries to collaborate with.

5.5.3 Technology Intelligence through Collaboration with Partners

Collaboration with partners, defined as customers, suppliers, and universities, provides good opportunities for long-term relationship, access to relevant as well as important information, and improve business understanding, see Figure 27. The companies benchmarked in this thesis are collaborating with their partners for a long time, enabling understanding of each other's needs and knowledge. Further, partners possess different types of knowledge. Hence, choosing different partners to collaborate with, depending on what information companies are looking for, enable companies to learn about new technologies and trends. Partners often have their own technology roadmaps and trend assessments, thus through collaboration both parties can benefit by reaching a better understanding of future opportunities and threats.

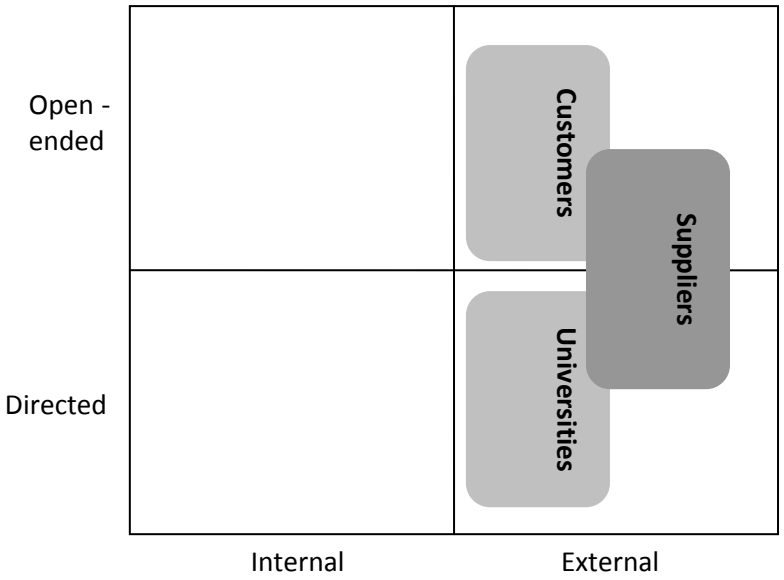


Figure 27 Technology intelligence through collaboration with partners

Most companies already possess relationship with their suppliers; however, it is not as usual that they share and collaborate regarding technologies and trends. Collaboration with suppliers regarding technology development can benefit both parties; suppliers can get access to future anticipations and needs, in return they can share information about new technologies in their technology pipeline enabling companies to identify future possibilities. Suppliers often work with many customers, who sometimes even are competitors; through collaboration companies can get an understanding for competitors' and the industry's future products and needs. However, as expressed in this thesis, one of the largest benefits with supplier collaboration is for companies to identify what new technologies are arising. With this information, companies can change their way of working, from providing

requirement specifications to their suppliers to collaborating and understanding what their suppliers' new technology can do for the their products.

Customer collaboration has in this thesis shown to be of great value for understanding future technology needs and business insights. Customers, who by definition are the market, have a good understanding of their customers, which sometimes might be the company's end-consumer. Tapping into customers' knowledge about market, trends, and technology demands enable for companies to find new technologies and solutions that might preserve future technology leadership. This is the case of SCA's Customer Research and Understanding, where they are collaborating for understanding what future threats and opportunities that they need to address.

University collaboration aims at reaching new technologies and research from top universities, utilizing this knowledge and competence to create company specific applications. Collaboration with universities is often an investment over a longer time period, where companies invest in university chairs, employs professors as well as PhDs for tapping into their knowledge, competences, and networks. However, as argued in this thesis and by others, university collaboration not always provides companies with new innovations. Instead knowledge and technologies from universities need to be aligned with the organization for fitting the industry environment. Nevertheless, there are some universities and institutions that have a great impact in different industries and regions. Thus, companies get access to important information by collaborating with universities in these industry clusters. Companies also use university collaboration as a pool for branding and recruitment. It does not only grant access to students and employees of universities, it also provide companies with the possibility to brand themselves, later on putting them in a better position for different types of employment. Employing top students and university employees help companies to get access to a huge network of alumnae, industry, and education contacts, facilitating transfer of new technologies and knowledge from universities to companies. This helps to develop a better understanding of technology development and creation of new products, processes, and services.

5.6 Technology Intelligence for Managing Change

Technology intelligence is an important tool for managing technology change. Establishing an efficient network, companies gather information about technologies and trends, thus creating opportunities for cost reduction and new products and services. Low end, disruptive innovations are threatening companies from developed markets as companies from emerging markets are gaining speed and market shares. Identifying technologies from these geographic areas is essential for sustaining technology leadership, hence creating competitive advantages. However, most companies are afraid of this change and are trying to have a closer control over their R&D for creating new, truly innovative products. As this thesis points out, opening up for the external environment companies does not only become more

innovative, they have also realized the importance of establishing themselves in emerging markets. Establishment, enable for companies to become more aware of the industry movement, thereby creating opportunities for coping with technological change. Successful presence in emerging markets is dependent upon long-term relationship and commitment, where companies create opportunities not only for themselves but also for the market.

SCA have a strategy, where they are keeping their research close and instead working with intermediaries for finding global innovations and technologies. Their collaboration with InnoCentive has given them a success rate at around 50 per cent and has improved their knowledge and problem solving skills within the company. The collaboration grants them access and connections to innovators and scientists in adjacent industries, thus creating opportunities for finding technologies and solutions that else would not appear if only looking for new technology within their industry. The success is dependent upon openness for external collaboration and commitment over a longer time period, where SCA decided to use InnoCentive for finding new opportunities. Given this, they dedicated resource, internal as well as external, for the collaboration which made it easier to fine-tune the process and for both parties understand each other's needs and organization.

In the case of Vestas, their success hinge upon long-term commitment and collaboration not only with the industry, but also the government and universities. Managing these is essential for collaboration in emerging countries, such as China. Vestas have not only managed to create new opportunities and find new technologies and solutions in China, they have also changed the way they research and develop new products. Vestas development of a new wind turbine in China, for the Chinese market, and then taking it to the global market when proven successful is an interesting case. The product meet the high standards and demands Vestas have on their products, and it also have a cost structure suiting the Chinese market. This is a current example of reverse innovation and it does not only show the power of the Chinese technology and innovation capability, it also proves that companies can benefit from working with the global community.

5.7 Key Learning from Analysis

- Technology intelligence is a process for capturing information, digestion for creating organizational awareness as well as innovation impact, and delivery of intelligence. Thus, creating action from knowledge.
- Organizations performing well, with regards to technology intelligence, are engaging themselves in collaboration with scouts, partners, and knowledge brokers
- Technology intelligence not only help companies to understand their competitive environment, further it provides the opportunity to identify cost reductions and opportunities for new product, process, and service innovation

6 Conclusions

In this chapter, academic and managerial implications for collaboration and digestion, in the area of technology intelligence, are presented. Listening posts are developed through the addition of knowledge brokers. Digestion is described as a compounded process consisting of four sub-processes enabling companies to absorb and act upon intelligence in a more efficient way.

6.1 Academic Implications and Future Research

Throughout this thesis, the technology intelligence process has been discussed where two important areas have been covered; (1) with whom companies are collaborating, in order to identify different types of intelligence and (2) how companies are digesting information and intelligence, thus creating organizational understanding and innovation impact. These areas are not only parsimoniously covered in academic literature; they are also of importance for companies when opening up for external collaboration. Further, this thesis identifies the importance of working with external partners while developing an efficient process for absorbing the knowledge gained from the collaborations. In conclusion, organizations are utilizing collaboration and digestion to different degrees and this is influencing the performance of technology intelligence and its ability to find cost reductions and new product, process and service innovation.

6.1.1 Collaboration

Industry university collaboration has been a popular subject covered by scholars; however, their impact on innovation has been questioned. Thus, there is an opportunity to further explore other types of external collaborations, their relationship to technology intelligence and impact on innovation. As IBM CEO Study identified, external partners, such as business partners, customers and consultants, are important for companies innovativeness and external awareness. This thesis does not only enhance this conclusion, it also states that suppliers, universities, and customers offer additional opportunities for companies aiming at improving their technology intelligence. These external partners are having different technology knowledge, thus offering complementary information to companies, further providing access to information from other customers and even competitors. Knowledge brokers are used for supplementing companies' Technology Intelligence department, and this thesis has identified three types of knowledge brokers; directed intermediaries, open-ended intermediaries, and matchmakers. These knowledge brokers are not only granting access to and supplying companies with different kind of information; they also offer companies new kinds of collaborations with the ecosystem in which they operate.

This thesis has only nudged the surface of collaboration; nevertheless, it can still be concluded that external collaboration is changing the way companies are performing in their aim to become more cost efficient and finding new product, process, and

service innovation. Hence, academia should find an interest in investigating how the set-up of these collaborations is organized and what impact it has on organizational performance. This thesis is based on qualitative studies, and interviews with a small number of organizations. Taking a broader approach, quantifying the performance of collaboration, the real impact of collaboration can be established, further deepening the understanding of collaboration with the ecosystem. Nevertheless, the participating companies in this thesis state the importance of external collaboration and they are explaining some of their success by enhancing the impact of their partners. Addressing partnership and collaboration in emerging markets and how this is improving companies' ability to find cost reductions, and new product, process, and service innovation is also an opportunity for scholars. The initial findings from this thesis suggest that external collaboration might be a prerequisite for creating and finding low end disruptive innovation, thus facilitating reverse innovation from emerging markets.

6.1.2 Digestion

Digestion is a subject surprisingly absent in the academic literature covering technology intelligence. Instead, academia is covering capturing of information and delivery of intelligence, explaining adoption of intelligence within the organization as more of a one-way communication. However, according to the authors of this thesis, this is not enough. Instead, companies engaging in digestion, a two-way communication and collaboration, during the intelligence process tend to be more efficient when disseminating and incorporating the intelligence in the organization, thus creating action from it. Just as identified by the report from EIRMA, it is this last part of the process, turning knowledge into action, where most companies fail. This thesis identifies lack of understanding, from both the giving and the receiving organization, as a plausible reason for dissatisfying digestion. Further, working with only one end of the digestion spectrum deteriorates the process. Thus, companies need to identify where they are putting their effort for creating digestion to enhance the opportunities for new kinds of digestion. Thereby, organizations can improve the possibility to adopt intelligence, while fostering a culture of information sharing and understanding.

This thesis has neither aimed at, nor identified the relative importance of different forms of digestion; it has primarily recognized that companies performing well regarding their technology intelligence process are elaborating on different forms of digestion for facilitating the process. Hence, there is an opportunity for scholars to investigate different types of digestion and how it influences the performance of technology intelligence. Exploring digestion further could improve the understanding of the linkage between organizational departments. Moreover, it could enhance the importance of creating technology intelligence organizations with access to different competencies and experiences. Addressing digestion emphasizes the active process, by both technology intelligence departments and receiving organizations, for creating an understanding and transforming the intelligence into knowledge of importance for the organization. Lacking this understanding and

transformation, might not only make organizations perform worse than they otherwise would, it might also result in organizations neglecting important opportunities and threats. Hence, investigating the collaboration between departments and how to foster digestion is a future area of interest for research within academia.

6.1.3 Academic Contributions

Gassmann and Gaso argued in 2004 that there are three types of listening posts; technology outpost, trend scout, and matchmakers. This thesis argues that matchmakers are to narrow description, instead the term knowledge brokers (Hargadon, 1998) is more suitable. The authors argue that knowledge brokers are not only one entity of firms, instead they can be divided into matchmakers, directed intermediaries, and open-ended intermediaries, see Figure 28.

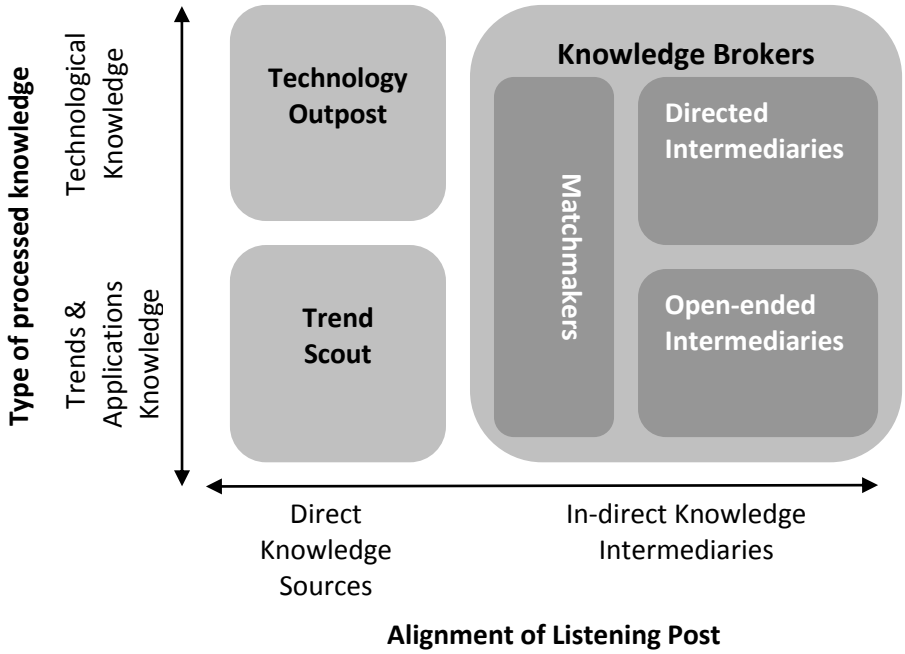


Figure 28 This thesis proposal for extension of the term knowledge brokers into the theory about Listening posts

This extension of Hargadon and Gassmann Gaso's theories expand the description of external collaboration partners that can be used as listening posts. Further, it implies the need for organizations to direct their collaborations to knowledge brokers with suiting capabilities. Matchmakers are as defined by scholars spanning trends and technological knowledge, hence granting access to new and complementary areas of knowledge. Intermediaries are divided into two categories, thus emphasizing the difference between them and enlightening that not all knowledge brokers possess

technological and trend knowledge. Hence, the term knowledge broker has a more faceted denotation than previously stated in academic literature.

Kerr et al. (2006) stated that technology intelligence illustrates how companies capture information and deliver intelligence. However, as the authors of this thesis argue, just incorporating these two into the intelligence process is not enough for turning knowledge into action. This phenomena, incapacity of turning knowledge into action, is an extension of the EIRMA knowledge pyramid and is called the knowing-doing gap[2], see Figure 29.

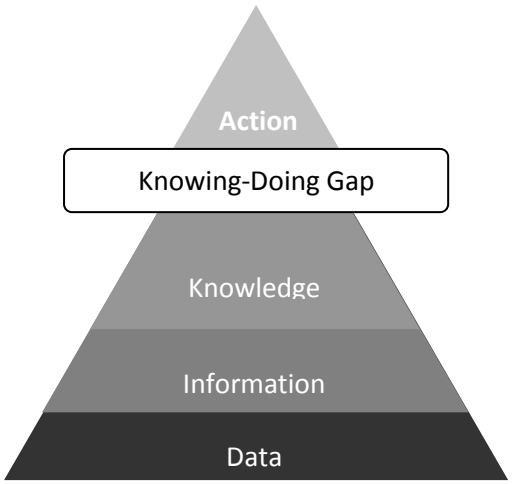


Figure 29 Knowing-Doing Gap is preventing companies from transforming knowledge into action, adopted from Bengt Järrehult, SCA

Just as asseverated before, the gap is not caused by lack of knowledge; instead, it is the organization's ability to use this knowledge that is causing the gap. This ability, digestion, is a compounded process of four sub-processes; refinement, enrichment, alignment, and reflection, see Figure 30. Companies succeeding with digestion, thus turning knowledge into action, have started the process of digesting insights early in the capture process. Through, continuously refining their findings, enriching it with knowledge and experiences, aligning it for suiting the organization's needs, and finally reflecting about what and how to change the process for evolving the business, companies are becoming more adoptive, thus coping with competition more efficient. Further, these companies collaborate not merely across departments and functions; they collaborate over countries and company borders. Thereby, companies that foster and utilize digestion can overcome the knowing-doing gap, hence, becoming better at coping with an increased competition and changing demands from the market.

[2] Adopted from Bengt Järrehult, 2010-04-21

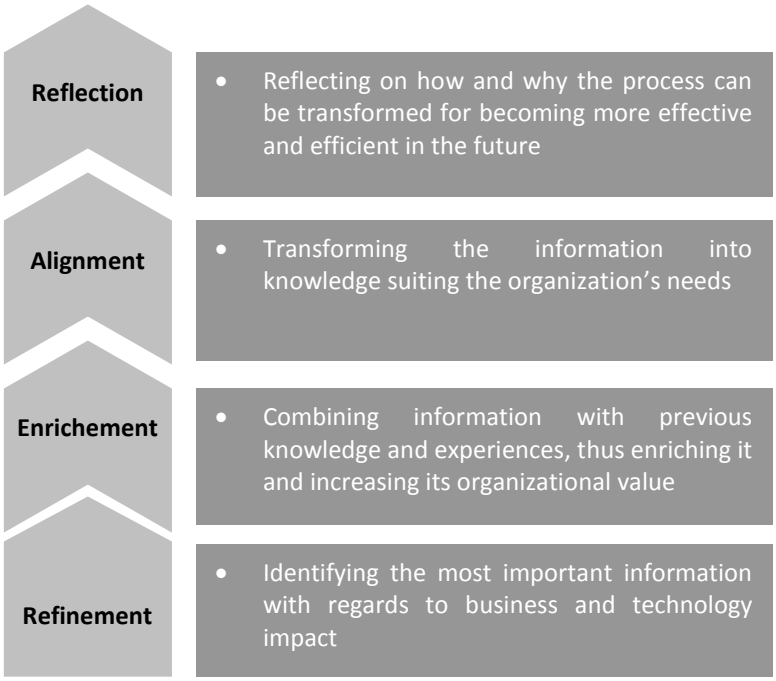


Figure 30 The digestion process with its four subprocesses, refinement, enrichement, digestion, and reflection, enable companies to overcome the knowing-doing gap

6.2 Managerial Implications

6.2.1 Technology Intelligence through Collaboration and Digestion

Technology intelligence is used for coping with competition, taking advantage of new business opportunities, and becoming aware of potential threats. This is enabled through some identified managerial prerequisites; collaboration and digestion, which help to create organizational understanding and innovation impact. This thesis has identified three challenges that organizations are required to manage, for building efficient technology intelligence systems:

- Effectively manage the digestion interface between information capture and delivery of intelligence, enabling efficient dissemination of intelligence, hence turning knowledge into actions.
- Identify external associates to collaborate with, thus aligning technology intelligence with knowledge brokers, partners (such as universities, suppliers and customers), and scouts.
- For enabling effective digestion, organizations should encourage and create communication between Technology, Market and Competitor Intelligences departments and the entire organization.

If these three challenges are managed, through collaboration and digestion, technology intelligence can enable cost reductions and identification of opportunities for product, service and process innovation.

Depending on organizational set-up and industry context, companies tend to use different strategies and sources for creating technology intelligence, thus fulfilling the organization's needs (Kerr et al. 2006). Hence, deciding which intelligence companies are interested in, directed or open-ended, is a prerequisite for identifying external associates to collaborate with. Aligning needs with potential associates does not only sustain companies' capabilities and flexibility, it can also lead to a more cost efficient process and sometimes even improve the quality of the intelligence process. Furthermore, in the companies' effort to improve their technology intelligence process it is of interest to cover both directed and open-ended assignments by addressing internal and external sources. Ensuring that accurate sources are used, enable companies to avoid information overload and prevent them from investing in excessive resources.

6.2.2 Set-Up of Technology Intelligence in China

The authors have found certain elements that are crucial for establishing a technology intelligence system in China. To begin with, the organization has to choose intelligence focus, in terms of directed or open-ended, and if the search should be conducted externally, internally, or both. When determined, a team should be appointed with the purpose to either conduct the intelligence work on their own or with the responsibility to coordinate the activity. Establishing clearly defined purposes with the activity as well as roles in the organization is vital for success. For conducting intelligence activity in China, it is important to set up an exchange system. Nothing is free, this is especially true in China, thus organizations have to define what information they are interested in, and what information they are willing to release for acquiring this information. Further, by using scouts who are well connected with formal and informal networks, organizations can tap into larger networks. Hence, through employment of well connected scouts and collaborating with external associates, organizations can not only raise the total number of sources available, they can also get in contact with sources that they otherwise might not have been granted access to.

During this thesis, interviews and workshops have been conducted with industry peers, universities, experts, and consultancies in China and Europe with extensive experience from intelligence work. From these interviews, a list of best practice guidelines and how to conduct and set-up technology intelligence in China have been established:

- In China organizations collaborate with universities, industries, and government, due to their relative power and connectedness
- Presence and long-term commitment is a prerequisite for successful establishment of technology intelligence in China
- Utilization of expatriates and repatriates enhance knowledge transfer to and from China

- Creation of a win-win situation with collaboration associates; exchange should not only be monetary, instead focus on exchange of knowledge and project management skills to facilitate collaboration
- Continuous feedback to and from headquarter and co-location of business units enhances collaboration and knowledge transfer
- Employment of scouts that have an understanding of the organization's technology and business, further they should know the native culture and language which is preferable when working in Asian cultures
- Informal networks and formal are effective sources for scouting and intelligence in China. Moreover, networking is an effective way to nurture relationships often through informal activities; dinners and social events can sometimes be more important than formal meetings

These guidelines are general and need to be adopted to suit the fostering organization and its industry context. Hence, for establishing technology intelligence organizations in China, companies need to apply these guidelines to their own organization for reducing the risk and raising the overall impact of their intelligence work.

For more company-specific recommendations, two presentations will take place at Tetra Pak; one on June 4, 2010 together with employees from the whole organization who has contributed to this thesis and one on June 8, 2010 together with the steering committee at Tetra Pak. These presentations will not only act as an internal verification of this thesis findings, furthermore, they aim at create an internal company discussion with regards to how to conduct technology intelligence in China and how to connect it to the business. Hence, improving digestion within Tetra Pak and creating a closer collaboration with the internal and the external environment.

6.3 Key Learning from Conclusions

Throughout this thesis, the technology intelligence process has been discussed where two important areas have been covered; (1) with whom companies are collaborating, in order to identify different types of intelligence and (2) how companies are digesting information and intelligence for creating organizational understanding and innovation impact. Initial research indicates that external collaboration and digestion might be prerequisites for creating and finding low end disruptive innovation, thus facilitating reverse innovation from emerging markets.

Two academic contributions have been developed by this thesis; (1) the theory about listening posts is extended through the addition of knowledge brokers, which are entities spanning application, trends, and technology knowledge. Further, (2) the theory about digestion was created, which is a compounded process that fills the knowing-doing gap, thus enabling action from knowledge.

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7.4 Company specific documentation

Internal documentation

- Development & Engineering
- Tetra Pak history
- Tetra Pak organization
- Tetra Pak products

8 Appendix

8.1 Summary of Case Companies

	Organization/Focus	Capture	Deliver	Digestion
Tetra Pak	Directed search and open-ended search Line management	Internal focus – using employees for finding external information Analyzes and some trends Experts/Scouts	Databases Workshops From HQ --> Sub Written reports	Primarily technology experts and TI merging information Sharing with other parts of the organization Technology Strategy & Planning Technology & Competitor roadmaps
Vestas	Open ended R&D-hubs	External focus Trends Collaboration/Partnership Suppliers/Customers	Collocation (creating spill over) Repatriates R&D-hubs HQ <--> Sub	R&D hub responsibility, acting as knowledge brokers Dedicated teams (strategy team) Collocation/Collaboration
SCA	Directed search Researchers as Scouts	External focus Intermediaries BI/CRU	Reports from intermediary Promotion by challenge owner	Together with intermediary in an iterative process Owner starts project
Ericsson	Open ended Group function	Presence in innovation clusters Trend scouts and outposts Collaboration Trends	Newsletter Trend-analyze Outlook and speculation trends HQ <--> Sub	Cross-functional experts from both market and technology TI responsible for merging information Cross-functional discussion forums