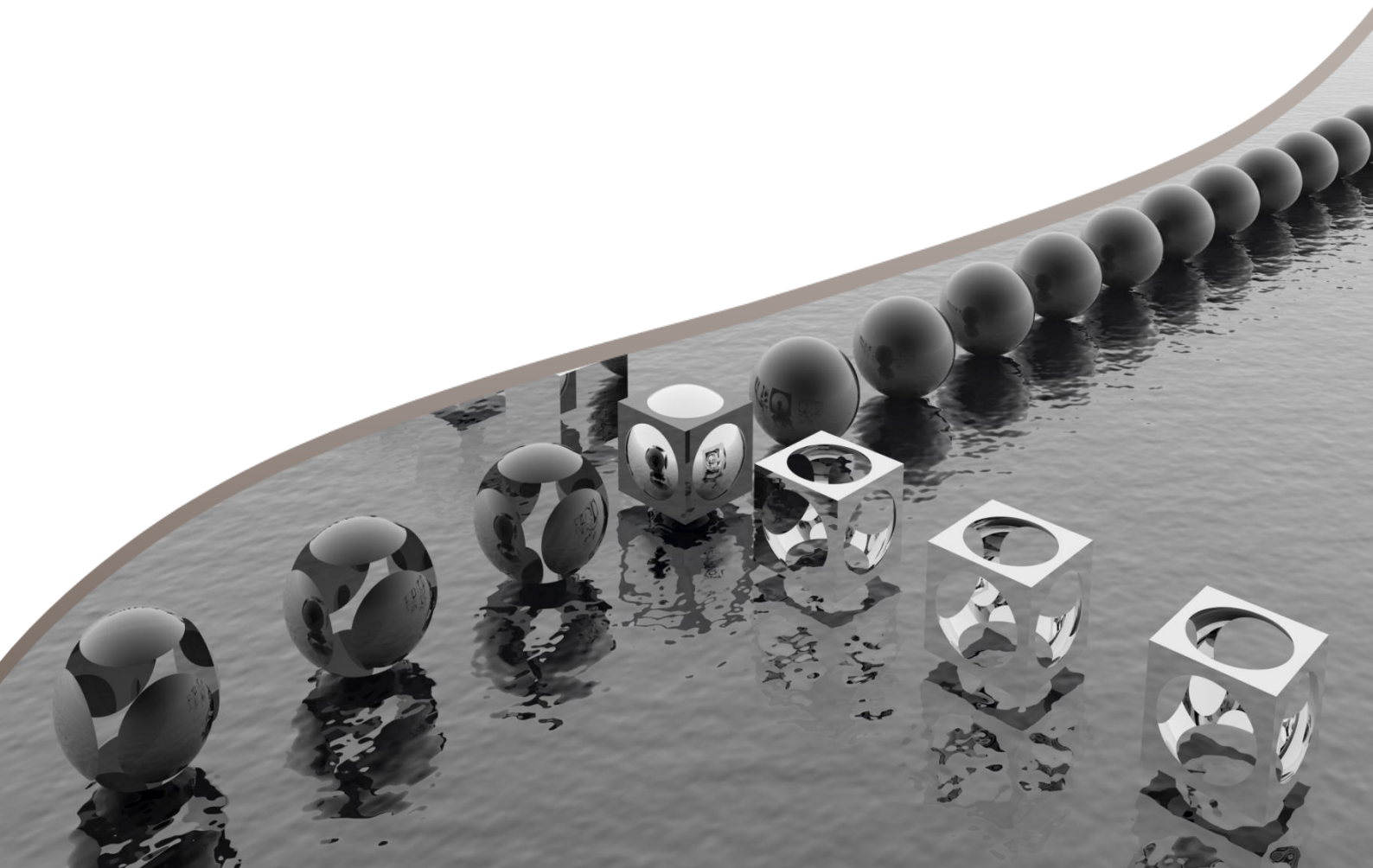
Capgemini Consulting

The effect of silo mentality on supply base information sharing

Bachelor Thesis

Jelle Burger & Thomas Pot

17-10-2011



Preface

March 9th, 2011. Student association A.S.V. Taste organized a company dinner at restaurant 'Jou & Mij' in Enschede. Twenty-five student were selected based on their resume and enthusiasm to accompany this diner. The purpose of this dinner was to introduce students to the different companies and vice versa, for application for possible internships.
Two delegates of five different companies were also present during this evening. Amongst these companies was the Capgemini Corporation. More specifically, the consultancy service of Capgemini Corporation. As the evening progressed, we came to speak Christian Bercz and Robbert den Braber, senior consultant respectively managing consultant. It became clear that they were searching for two students, wanting to graduate for their bachelor in business administration. After exchanging business cards, we held contact till the actual signing of contracts to start a duo bachelor assignment. The final end report, and thus result of this duo bachelor assignment lies before you.

May 2th, 2011, the duo bachelor assignment started. For the next 3 months, we travelled to the headquarters of Capgemini Corporation (NL) in Utrecht, three or four days a week. Due to the distance and long travelling time between Enschede and Utrecht, we stayed at our parents home during these weeks. Tightly suited and all tied up, we arrived around 9 a.m. each morning, as interns of cluster 51. This cluster was part of the consultancy service, and is called 'supply chain management'. More specifically, we were part of the 'purchasing' function of the supply chain management practice.

As many students would confirm, conducting your bachelor assignment and writing an academic report is no easy job. Fortunately, we had very valuable and much guidance from Christian Bercz, our first mentor. Christian is very precise, and always had something to make comments about. We not always agreed, but at the end, our collaboration was very pleasant. Almost every day when we were present in Utrecht, Christian spent at least 1 hour helping and guiding our assignment. Therefore, our greatest acknowledgements go out to him. We would also like to thank Paul van Wilgen, our second mentor of Capgemini Corporation. His comments and very professional way of working, made us realize what this assignment was all about.
Off course, we would also like to thank Jos van Hillegersberg, our mentor from the University of Twente. In the months we conducted our research, we had several appointments with Jos to discuss our progress and report so far. During these appointments, Jos usually pointed out some issues and/or directions which we could used for the next few weeks. His remarks were very useful. Lastly, we would also like to thank Holger Schiele, our second mentor of the University of Twente.

Last but not least, we would also like to thank our parents for the support and confidence. We left home about 4 to 5 years ago, to start our studies in Enschede. But during our bachelor assignment, it felt like being 18, under our parents wings, again.

October 2011

Jelle Burger
Thomas Pot

Management summary

Introduction
Over the last few years, Capgemini Consulting identified capabilities of software solutions that support procurement business processes by conducting several studies. These software solutions focused much on 'traditional' purchasing processes, e.g. sourcing and contract management. These type of solutions are called Supplier Relationship Management (SRM) solutions. However, the market for these type of solutions has matured; many companies have adopted and are currently using these kind of software solutions.

Nowadays, multinationals have suppliers all around the world. Along with this global network of suppliers come new business developments, stated as 'mega trends' in this report (Caps research, 2007). The word 'trends' is used, as all organizations in the business will eventually encounter or will be influenced by the trends. Product life cycles become shorter and shorter, innovation occurs more rapidly and production is done globally, are some examples of these trends. They do not only exercise pressure on the relation between suppliers and buyers; it involves all functions within a company.
Often, many different departments and functions of a company interact with suppliers. It is not only the purchasing function which regulates the relationships with these suppliers. All these departments and functions require (a certain need) information about the suppliers. This information consist of data concerning the supply base, managed in supply base management (SBM). The sharing of information to and over the supply base, is the focus of this research.

Research Model
This research tries to indentify and determine the influence of other organizational functions on the purchasing function in the context of supply base information management. The main and underlying assumption of this research, is that a silo mentality or silo organization may be the cause that organizations cannot cope well with the mega trends. With silo mentality is meant that every function or department of an organization has its own way of collecting, developing, sharing and exchanging information with the supply base in this case.
Using academic literature, an ideal situation for all different functions in an organization is sketched; this forms a reference model in this research. Using an empirical study, information on how organizations are performing and organizing their supply base management is gathered. For this empirical study, managers of eight different large manufacturing organizations are interviewed. By comparing the reference model and the findings from the empirical study, an analysis is made and conclusions are drawn.

Findings
Most information about suppliers is documented within the information systems of the companies which participated in this research. In most cases, the organizations knew what (kind of) information is documented and for what purpose (giving feedback to supplier and regulating orders for example). However, this information is not easily accessible for higher level management, including the purchasing function, because this information is being documented at operational level. Therefore, strategic decision making concerning supply base management is difficult.

It seems that the effects of silo mentality are prevalent in the organizations, but it is not that the different departments and/or functions work solely or on their own. Many interviewed managers acknowledge that because of choices in the past, different departments and functions have developed their own best of breed systems or solutions. So there is no silo mentality but silo organization. Which reveals itself in the form of a restriction in work activities due to the use of (different) information systems. Generally, systems are not integrated, linked or working together, whereby the exchange of information often needs to be done manually.

Discussion and further research
The goal of this research is to contribute to the development of collecting, developing, sharing and exchanging information between the different business functions that interact with the supply base, so that it is useful for all these different parties. Due to the complexity of organizations and their supply base management function, this research is only a small part of a possible solution; to be able to advice companies how to organize information exchange in relation to supply base management. What could be the best solution for managing a company's supply base, depends on many factors. The level of integration between different IT systems, the business itself, and e.g. organization culture all influence the companies way of sharing information with its

supply base. When these aspects are studied more specifically and in a larger study group, their impact on firms performance could be more significantly tested.

The other point from the discussion is that no matter what happens with the megatrends, it is to the customer to decide whether companies will be punished for not keeping up with them. The company that is able to make from the challenges, the megatrends are causing, his new strengths will be the next riser in the fortune 500. And to tackle those challenges, the purchasing function will play a very significant role in the future.

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Abbreviations

Abbreviation	Meaning
BIS	Business Information System(s)
BOM	Bill Of Materials
CAPS	Center for Advanced Procurement and Supply chain management
ERP	Enterprise Resource Planning
GRC	Governance, Risk and Compliance
IT	Information Technology
KPI	Key Performance Indicator
MDM	Master Data Management
OPCO	Operating Company
PO	Purchasing Order
PLC	Product Life Cycle
PLM	Product Lifecycle Management
QA	Quality Assurance
QMS	Quality Management Systems
RFQ	Request For Quotation
SBM	Supply Base Management
SCM	Supply Chain Management
SIM	Supplier Information Management
SPM	Supplier Performance Management
SQM	Supplier Quality Management
SRM	Supplier Relationship Management
SRMM&T	Supplier Risk Model Map and Track
VRM	Vendor Risk Management

1 Introduction

Businesses are developing constantly; not only the day to day job has changed, communication and coordination of their activities might have changed even more. The Internet, ERP systems and other information (technology) systems shape organizations. Many organizations rely on information technology (systems) nowadays. These systems offer possibilities for the businesses, along with their advantages as well as disadvantages. This chapter describes the motivation for this research and its contents.

Capgemini Consulting was looking for two bachelor students for a 3 month joint assignment. Capgemini Consulting focuses much on consultancy from an IT perspective. To keep up with developments in a growing market, the firm does a lot of research in this field of business. As stated on the internet site of Capgemini:

"*Capgemini, one of the world's foremost providers of consulting, technology and outsourcing services, enables its clients to transform and perform through technologies. Present in 36 countries, Capgemini reported 2007 global revenues of EUR 8.7 billion and employs over 88,000 people worldwide.*
Capgemini Consulting is the strategy and transformation consulting division of the Capgemini Group, with a team of over 4,000 consultants worldwide. Leveraging its deep sector and business expertise, Capgemini Consulting advises and supports organizations in transforming their business, from strategy through to execution. Working side by side with its clients, Capgemini Consulting crafts innovative strategies and transformation roadmaps to deliver sustainable performance improvement."
(Capgemini, 2011)

Figure 1: Geographical Presence Capgemini **Source: (Capgemini Consulting, sheets '*Procurement transformation sales deck'*, 2011)**

This chapter will continue explaining the assignment in more detail. The focus of the assignment, the problem definition (including the goal and research question) and at last the research method will be given.

1.1 Changes in the procurement function

For the last five years, Capgemini has executed several studies to identify capabilities of software solutions that support purchasing business processes. These software solutions focus on traditional purchasing processes such as sourcing, contract management, "purchase to pay" and to a lesser extent vendor rating. In the market place, these types of solutions are called Supplier Relationship Management (SRM) solutions. The market for these types of solutions has matured and mature purchasing functions have implemented SRM type solutions. Those systems were needed to control the growing number of suppliers. As written in an article of Handfield (2004): '*Suppliers are now responsible for a large portion of the materials used in finished products and are managing a growing number of processes and functions that were once controlled by their customers organizations'*. Thus, the role of a supplier is intensifying in the core business processes of other companies.

The next challenge companies face, are the changing demands from and in the market. Multinational businesses in manufacturing environments experience a difficult environment to operate in at this moment.

Product life cycles become shorter and shorter, innovation occurs more rapidly and production is done globally (Gunasekarana et al., 2005). Moreover, customers and governments are increasingly demanding about quality and corporate social responsibility of the entire supply chain (Tan, K. C. , Handfield, R. B. and Krause, D. R., 1998).

Figure 2: Megatrends in Supply chain management ***Source:*** **(Carter et al., 2007)**

The developments are visualized in Figure. These developments may be called 'mega trends', as written in the CAPS research of the institute of supply chain management (Carter et al., 2007). As a result of these megatrends, there is a greater demand for supplier performance and quality management. As information technology develops, firms tend to be more integrated (Zhou & Benton Jr., 2007). According to a study of Capgemini (sheets *The future in procurement and supply management*, 2011) and the CAPS research (Carter et al., 2007), seven trends can be distinguished in supply base management, these are explained briefly below:

Globalization and the Rise of Emerging Markets

- Sources of supply shift towards emerging markets. Relocation of manufacturing driven by lower labor costs and proximity to emerging (consumer) markets.

Technological Advances & Innovation

- Core technologies become commoditized, leading to supply base consolidation and effecting SC structure and supplier relationships. Shortages of raw materials and energy sources lead to technology changes.

Increased Product Variety and Shortening product life cycle (PLC)

- Mass customization, shorter product life cycles, late customization and different consumer tastes in emerging markets.

Supply Market Challenges & Opportunities

- Volatility in raw material & energy prices, risk in shortages of key materials, maturing supplier capabilities.

Governmental Regulation

- Increased regulations to improve trade security, transparency and record keeping. Stricter regulations to enforce corporate social responsibility and environmental protection.

Corporate Social Responsibility

- Reduce energy consumption, reduce harmful emissions and reduce waste. Increased risk of exposure to unethical practices such as child labor, working standards and damages & pollution of the environment.

Mergers & Acquisitions and Supply Market Consolidation

- Supply management is expected to deliver a major part of the cost savings from Mergers &Acquisitions. Supply market consolidation increases the capabilities as well as the power for suppliers.

With an eye to the focus and scope of this assignment and the (central) research question(s), the next paragraph will introduce the concept 'supply base'.

1.2 Research context

According to academic literature, a 'supply base' may be defined as '*all businesses engaged in value-adding activities purchase goods and services from a group of suppliers'* ((Dobler, D., Burt D., 1996); (Handfield R.B., Nichols E.L., 1999)). This group of suppliers is called the 'supply base' and the buying company that purchases from the group of suppliers, is referred to as the 'focal company' (Choi T.Y. & Krause D.R., 2006). This can be visualized as in Figure 3.

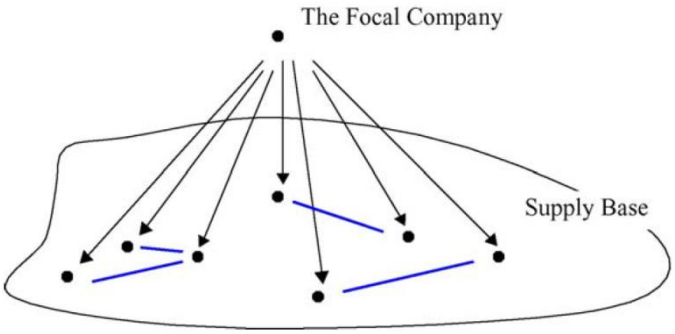


Figure 3: The supply base Source: (Choi T.Y. & Krause D.R., 2006)

This figure shows the overall relationship between a focal company and its suppliers; the supply base. The arrows symbolize the influence and its direction (control and coordination). Blue lines symbolize the relationships between suppliers as a result of this influence or which developed naturally (mergers, joint ventures, collaborative product development, etc.).

Companies rely on business information systems (BIS) that enable visibility in supplier information, performance, risk, and standardized supplier quality & performance management processes. Supply Base Management (SBM) is the term used to indicate all the interactions and activities between the suppliers and the focal company. SBM will be explained and defined in the paragraph 'Supply base management'.
Besides purchasing, many other business functions interact with the supply base. These business functions use their own (point) solutions, such as product lifecycle management (PLM) tools, plant maintenance and quality assurance solutions. The next paragraph will describe what the influence of the mega trends is on the purchasing function and why this is relevant for this assignment.

1.3 Impact of mega trends

Capgemini consulting observes that many companies have found that traditional methods in purchasing have got them so far, but are now searching for new ways to create value (sheets *The future in procurement and supply management*, 2011). Many purchasing functions of companies are still struggling to master the basics. By basics is meant; effective sourcing, contract compliance and accurate spend visibility for example.
As purchasing matures, it evolves from a transactional function to an internally and externally integrated strategic function shifting focus from cost to value generation. Increased dependency on suppliers, volatility in raw material & energy prices, shortages of key materials, currency imbalance and the financial crises have made companies recognize again the importance of supply risk management and improving overall resilience.

In order to make the shift towards more value generation, traditional purchasing will no longer be effective enough. This means that companies should know exactly what data is collected concerning their suppliers, why this information is relevant and for what purpose this information is useful. This seems a broad statement, but

what kind of information is useful, is obviously different for each company. Due to the mega trends, Capgemini consulting sees a rising problem within companies. Their main question is, why can companies not share information (concerning their supply base) properly, in such a way that they are able to cope with these mega trends? Spekman et al. (1998) state:

'Again, we hear the theme that a gap exists between the goals and concerns of senior managers and the activities of the procurement function – buyers have not fully responded to the challenges of managing suppliers with the intent of gaining the full complement of skills afforded by an integrated supply chain.'

A gap between organizations objectives and their real outcome exists as Spekman et al. (1998) found in a study of 25 complete supply chains. The challenge now is to cope with the megatrends. In the next paragraph, this will be explained more extensively.

1.4 Research model; the silo mentality

Besides purchasing many other business functions interact with the supply base. These business functions use their own (point) solutions, such as PLM, Plant Maintenance and Quality Assurance solutions. This is the result of the organizational form of companies/how companies are organized. Traditional companies are divided into independent business functions. They all had their own choice and money in selecting a certain IT system, resulting in all kind of different systems within one company without integration. According to Feld et al. (2009, this may be called a 'silo organization'. Feld et al. (2009) state that such a platform with a wide variety of vertically oriented data silos which serve individual corporate units (HR, accounting, and so on) should be replaced with a clean, horizontally oriented architecture designed to serve the company as a whole.

Because of the use of different IT systems, this resulted in a poor way of information sharing and eventually a low supply base management function performance. This view of Capgemini consulting matched with academic literature and is visualized in Figure 4.

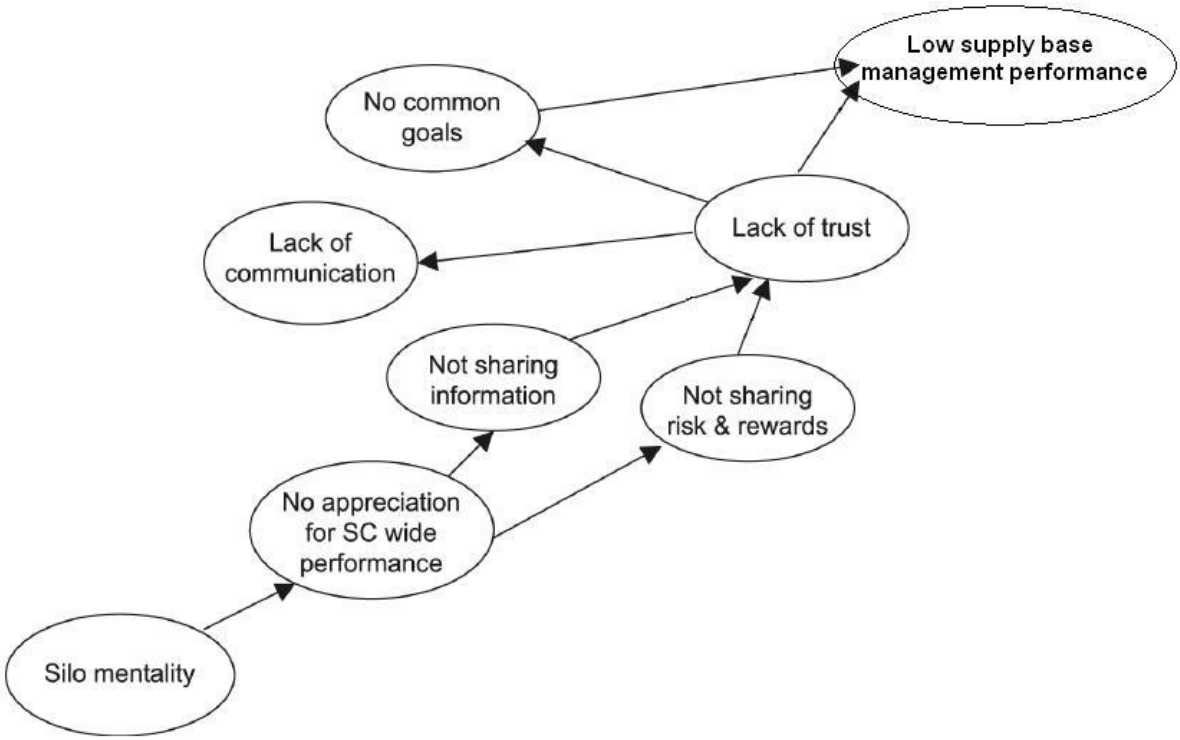


Figure 4: The silo mentality Source: (Rahman S., 2002)

This figure shows causal relationships based on supply base management (Rahman, 2002). It visualizes 'the silo mentality'. As one can see, the primary cause which leads to a low supply base management performance, is a silo mentality. By silo mentality is meant that every function within an organization has its own way of

collecting, developing, sharing and exchanging information with the supply base.

This research tries to break down those silo's walls and contribute to the development of collecting, developing, sharing and exchanging information between all of the different functions that interact with the supply base, so that it is useful for all stakeholders.

This was also the idea when ERP systems were developed and implemented. A definition of an ERP system; *'configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization*' (Kumar K., van Hillegersberg J. , 2000).
However, many functions and departments in organizations kept using their own 'best of breed' systems, which developed further and offered more functionality than an ERP system. This 'silo mentality' and 'silo organization' might be the cause that organizations are not able to react properly to the mega trends. How to determine whether a silo mentality or silo organization is prevalent in a company, will be described under paragraph 'research process'.

1.5 Research contribution

Companies often do not have a system or process to store information in a way that it can be shared effectively with all stakeholders. More specifically, *what* information companies want to share with their suppliers and between functions is often not clear, and *which functionality(s)* information systems need to have, to *support* this. Companies have invested in many different point solutions that are poorly integrated. The consequence is information which is required to manage supply risk and supplier performance, is stored in various systems. If information is present, it is often incomplete with regard to supplier capabilities, qualifications, product roadmaps, supplier contact data, etc. or stored in an inconsistent way, e.g. different material and vendor codification. Thus, extracting relevant information to manage supply risk and supplier performance is therefore inefficient and/or ineffective.
Normally, the 'users' (buying/focal companies) create a demand for information (systems). Thus, a pull market demand. Software producing companies respond by producing software modules which should support this demand. From those software, users should benefit by optimizing their SBM and thus create business value. To illustrate this story, Figure is shown.

The result of this research will provide a set of actions which a company can perform in order to achieve the goal of this research: an optimal use of information sharing in the supply base. These actions are supported by IT systems. When statements can be made about what processes that need to be covered by certain functionalities of IT systems, then Capgemini is able to link these with the functionalities of IT systems. This results in a better advice for companies to address their problems in this field of practice. Helping them to select (or deselect) their IT systems. Concluding, the goal of this research is to contribute to the development of collecting, developing, sharing and exchanging information between the different business functions that interact with the supply base, so that it is useful for all these different parties. In that manner, companies can achieve more value from their purchasing function and IT systems.

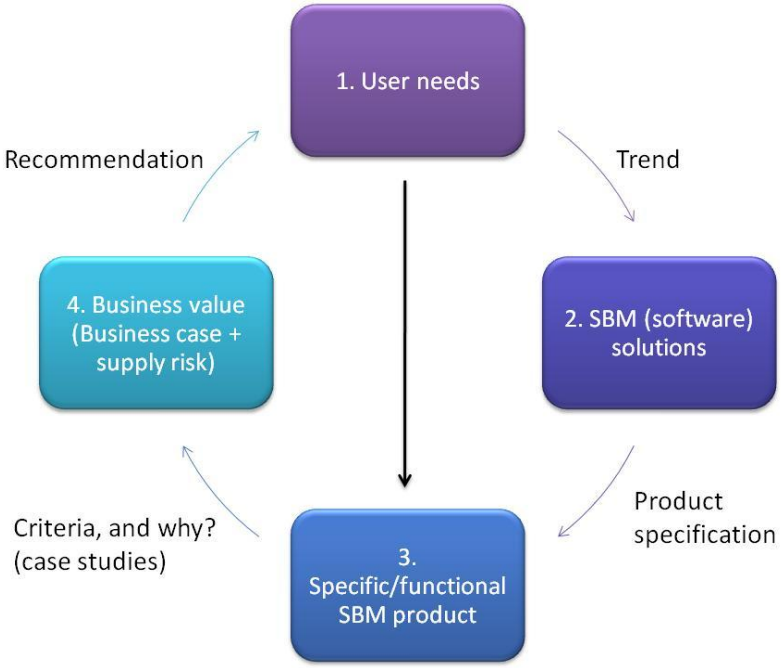


Figure 5: Software creation cycle Source: Burger & Pot (2011)

1.6 Research questions

According to the problem definition and goal, the central research question of this assignment:

- *How could supply base information sharing be organized in order to fulfill the needs of all functions of an organization that interact with the supply base?*

Sub questions:

- *How should information concerning the supply base be optimally organized per business function according to academic literature?*
- *Do companies experience a silo mentality in their organization and what kind of effects does this have on their organization?*
- *What, in practice, are the information needs of the purchasing, quality assurance, asset management, inbound logistics, finance and R&D function in order to manage supplier performance and supplier risk?*

To support the central research question and to ensure this research is useful for Capgemini, sub questions were added to find out how (in academic literature) information in a supply base is optimally organized. Furthermore, this research will determine whether silo mentality is prevalent, and what the actual information needs are within a company.

1.7 Focus

The sharing of information about and over the supply base is the main focus of this research. Although there might be plenty of reasons for the limited use of information systems in companies, the silo mentality will be the only perspective used in this research. This means however, that only a small part of the problem as described under 'problem definition' can be answered.

Other factors may also be of influence. However, this research focuses only on the information sharing process. Large companies often have a (stand alone) purchasing/procurement (difference/overlap between these two terms is explained under chapter 2.2) department, with employees who are working in this department for quite a long time. When concluding that information (systems) should be used better, different or more optimal, one counts on a certain skill of these employees. This is more a HR or people's perspective to the

problem. To stimulate, create or force change in an organization, introducing another way of using information systems is probably not sufficient.

Large manufacturing companies, often have a large amount of suppliers. Therefore, their supply base is huge and complex. Suppliers are playing a more significant role in the supply chain of manufacturing companies nowadays, and their products make up to 80% of the input materials (Reader purchase management, 2007). It is for this reason, these kind of companies are taken to account in this research, for most relevant results can be acquired from these companies.

1.8 Supply Base Management

In this paragraph, Supply Base Management (SBM) will be explained and defined. Also, the scope of the research process will be presented.

Literature describes SBM in the following way: '*A portion of the supply network that is actively managed by the focal company through contracts and purchasing of parts, materials, and services.'* (Choi T.Y. & Krause D.R., 2006). Whereas the supply network can be defined as *'All inter-connected companies that exist upstream to any one company in the value system'* (Choi T.Y. & Krause D.R., 2006).
The two definitions above contain concepts such as 'purchasing', 'parts', 'materials' and 'companies…upstream…value system'. These terms are characteristic when speaking about a value chain of manufacturing companies. To have a better understanding of supply base management and what it contains, Figure is presented.

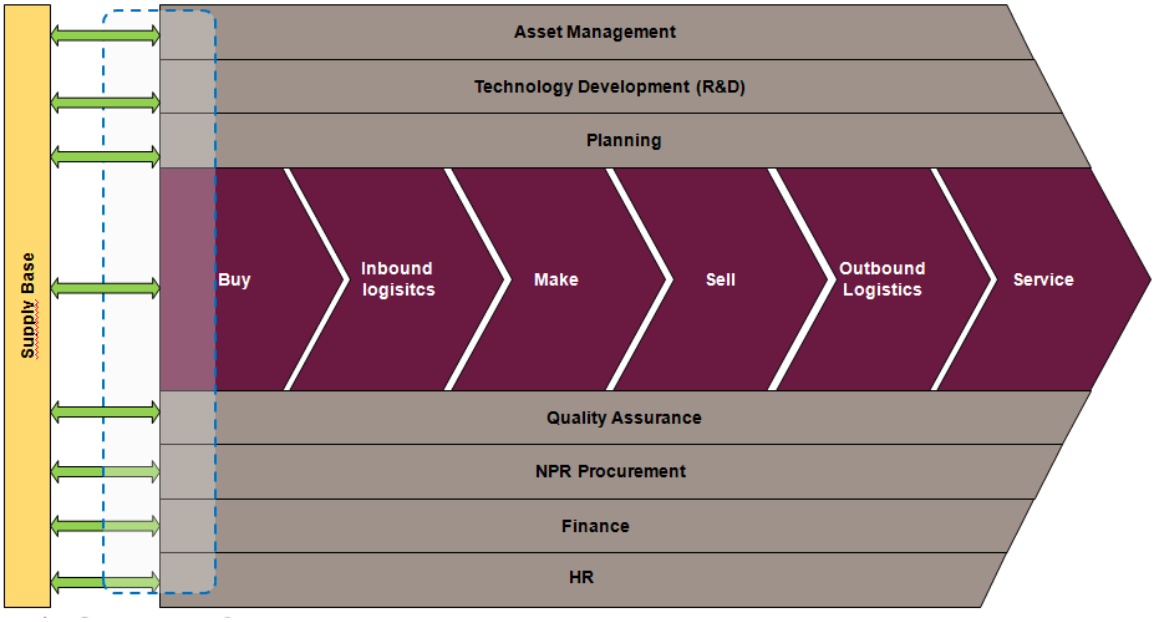


Figure 6: Functions within the supply base

Source: (Capgemini consulting, 2011)

This figure is based on the 'value chain' of Porter (Porter M. E., 1985). The original value chain brings strategically, relevant activities of an organization together (see Appendix A). Porter's model is useful in researching external stakeholders of an organization. It helps to identify an organization's core competencies and analyze their sources of competitive advantage (Porter M. E., Millar, V. E., 1985).
Porter's model contains two types of activities, primary and support activities. Primary activities are activities such as inbound and outbound logistics, marketing & sales, operations and service. Those are primary because they have direct effect on the product of the company. At 'Buy' (from now on 'purchasing') the materials are purchased, they are transported (inbound logistics) to the production facility and from there on they are made to a product, than sold and shipped to a customer. Support activities are activities such as non product related (NPR) procurement, technology development, HR and the firms' infrastructure.

It can be seen that, not only the purchasing function interacts with the supply base, but several other functions as well as quality assurance, finance and R&D. These functions will be explained and discussed in Chapter 3 more extensively. The choice whether to include functions will be based on their interaction with the supply base. Functions which interact often with the supply base are relevant to include in this research, for there is much to investigate and achieve in terms of SBM.
Therefore, only primary activities as stated in Porters model (1985) such as purchasing, quality assurance, asset management, inbound logistics, finance and R&D will be included in the scope.

1.9 Research process

How this research is conducted will be presented in this paragraph. A literature study and an empirical study (using interviews), will be used in order to answer the research questions.

1. The first step is performing a literature study. This is to identify supply base management best practices for each function that interacts with the supply base. Another reason to start with a literature study is that not only the results of the empirical(field) study can be compared with the results from this literature study, it also gives one a better view and insight in supply base management and what academic literature states about this subject.

2. The second part will enhance the empirical part of this research. Therefore, interviews with managers from several manufacturing companies will be held. Eight different companies, preferably two managers per company need to be interviewed, to gain enough input for this study. Organizations were selected based on a few criteria; the organization has over 250 employees, operates on a global supply base and has a significant purchasing volume.

3. The final step combines the findings from the interviews and the literature study to draw conclusions. Is a silo mentality prevalent at the companies interviewed? And how do the results in the empirical study correspond with the results found in the theories? The aim is to create a model, where several steps or levels which show the current position of a certain company and what needs to be done, if it wants to develop further. To determine what is needed to get to the next level, a checklist is made for each step. This checklist will contain processes, strategic decisions or IT functionalities which have to be met by the organization.

1.10 Interview method

Semi-structured interviews will be used to interview the managers of selected companies. The interviews will take about 1 hour per person. A questionnaire (see Appendix B) guides the interview along certain topics. However, managers are free to speak about their own experiences or business function. By adapting questions and anticipating to the answers of the managers the interview will take place. All of the interviews will be recorded (if agreed by the interviewed person) and notes shall be made.

The interviews will be a combination of structured and semi-structured questions. The structured questions are used to gather basic facts and figures about the company and business function. In the theory of Meridith et al. (1989) states:

The main reason for personal interviewing is to control the situation and responses, thereby aiding uniformity in analysis. The results may then be systematically analyzed through non-quantitative means or subjected to intensive statistical analysis to identify factors, clusters, and other such relationships in a statistically significant way. In structured interviewing, a fixed format is followed for the interview and the details of every answer are carefully noted as the interview proceeds. All questions are the same so that the typically constrained answers (check marks, values on a given scale) can be compared across interviews, situations, plants, and so forth.
(Meredith, 1989)

The reason for using semi-structured questioning techniques, is to be able to elaborate further on specific issues or developments rose by the interviewer. Again Meridith et al. (1989) explain why intensive or unstructured interviewing is useful:

Here, people are interviewed using open-ended questions. As issues or points of interest to the researcher arise, these are followed up on the spot or in later interviews to give further insight to the researcher. This approach is particularly good for the descriptive and exploratory phases of research. It has the advantage that the issues are framed by the participants and the researcher may not have even been aware of them.
(Meredith et al., 1989)

The exploratory phase of research is the reason why also unstructured interview questions are used. It allows us as researchers to ask for developments. Therefore we made not only a questionnaire but also a question matrix (see Appendix C) to ask open questions about certain topics.

1.11 Division in tasks

This assignment has been executed by two bachelor students. The aim is to work parallel as much as possible on the assignment. The research proposal will be written jointly by the two students. For setting up the interview and surveys with the companies, tasks will be split up equally.

Obviously, there will be parts in which one student does more work than the other. This will be compensated in other chapters/paragraphs. Writing the final report will be done together as well, except for the personal reflections. At the end, the presentation will be done by both.

2 Theoretical framework

A literature study will be conducted first of all. This is to give better insight in supply base management and eventually to be able to give best practices (per function). Therefore, the first sub question '*How should information concerning the supply base be optimally organized per business function according to academic literature?*' can be answered. This chapter concludes with a reference model which is used to make a comparison with the empirical study. This reference model is the summary of all paragraphs as stated in this chapter. Thus, this reference model is the answer to the first sub question.

The literature study is conducted using the online library of the University of Twente, several books and a reader for the course 'Purchasing' of the University of Twente. Scopus, Google Scholar, Picarta and the online catalogue from the University of Twente are used to search for articles, books and (online) journals. The 'snowball' method is used to quickly find journals and articles with many citations and good references. The snowball methods is a simple method where one picks an article leading on a certain subject (an article with many citations) and then uses the references of that article to search more articles. Many different search terms or key words are used to find a broad set of literature. To enhance results and to oversee the literature, this method proves very useful. In total, approximately 50 articles are found, which are used as input for this literature study (see 'References').

Keywords used: *supply chain, supply chain management, supply base, supply base management, performance management, supplier development, quality management, quality assurance, purchasing, asset management, planning, (NPR) procurement, ERP and trends in supply base/chain (management).*

At the end of this chapter, a theoretical framework is shown in Table 8. This is the summary of the literature study. This framework is the combination of the paragraphs in this chapter, presented in a table . It describes per function (see under *Focus* which functions):

1. Definition of the function according to the theory.
2. Which information and where is it needed to perform at the desired level?
3. What information is needed from other functions, and where is an overlap?

When all functions are described in terms of these three points, a comparison (in chapter *Results*) can be made with the results from the interviews.

2.1 Supply Chain Management

To understand where all functions are part of, the literature study will be started with supply chain management. Supply base management for example, is a part of supply chain management (SCM). Supply chain management however, is a very broad term for which academic literature offers many definitions. This section will give some of these widely used definitions, according to various authors/literature.

Some authors see SCM as a single process; not as different parts performing their own function (Tan, 2001). One way of looking at SCM is the 'system approach'. This is shown in Figure 2.

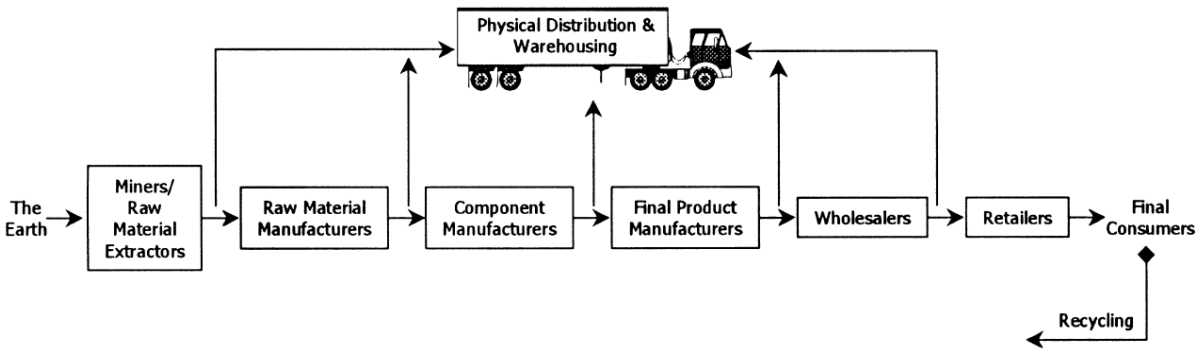


Figure 2: Activities and firms in a supply chain **Source: (New, Payne, 1995)**

Value chain is an acronym for supply chain. Figure 2 shows how a particular value chain looks like. It starts with the extraction of raw materials from the earth. Manufacturers, wholesalers and retailers eventually sell their products to the end users. Recycling has not always been seen as a part of the value chain. Now that environmental, ecological and CSR issues become more important, recycling becomes a fundamental part of the value chain (New, Payne, 1995).

This perspective at SCM, is characterized by the system approach; *'a sort of thinking that emphasizes the interdependence and interactive nature of elements within and external to an organization.'*
(Free computer dictionary, 2011)

Daft (2007) defined SCM as *'managing the sequence of suppliers and purchasers, covering all stages of processing from obtaining raw materials to distributing finished goods to final customers.'*

In an article of Tan (Tan, 2001), two definitions of SCM are given as:

Harland (1996) describes supply chain management as *'managing business activities and relationships (1) internally within an organization, (2) with immediate suppliers, (3) with first and second-tier suppliers and customers along the supply chain, and (4) with the entire supply chain.'*

Scott & Westbrook (1991) and New & Payne (1995) describe supply chain management as *'the chain linking each element of the manufacturing and supply process from raw materials through to the end user, encompassing several organizational boundaries.'*

According to Mentzer et al. (2001), definitions of SCM can be classified into three categories: 1) a management philosophy, 2) implementation of a management philosophy, and 3) a set of management processes.

From a management philosophy perspective, SCM is seen as a system approach (as visualized in Figure 2). A process which runs step by step thru the whole system. Other authors focused on the activities that procure SCM, this is the 'implementation of a management philosophy' perspective. These activities are:

1. Integrated behavior
2. Mutually sharing information
3. Mutually sharing risks and rewards
4. Cooperation
5. The same goals and the same focus on serving customers
6. Integration of processes
7. Partners to build and maintain long-term relationships

(Mentzer J. T., 2001)

A set of management processes is a viewpoint on SCM; all of the different functions within an organization are key processes. These functions must overcome their 'silo approach' and adopt a process approach. A process approach sees SCM as a single entity instead of individual parts or steps in the process, each performing its own function (Ellram L. M., Cooper M. C., 1990).

For this assignment, the definition of SCM from Mentzer (2001) is used. This because of the goals set to SCM, it is a theory which focuses more on what SCM could do for a company rather than a descriptive (or system) approach such as the theory from News and Payne. This research focuses on how in the end a company could be made better on a certain area, an theory which measures on performance is therefore more usable. The total definition the research uses is:
'the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.' (Mentzer J. T., 2001)

2.2 Purchasing

Purchasing and (not product related) procurement, are terms which are overlapping and very similar. Purchasing is the acquiring of goods and services from another company, a supplier, as input for an organization's production. Procurement can be a department, function or process in an organization. Therefore, procurement refers to the 'purchasing' process.

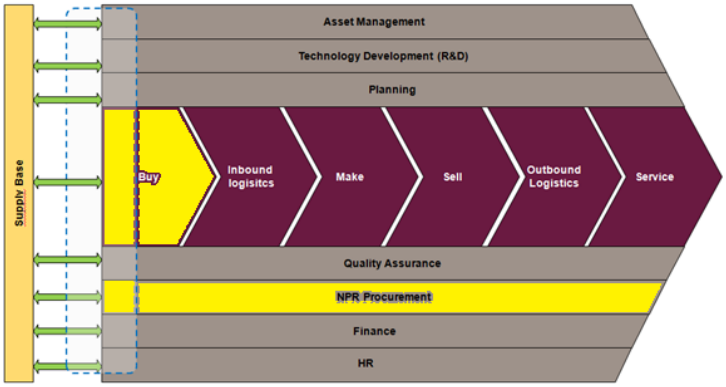


Figure 3: Position of (NPR)Procurement and 'Buy'

Purchasing according to van Weele (1994) contains the specification (what), selection (who), contracting (how), ordering, monitoring and the after-care activities for acquiring certain goods or services for an organization. NPR (not product related) purchasing refers to the purchasing of any item in the organization which is not related to the product itself. One can think of pencils, copy machines, chairs, etc.. In the context of supply base management in a manufacturing environment, procurement contains: contract management, Sourcing and P2P (Purchase 2 Pay).
Daft (2007), defines procurement as *'purchasing supplies, services, and raw materials for use in the production process'.* Whereas Rainer & Cegielski (2007), define procurement as *'sourcing goods and materials, negotiating with suppliers, paying for goods, and making delivery arrangements'.*

Purchasing can be defined as '*the management of external resources, in such a way that the supply of all goods, services, capabilities, and knowledge which are necessary for running, maintaining and managing the company's primary and supportive activities is secured under the most favorable conditions.'* (Telgen, Buter, Schotanus, 2007 - 2008) *and* (van Weele , 1994).
Many authors agree that purchasing is more of a tactical nature, whereas others procurement is more of a strategic nature.

The purchasing process contains six steps:

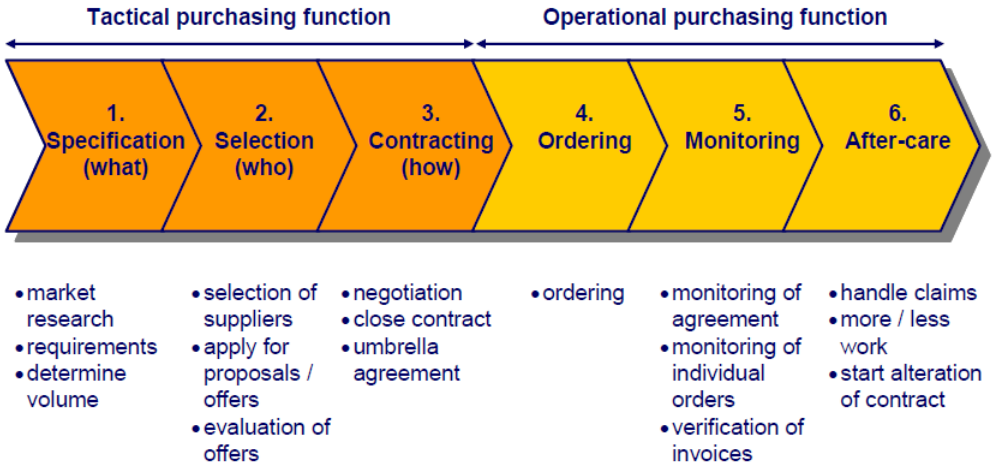


Figure 4: the purchasing process Source: Reader 'Purchasing' (Telgen, Buter, Schotanus, 2007 - 2008)

In the specifying phase, it is defined what is going to be purchased. Listing the requirements of the products/services, which are going to be purchased, is very important. Selection is about choosing the supplier who makes the best offer. The suppliers use the product/service requirement list to come up with their proposal. Then, the contracting takes place. In this phase, a supplier has been selected, and both parties try to agree on certain terms and conditions. Ordering is the actual request of a delivery. E-procurement focuses on this part of the purchasing process, because of the administrative processes involved.
Once an order has been placed, monitoring keeps track on incoming invoices, and whether the buyer and/or supplier abide on the agreed terms/conditions. Finally, the after-care is about handling situation in which

something has gone wrong during the purchasing process. Therefore, it uses information from the monitoring phase. (van Weele, 1994)

To highlight differences between purchasing and procurement (defined in the first part of this paragraph), some activities are listed in Table 1.

Purchasing activities	Procurement activities
Identification of purchasing needs	Material specification
Discussion with sales people	Material studies and value analysis
Identification of suppliers	Market research
Market studies	Purchasing functions activities
Negotiations	Management of supplier quality
Analysis of proposals	Purchase of inbound transportation
Selection of suppliers	Management of investment recovery
Issuance of PO's	
Contract administration	
Purchasing records	

Table 1: Differences between purchasing and procurement **Source: (Hahn, Kaufmann, 2002)**

The purchasing function has become more and more transit with supply management, where traditional purchasing was a function about buying goods and ensures they were there in the right amount, time and at the right place. As Kraljic (1983) mentioned that purchasing should become more like supply management. A purchasing manager should look more closely to her or his suppliers, vendor rating, risk management etc. were introduced (Kraljic, 1983)
Supply (chain) management has changed over the last decades. The costs of purchased goods and services are the majority of total costs or spend for most companies. Also, outsourcing of manufacturing activities, due to low labor countries and developing technology, ensures that companies are more and more dependent on other companies. When designing supply base management of an organization, the purchasing function therefore is very important. (Dubois, 2003). This importance of purchasing can also be described as Cammisch & Keough (1991) and Dyer (1998) state:

'A typical manufacturing company spends between half and three-quarters of its turnover on purchases such as raw materials, components and semi-manufactured goods'.

According to these authors, one may conclude that the purchasing function is of high importance to a company. The function performs many processes and faces many challenges. Therefore, scientists do not agree on a single best practice for the purchasing function.
There is no single 'best practice' on how to organize the purchasing function, as each organization is different. It can identify the best suppliers in the market, try to reduce costs in the supply chain or negotiate the best offers, the impact of purchasing is determined by the relative importance and corporate strategy of a certain company according to Ellram and Cooper (1990).

Gadde and Hakansson (1994) state there are three strategic issues to purchasing: 1) Make or buy, 2) design of the supply base structure and 3) the nature of customer-supplier relationship. In a make or buy decision, the challenge is to identify the most important, strategic components in the form of costs. When designing the supply base structure, the number of supplier and the organization of suppliers play an important role. When having few suppliers, a company is more dependent on these suppliers instead of having many suppliers. The organization of suppliers refers to the degree in which an organization has organized the managing of its suppliers; determining first, second and tier suppliers. The nature of customer-supplier relationship refers to the reduction of administrative, production and material flow costs. These costs can only be reduced when a buying company has and/or develops a close relationship with its supplier(s).

The information needs of purchasing

Purchasing needs information from many other functions and departments. In practice, this means doing audits, managing supplier performance and maintaining close relationships with suppliers (Kraljic, 1983). E.g. to make a vendor rating, the purchasing function needs information from operations concerning delivery times, payment details from finance and quality audit reports from QA. To determine what information purchasing needs,is difficult. Companies might have different priorities for certain key performance indicators (KPI's). For example, a food and beverage company could need information about quality as most important, whereas an offshore company has more preference for delivery time information.

Table 2 contains several 'types' of information which are used by the purchasing function. Under 'target' is described for what purpose the information is used. Under 'context' is described what the goal of using this information is. Under 'source' is stated from which function this information should be provided.

Type	Target	Context	Source
Delivery details (delivery times, quality etc.)	Rating of a supplier	Improvement of supplier performance	Operations
Quality audit reports	Rating of a supplier	Improvement of supplier performance	QA
Payment details	Minimize risk	Prevent from loss of supply	Finance
Rate of innovation participation	Select innovative supplier for R&D projects	Get innovation from the suppliers	R&D

Table 2: Information demand of purchasing

- *Operations:* Delivery information is used for one of the main tasks of purchasing; rate suppliers. This information is needed to make vendor ratings in order to keep track and improve the suppliers performance.
- *QA:* should provide information concerning the quality of products delivered by a supplier. It is not only interesting for purchasing to know what the quality of delivered products is, but also what quality standards a supplier uses. This is important to be able to make decisions concerning e.g. corporate social responsibility (CSR) and determine KPI's such as working standards or pollution numbers.
- *Finance:* (un)paid invoices can be used as input for measuring the financial status of a supplier.
- *R&D:* If an innovation project starts and supplier involvedness is necessary, purchasing has to choose which suppliers are best. R&D should thus provide information about how innovation driven the suppliers are, which impact they had on former projects, confidentiality etc.

2.3 Quality Assurance

Quality assurance (QA) contains practices that may be defined as '*a set of activities and attitudes in the firm that promotes collective involvement to work together in a process of continuous improvement and product and service quality assurance'* (Gonzalez-Benito, Martinez-Lorente and Dale, 2003).
In the context of supply base management in a manufacturing environment, quality assurance can be for example: supplier auditing, supplier certification, incoming goods inspection and monitoring supplier performance/products. Figure 5 shows the place where QA is placed in Porters model.

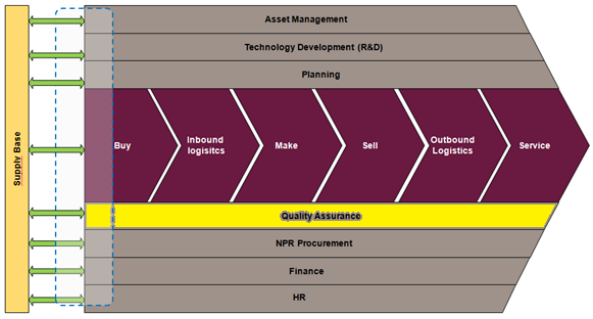


Figure 5: Position of QA

QA, risk and corporate social responsibility (CSR), are hot topics in supply chain management nowadays. Customers and governments are increasingly focusing on CSR. CSR means that a corporation may be held responsible socially and ethically accountable, in relation to its stakeholders (employees, customers, communities, governments, etc.) (Maloni M. J., Brown M. E. , 2006).

QA refers partly to the inspection of purchased goods; process control, building quality into the product; and process improvement; modification of the process (Tan, Handfield and Krause, 1998). Certification systems, ISO 9000 and similar quality systems are important for internal operations of QA; it ensures that supplied components meet the product specifications. Reason is to ensure the quality of the production process. Quality of purchased products has always been one of the main performance indicators of an organization. In supplier selection, quality is used as one of the major drivers for selecting and choosing suppliers.

For managing quality assurance, a good supplier-buyer relationship is most important. This is measured in many ways, but Goffin (2006) states the following: *The relationship between a manufacturer and supplier can take many forms and the distinguishing factors have been identified as the number of transactions, the longevity of the relationship, and the closeness. Close relationships with selected suppliers can enable manufacturers to reduce costs, improve quality and enhance new product development* (Goffin K., Lemke F., Szwejczewski M., 2006). So to keep a good relation, information such as the number (and value) of transactions should be saved within an organization.

Nowadays, more and more organizations are linking quality assurance to supply chain management. The combination of these two concepts can be called Supply Chain Quality Management (SCQM). SCQM can be defined as '*the formal co-ordination and integration of business processes involving all partner organizations in the supply channel to measure, analyze, and continually improve products, services, and processes in order to create value and achieve satisfaction of intermediate and final customers in the marketplace'* (Robinson, Malhotra, 2005)

Companies use supplier evaluation and performance measures, to identify supplier shortcomings. The measurement of suppliers' delivery, quality, and cost performance, site visits, certification of suppliers' products and processes, and the setting of performance goals are examples of such measurements (Tan, Handfield and Krause, 1998)

QA information demands

Delivery information, quality of purchased products and cost performance are indicators which are collected at operational level. Site visits are often done by QA itself. To get access to certifications (and contracts) of suppliers, QA should consult purchasing. This is because purchasing is responsible for these certifications. Purchasing needs quality KPI's and QA needs agreements and certifications from suppliers. Obviously, it can be possible that certifications are gathered directly from the supplier, but the purchasing function should be the communicator towards suppliers and thus supplying such information to other functions. An overview of these requirements is given in Table 3.

Type	Target	Context	Source
Delivery details (delivery times, quality etc.)	Rating of a supplier	Improvement of supplier performance	Operations
Certifications and contract	Keep up running contracts and regulations	Maintain a high quality	Purchasing

Table 3: Information demand of QA

2.4 Asset management

Asset management has many definitions. The term 'asset' refers to property owned by a person or company, regarded as having value and available to meet debts, commitments, or legacies (Oxford Dictionaries, 2011).

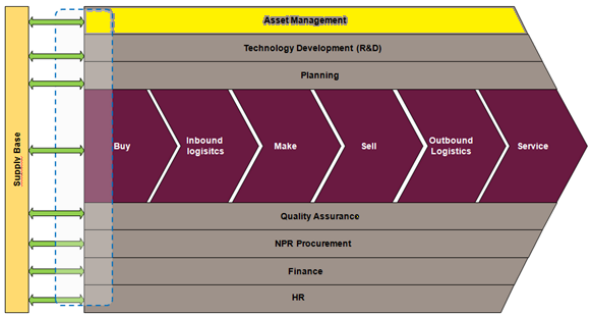


Figure 6: Position of Asset Management

According Michael (2005), asset management can be defined as *'The process that guides the gaining of assets, along with their use and disposal in order to make the most of the assets and their potential throughout the life of the assets. While doing this, it also manages and maintains any costs and risks associated with the assets. It is not something you can buy, but rather a discipline you must follow in order to maintain your assets.*

There are 5 main points an asset manager should entail:
1. Optimize asset use and manage all maintenance efforts involved by making assets as accurate, reliable, and efficient as possible.
2. Reducing the demand for new assets and thus save money by using demand management techniques and maintaining current assets.
3. Uses a form of asset tracking: knowing *where* the asset is at all times, how much the asset is *worth*, and how much the asset cost you to begin with. It should also incorporate this throughout the entire life of the asset.
4. Always try to achieve greater value for money through evaluating the asset options: the cost of maintaining, producing, the use of it, etc.
5. Always provide a report on the value of the assets, along with any costs involved in maintaining the assets. (Michael, 2005)

In the context of supply base management in a manufacturing environment, asset management can be described as the management of *physical capital*. Decisions related to the supply base are e.g.: plant maintenance/investments, equipment for bill of materials (BOM) and material requirements and inventory management of spare parts.

Asset management in relation to other functions

Asset management needs information from several other functions in the organization. In Table 4 is shown what information is needed exactly.

Type	Target	Context	Source
Asset financial details	Make decisions on repair or buy problems	Optimize the use of assets	Finance
Status of assets on the work floor	Clear overview of status from assets	Prevent unexpected repairs or failures and minimize costs	Operations

Table 4: Information demands of Asset Management

- *What it is worth* concerns obviously information that should be provided by the financial function/department. E.g. information about depreciation and weighted average cost of capital.
- *What the current condition*, *deferred maintenance* and the *remaining service life* is a task for operations to check. Sometimes asset does this on its own, but companies which produce and operate globally often do not have an asset management functions at all its operating facilities.
- *What they own* and *what they fix first* are things that asset management have to do on their own. With the help of operations they should have lists or databases with information about what is where and combined with the other entire information step 6 can be made.

Asset management needs a lot of information from operations and marginal information of finance. What is actually shared by the asset management function with suppliers, is limited to maintenance. Regular communication with suppliers about the state of machinery for example seems reasonable.

2.5 Inbound logistics

Materials handling, warehousing (management), inventory control and transportation are concepts which define this function. In the context of supply base management in a manufacturing environment, inbound logistics activities can be: material planning, store management, inventory management and logistics management.

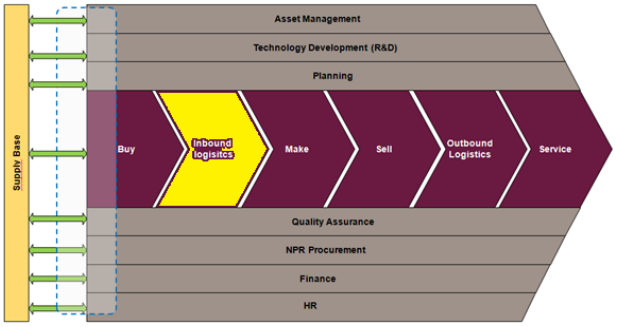


Figure 7: Position of Inbound Logistics

Nowadays, many organizations have a huge amount of suppliers all over the world. Logistics have a crucial role in the purchasing process, as it is concerned with the physical transportation of these products. To perform as a company on a global basis the logistics need to be well organized. However, a well organized network of suppliers and logistics processes does not guarantee improved organizational performance (Stock, 2000). According to Wu et al. (2006), there are ten risk factors concerned with inbound logistics. By managing these risks, the company can save money, time and effort. The ten risk factors are:

1. Quality
2. Cost
3. On-time delivery
4. Engineering/production
5. Technical/knowledge resource
6. Financial and insurance issue
7. Management related issue
8. Accident
9. Market strength
10. Internal legal issue

Inbound logistics information requirements

To manage and control the ten risk factors, inbound logistics has to communicate with other functions. In Table 5 is shown what information is needed. Below the table is explained what the information contains and if it is used by other functions as well.

Type	Target	Context	Source
Delivery details (delivery times, cost, quality, accidents etc.)	Reduce risks	Monitoring of incoming goods	Operations
Engineering and technical resource	Have knowledge from what is on the floor	Prevent unexpected repairs or failures and minimize costs	Operations/Engineering or Make
Financial, internal legal & management issues and the market strength	Keep up with current policies	Ensure the company its strategy and policies are followed	Purchasing/Finance

Table 5: Demand of information for Inbound Logistics

- Information about *Quality, Cost, On-time Delivery* and *Accident* is documented operational level. Thus, operations has to provide this kind of information to inbound logistics.
- *Engineering* and *Technical resource* information is being documented to prevent unexpected maintenance or machine failures. This information can be gained from engineering and production or in the Porter model the 'Make' part.
- The other items such as *financial issues* are gathered from either finance or purchasing. Most of the time, these issues are policies that all functions within an organization have to deal with. To keep up with these issues, inbound logistics should be provided with information about these issues (in document form).

2.6 Finance

This department is concerned with all financial activities of an organization. In the context of supply base management in a manufacturing environment, finance activities can be for example: financial administration, spend analysis or invoice control. The position of finance in Porters model, is shown in Figure 8.

Making payments, invoice controlling, bank guarantees, processing and regulating discounts and managing the conditions of payments are the core activities of finance. Besides these activities, finance supports purchasing in risk management. This is because when dependency increases between companies, in the form of supplier-buyer relationships, exposure to risks of other companies increases (Hallikasa, 2004).

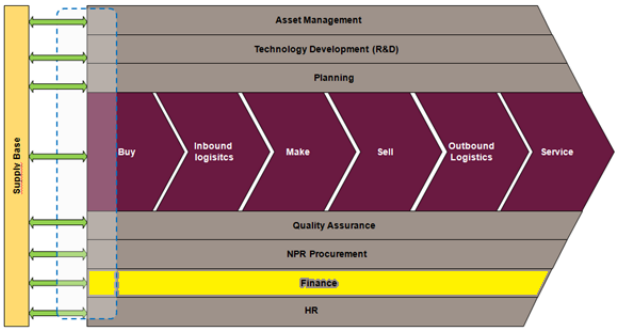


Figure 8: Finance its position in Porters Model

Valuation of supplier risks is done using several indicators. The direct risk of bankruptcy on one side, and the risk of becoming too dependent on a single or more suppliers on the other.

The issue of bankruptcy is that suppliers who not deliver any longer, while a payment has already been made, and so the production is in danger because the (unexpected) loss of supply. The other side is becoming too depended on a single or more suppliers, meaning there is little room for negotiation in price. The valuation of suppliers is done using complex models, trying to predict and foreseeing risks of suppliers. It is the responsibility of purchasing that the supplier's portfolio is managed; it is finance that supports them in doing so.

Academic literature does not state on how to deal with bankruptcy of a supplier or how invoices should be handled. A reason might be that a best practice is a breakeven point between the risk of failure and the lower price for materials of products. It is up to a company to set their own breakeven point according to their strategy. The dependency on suppliers however, is a field of study where many scientific articles are written about.

It is for a company important to be not to dependent on their suppliers. When the dependency between companies increases, they become more exposed to the risks of other companies. Networking also increases the supplier responsibilities and sometimes investment risks may be transferred to the suppliers. The optimal strategy is to aim at share and balance rewards and risks between organizations. Companies should also avoid being too dependent on a single network or organization. (Hallikasa, 2004)

Choi & Krause (2006) state it may be true that high complexity of the supply base network leads to high transaction costs and high supply risks. So there is an optimum between different strategies. The challenge for each company will be determining where that optimum lies within their strategy. That optimum is determined by purchasing and supported by finance. So the question is, what information does finance need to support purchasing in their decisions? This is discussed in the next paragraph.

Information needs for finance to support purchasing

Finance exchanges a lot of information with purchasing. However, purchasing is not the only function which needs information of the finance department. In Table 6 is summarized what type of information finance needs.

Type	Target	Context	Source
Contract details	Keep up with all contracts	Contract management, ensure discounts are included etc.	Purchasing
Delivery details, completeness and on time delivery	Pay only for delivered, good and on time products	Keep the financial flows in the company at a safe levels	Operations
Quality of delivered products	Meet the set standards	Contract management	QA

Table 6: Information demand of Finance

- To execute their core processes, finance needs information from other functions. Information concerning payments, price hedging, supplier quotations need to be provided by purchasing. Details are often summarized in framework contracts. On the other hand, finance provides purchasing with financial details about suppliers.
- To check if deliveries of suppliers are complete, finance has to match invoices with deliveries. This information needs to be provided by operations. Specific details such as the completeness of a product or any damages are relevant for finance, for e.g. waiting or making payments to suppliers.
- Again to check on incoming supplies, information from QA is needed about the quality of the purchased goods as they are delivered.

2.7 Research & Development

The R&D function handles issues regarding research & development and new products and/or process innovations (Dowlatshahi, 1998). In the context of supply base management in a manufacturing environment, technology development activities can be for example: design and product life cycle management, product development or innovation management. The relation with the supply base may particularly be important for open innovation, an innovation strategy where a company not only invents new products etc. by them self but also learn from their suppliers (or other actors in the supply chain).

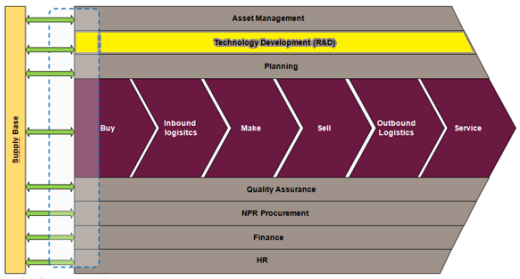


Figure 9: Position of R&D

The R&D function handles most of the product development processes. An important aspect of these processes is the new product development (NPD). It is here were R&D has it links with suppliers. The influence of a supplier in product development is defined as the integration of capabilities (Dowlatshahi, 1998) or as the information suppliers provide and their participation in decision making (Handfield, Nichols, 1999). In terms of using innovation in products and the organization, Stones (2001) states that suppliers are the most important external resource for co-operation ahead of customers and all other partners nowadays.

In an article of Echtelt (2008) is argued that the main factors to achieve a successful involvement of supplier in NPD, concerning two important aspects; how a company deals with them on a project basis and how they deal with them on a more long-term strategic level.
According to this part of the study, van Echtelt(2008) concluded that companies spend too much time on the operational aspect of a relation with the supplier. In contradiction, companies should have a set of strategic decision-making processes that help to create an alignment in the long-term with a supplier. Giving the supplier influence from the design phase, new product development increases the chance to establish a long-term relationship. Combined with a more strategic view on supplier management, firms can benefit more from their R&D (van Echtelt, 2008).

Information requirements from R&D

According to the theory, R&D should (try to) sustain a long term relation with suppliers. What type of information is needed for this relation is not really clear. Obviously, sharing of this information should be smooth. The purchasing function has most contact with suppliers, so it is purchasing which should provide R&D with useful information. This information contains innovative ideas from suppliers or new product developments from the market etc.

This means R&D gets only specific information of purchasing, concerning innovation related issues. The target for R&D is to use this information to start innovation projects collaboratively with suppliers, in the context of open innovation rather than closed innovation.

Type	Target	Context	Source
Innovation related information (e.g. market developments)	Start innovation projects with suppliers	Innovation should not only come from the company itself but also from suppliers	Purchasing

Table 7: information needs for R&D

2.8 Reference model

To summarize the theory as stated in the paragraphs, a reference model has been made and is shown in Table 8. It summarizes what kind of information is needed according to theory and of which business function this information should be provided. The model contains several 'types' of information which are used one or more business function(s). Under 'target' is described for what purpose the information is used.. Under 'context' is described what the goal of using this information is. Under 'source' is stated from which function provides this information. Under 'user' is described what business functions use this information.
With this reference model, a comparison can be made with the results of the empirical study.

Type	Target	Context	Source	User
Delivery details (delivery times, completeness etc.)	Rating of a supplier	Improve supplier performance	Operations	*Purchasing*
Quality audit reports	Rating of supplier	Improver supplier performance	QA	*Purchasing*
Payment details	Minimize risk	Prevent from loss of supply or money	Finance	*Purchasing*
Delivery details (delivery times, completeness etc.)	Rating of a supplier	Improve supplier performance	Operations	*QA*
Certification and contract details	Keep up running contracts and regulations	Maintain a high quality	Purchasing	*QA*
Asset financial details	Make decisions on repair or buy problems	Optimize the use of assets	Finance	*Asset Management*
Status of assets on the work floor (engineering & technical resource)	Clear overview of status from assets	Prevent unexpected repairs or failures and minimize costs	Operations	*Asset Management*

Payment details	Reduce risks	Monitoring incoming goods	Operations	*Inbound Logistics*
Status of assets on the work floor (engineering & technical resource)	Have knowledge from what is on the floor	Prevent unexpected repairs or failures and minimize costs	Operations/Engineering or Make	*Inbound Logistics*
Financial, internal legal & management issues and the market strength	Keep up with current policies	Ensure the company its strategy and policies are followed	Purchasing/Finance	*Inbound Logistics*
Payment details	Pay only for delivered, good and on time products	Keep the financial flows in the company at a safe levels	Operations	*Finance*
Certification and contract details	Keep up with all contracts	Contract management, ensure discounts are included etc.	Purchasing	*Finance*
Quality of delivered products	Meet the set standards	Contract management	QA	*Finance*
Innovation related information (e.g. market developments)	Start innovation projects with suppliers	Innovation should not only come from the company itself but also from suppliers	Purchasing	*R&D*

Table 8: Reference model

3 Data collection

To answer the research questions, data is collected by using an empirical study. This chapter gives an overview of the companies which participated in this research, and how these have organized their purchasing function. The information gained during the interviews will be compared with the reference model in chapter 4.

The data was gathered with semi structured interviews, based on face-to-face conversations with one or two quality, purchasing, R&D, asset management, finance and/or supply (chain) related manager(s). Most interviews took place at an office or headquarters of these companies itself, and lasted for approximately one hour. The interviews were recorded and written reports (in Dutch) were elaborated from the audio file.
To obtain enough data and input for our research, managers from eight different organizations have been interviewed. Organizations were selected based on a few criteria: the organization has over 250 employees, operates on a global supply base and has a significant purchasing volume. This is to get significant results, as the purchasing function within those companies plays a significant role.

Table 9 shows which companies and persons were interviewed. It also shows to what position in the organization the interviewers is reporting to.

Company	Position of interviewed person in company	Interviewed person in company reports to
Electronic/telecommunication company	Director Procurement Services/proc. & design to cost manager	CPO
Off Shore company 1	Consultant to procurement manager	Procurement manager & VP corporate services
Off Shore company 2	CPO	COO & Fleet manager
Oil company	CPO	Global purchase manager
Food & Beverages company 1	Procurement manager	CPO
Food & Beverages company 2	Procurement business process manager/ supplier QESH man.	CPO/ technical director
Aviation company	Procurement manager	CPO
Electronic/aerospace company	CPO/Head of SCM	COO

Table 9: Position of interviewed managers

The next paragraph describes what kind of organizations participated in this research.

3.1 Participating organizations

Eight different companies participated in this research, and ten managers were interviewed. At two companies, two different managers were interviewed. This paragraph will briefly describe what kind of companies were involved, how they are organized (especially the function in which the interviewed manager is active), and what geographical presence the companies have. The paragraph concludes with a summary of information about the companies interviewed.

To start, Figure 14 shows a part of the results of the questionnaire. It provides details about the percentage of third party expenditure and key suppliers, as well as the (total) number of employees and in the purchasing function. This is part of the structured interview method as described under paragraph 1.10.

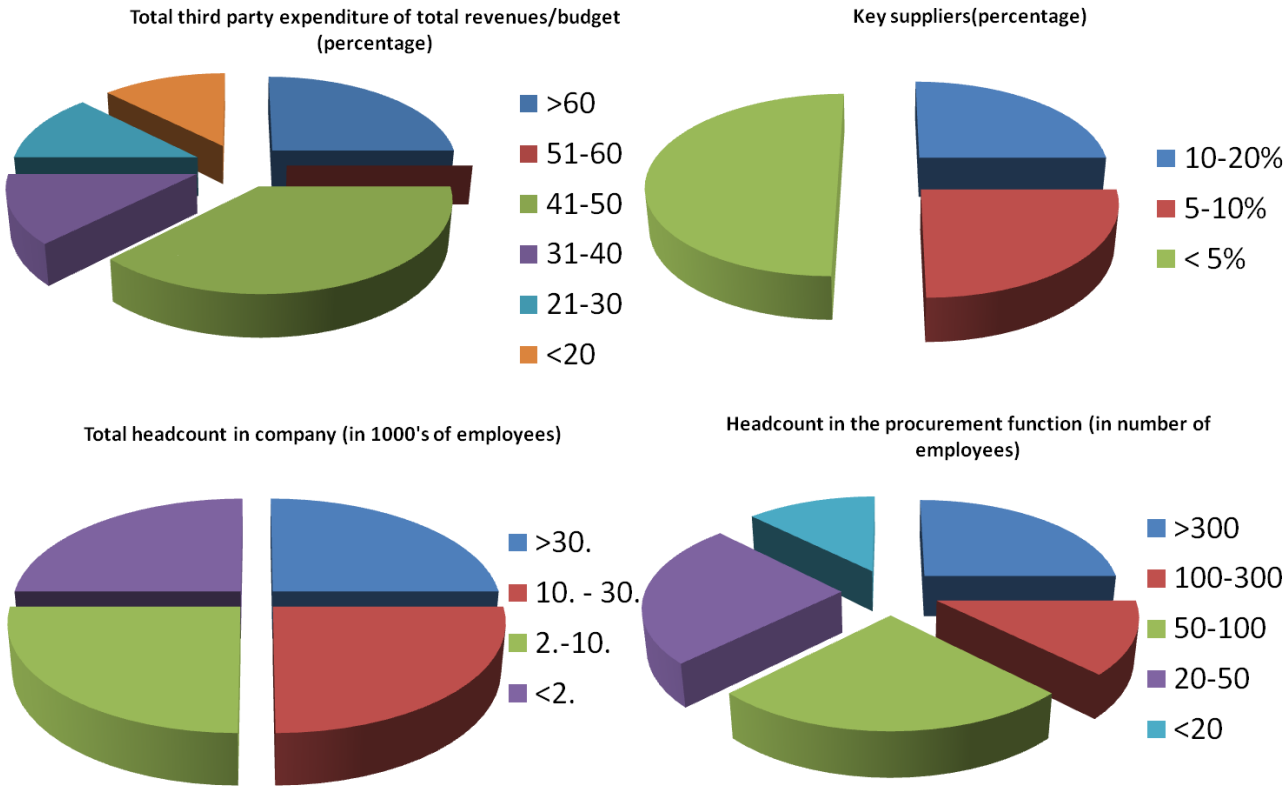


Figure 14: Results of the questionnaire

If one looks at the structure of the organization from the companies, some differences can be seen. At **food & beverages company 1** for example, different operating companies (opco's) are responsible for their own production, sales and profit. These opco's are divided on their geographical location. The purchasing function is only responsible for the delivery of the purchased goods to these opco's. **Food & Beverages company 2**, is organized in a similar way. The organization is decentralized, and various production sites are responsible for their own in-and output in terms of production and profit.

Off-shore company 1 on the other hand, is organized in a centralized manner. The purchasing function in this company is more seen as a support function. **Off shore company 2** is most traditional when it comes to purchasing. Their business is managed at the headquarters, and operations take place on different sites/locations around the world. These operating sites/locations place orders and the purchasing function just makes sure that these ordered materials/services are delivered on site and on time. The purchasing function is seen as an ATM, which only has to pay the bills. This is a very traditional way of purchasing.
The **aviation company** has a centralized purchasing function, which supports the three different business units. Within the purchasing function, ten different domains operate; each with their own scope and 'spend'. These domains report to the CPO of the company. The purchasing function is responsible for the whole purchase process of all these domains. Purchasing itself does not have any 'spend'. The different businesses have their own 'spend', for which purchasing is responsible.

The oil company is organized decentralized. Its headquarters supports the various production facilities around the world. These production facilities are responsible for their own production, purchasing, suppliers, profit, sales, etc. The role of the purchasing function is therefore different in each of the production facilities. However, purchasing is mostly concerned with PO's, payment of invoices, and supplier related issues.
The **electronic/telecommunication company** is organized around three different operating segments and three different geographical regions. All of these segments and regions have their own purchasing function.

However, this company has only one centralized production facility for all of its products. Lastly, the **electronic/aerospace company** is organized around five main business functions. The company is decentralized, and has many (production) sites all over the world.

Concluding, most companies are organized in a decentralized manner due to their size, amount of employees and geographically dispersed (operating) facilities all over the world. Often, these companies are organized around a few main business units or segments. Table 10 gives a general overview of the firms which participated in this research.

Company	Organization structure	Organization of purchasing function
Electronic/telecommunication company	Decentralized	Project based, limited number of manufacturing facilities
Off Shore company 1	Centralized	Project based
Off Shore company 2	Centralized	Ad hoc, project based
Oil company	Decentralized	Project based
Food & Beverages company 1	Decentralized	Centralized, complete mandate to purchase for OPCO's
Food & Beverages company 2	Decentralized	Centralized
Aviation company	Centralized	Centralized (support to their business units)
Electronic/aerospace company	Decentralized	Project based

Table 10: General overview of interviewed companies

3.2 The omission of inbound logistics

During the interviews, it became clear that the managers could not provide sufficient and relevant information about the inbound logistics function. A reason was that most interviewed managers were active in (very) high management levels. Therefore, the inbound logistics function will be omitted in chapter 4. It is included in chapter two to give an overview of the complete (initial) focus of the research.

4 Results

This chapter analyses the results found during the interviews. First will be discussed whether a silo mentality/silo organization was prevalent and how this affects supply base management performance (par. 4.1). Secondly, a description of the organization of the purchasing function in the companies which participated in this research. Next, issues and/or conflicts which the interviewed managers indicated in their organization are described. The description of the purchasing functions and the issues and/or conflicts will be combined in paragraph 4.3. Next, a comparison of theory and result of the interviews (par. 4.3). This chapter concludes with a table of summaries (par. 4.4).

4.1 The silo mentality & organization

An assumption made in this research, is that a silo mentality (see Figure 10) may be the cause that organizations are not able to react properly to the megatrends. To answer the second sub question of this research '*Do companies experience a silo mentality in their organization and what kind of effects does this have on their organization?'*, this paragraphs describes the answers given by the interviewed managers during the interviews, as an answer to this second sub question.

During the interviews it became clear that all companies unanimously recognized the stated problem. That is; the use of different IT systems resulting in a limited way of information sharing and eventually a low supply base management performance. However, what kind of effect did this have on their actual supply base management activities and how did the problem reveal itself? The managers did not recognize a problem concerning the human resource aspect of the silo mentality; employees did appreciate SC wide performance, wanted to share information and risk/rewards. The way in which the organization was organized and the way in which information systems were used, was the real problem. So there was a silo organization present rather than a silo mentality.

A silo mentality was not present, because the purchasing function was given a leading role in sharing information about suppliers. Many other departments and functions, communicated via the purchasing function to suppliers. Therefore, employees did not work through a silo approach in relation to supply base information sharing.

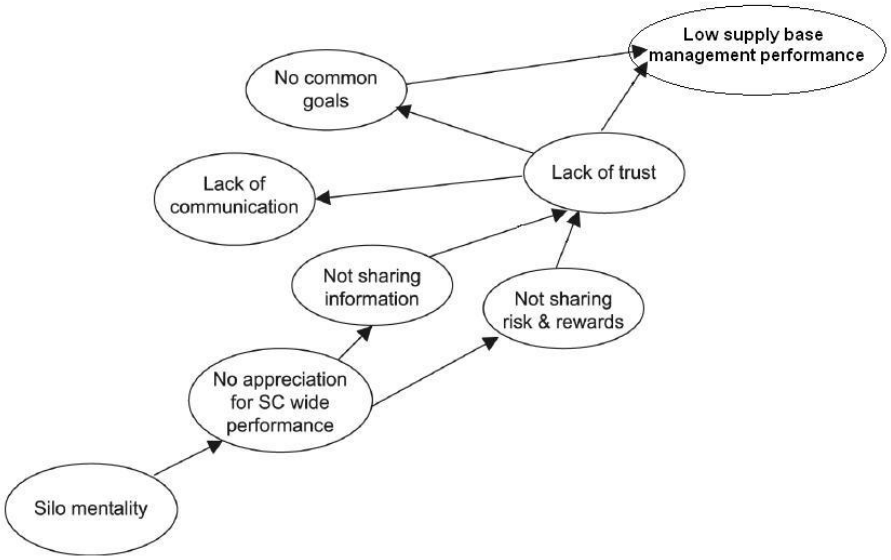


Figure 10: The silo mentality Source: (Rahman S., 2002)

What the managers did see, was a lack of information sharing, communication and the rewards and risks were not being shared. This was not because the employees did not want to share information, but because these

employees could not share information in the first place. The number of different IT systems, procedures and communication tools was so enormous, so that integrations between functions was very difficult. In practice this meant that a lot of essential information was manually send to other functions. Which again resulted in slow, inefficient and inaccurate supply base information sharing. It can be symbolized by a quote of a manager from the **food & beverage company 1**; *"every opco had its own IT systems, resulting in tens of different systems across the entire organization".*

4.2 Most important topics

To discuss the issues and conflicts managers come across when trying to use information effective in managing their supply base, it is necessary to describe how the companies are organized at this moment. Therefore, first will be described how the purchasing function is currently organized within the eight different companies. Secondly, comparing these descriptions with the reference model. By doing so, the answer to the third sub research question '*What, in practice, are the information needs of the purchasing, quality assurance, asset management, inbound logistics, finance and R&D function in order to manage supplier performance and supplier risk?*' can be formulated.

4.2.1 Organization of purchasing (processes)

In the companies of the managers interviewed, the purchasing function is organized in many different ways. This is can be concluded due to the first question of the semi-structured interview; *how is your purchasing function organized?* Table 11 shows what main process of each function is, according to the interviews. The rest of this paragraph describes why companies have organized their purchasing function in this manner.

Company	Main process
Food & beverages company 1	Negotiations
Food & beverages company 2	Gathering data
Offshore company 1	Auditing
Offshore company 2	Ordering
Aviation company	Keeping track of business activities and give consult to other business units
Oil company	Advise on tenders
Electronic/telecom company	Advise business units on forecasts in sales from their customers
Electronic/aerospace company	Support projects with consult about ordering, quality checks and supplier related problems

Table 11: Main process of each function

At food & beverages company *1*, the key process of the purchasing function is mainly concerned with the negotiations with suppliers about the price of raw materials. This is because of the volume/quantity of these input materials. The operating sites 'simply' order goods, and the purchasing function makes sure these goods are purchased and delivered. At **food & beverages company 2**, an interesting SRM tool is being used in the purchasing function. This tool rates suppliers on the basis of certain criteria. These criteria enhance the quality, service, innovation and cost/value of suppliers. The results of this SRM tool are being presented and discussed with many of the suppliers. They do this 2 or 4 times each year and the results are used as input for negotiations with these suppliers.

Most important processes at **Offshore company 1** enhance quality and financial topics. Complexity, level of customization, risk, value and trust are the criteria for quality inspections. E.g. when a purchase order (PO) gets more complex, quality assurance is done at the site of the supplier itself. It is there were ordered products are checked and inspected. Pre-qualification is being performed before any PO is send to a supplier. In this manner, the company orders only from pre-qualified suppliers to ensure quality and other criteria. Financial qualifications are done on the basis of bank guarantees. From the planning department, parts of information are combined into project reports. These reports are leading for making decisions in the purchase process. **Offshore company 2** is a different story. This organization is organized very traditionally, and therefore the purchasing function is 'simply' about purchasing goods, for which the operating units have placed orders. Business is done on a day-to-day basis, very ad-hoc. Picking up the phone, ordering goods, and get these

delivered on time and in the right quantity, is all that really matters.

The aviation company, employees of different functions of the organization are involved in a purchasing decision, due to the relative importance of the decision. Most important process for the purchasing function, is keeping track of its business units, and providing consult were needed. Request for X's (were X means 'information', 'quotation', or 'tender', etc.) are important. Complexity and value of the purchased goods are criteria for dealing with suppliers. Suppliers which have a relatively big impact on the business, have a structured meeting agenda with the aviation company, the top of the purchasing function and someone of the business concerned will be present during these meetings.

At the oil company, a complicated system is being used for investments. When an operating facility or plant wants to build a new (part of a) factory or machine, this request has to be put into their capital management system (CMS), a year in advance. Then, all of the stakeholders to this decision gather and discuss the requested investment in terms of the expected value of this investment. When a request is explained in more detail and clearer, it may be easier for all these stakeholders to make a positive decision.
Ideally, the engineering department comes to purchasing and asks 'We want to build a new chimney in one of our factories, how much is this going to cost?' Then the purchasing department sets out tenders and looks for the (best) options, and gives advice and consult to the stakeholders about this request.

For **the electronic/telecommunication company**, most important process is that they advice the business about the forecast of purchases from their customers. This forecast is more stable and easier to give in each of the different segments, due to the market this segment operates in.

Much of the business of the **electronic/aerospace company** is project based. This means that work is done through an extended process in response to a problem, complex question or challenge. Usually, a (cross functional) team is composed consisting employees of all business function, due to their importance to the project. These teams decide which suppliers are chosen for the particular project. Because of government regulations and laws and the fact that much of the project is long term driven (30 years or more), the supply base is relatively fixed. Changing and choosing suppliers almost never really happens. This is because the customers of this company (large aircraft manufacturers) have a certain preference for one or more suppliers, so it are these suppliers which the electronic/aerospace company works with often.
In supplier selection therefore, not much is possible in the **electronic/aerospace company**. The tendering of commodities is done more often, but it is less relevant because the indirect cost/spend is more than four times less than direct cost/spend. The purchasing function can track all spend, using dashboards. Input for these dashboards in terms of information, is being delivered by other departments or functions.
However, suppliers undergo a QLTC test. Quality, logistics, technology and cost are being measured to have a better insight in a suppliers performance. This QLTC test are performed by (cross functional) teams. For the financial performance analysis of a supplier, Dun & Bradstreet measures are used.

4.2.2 Issues in the organization

Issues in SBM in the **food & beverages 1** company mainly concern the monitoring of supplier performance. There is almost no involvement of the purchasing function in (innovation) projects. Also, the purchasing function has no direct insight in what happens at operational level. They could not say how much, where and what was produced at one of their operating facilities on a certain day, week or month. Supplier performance is measured by using excel sheets, provided by the operating facilities. However, these excel sheets contain data which is two to four weeks 'old'.

'I have absolutely no idea what was produced in France yesterday!'

CPO food & beverages company 1

Secondly, when the R&D and engineering department of **food & beverages company 1** decided to develop or launch a new product, purchasing was often involved almost at the end of such a project. 'We have a developed a new product with one or more suppliers, and oh yeah; here is the bill!'. Lastly, when an opco decides to buy or use a new system or machine, they do this based on earlier experience of preferences. Not

on the basis of financial calculations.

At f**ood & beverages company 2**, issues in the purchasing function relate to communication issues the lack of IT support. There is no clear policy about who may contact suppliers. For example; when a critical error (wrong products are delivered, or bad quality/quantity) occurs at an operating facility, the director of this facility picks up the phone and calls directly to the head of supply chain management. In his turn, this manager calls the purchasing manager and asks 'What are these guys doing?', while purchasing is not aware of the situation at all.
Another example; when a supplier has delivered goods at an operating facility, but products are of bad quality, the head of the facility sends them back. As a result, this operating facility cannot produce for a whole day. So the director of the facility calls the supplier, tells him what the problem is and sends a financial claim for their missed production. Then, the supplier calls the head of supply chain management, and asks what is going on. Again, there is no clear policy in who is reporting to who, and who is authorized to make financial claims for instance. However, this company has a strong policy on SRM, but it is supported by an old IT system. Much information about operations must be put into the system manually, which is time consuming, leads to low efficiency, higher change of human mistakes and above all, a high administrative load. When dealing so much with the IT systems about SRM, there is simply no time for more processes such as risk management and supplier performance management. When one compares this to the reference model, one can see that the purchasing function should do a lot more than collecting data.

At the **off shore company 1**, the main issue concerns the lack of communication between functions and the silo mentality of each of the department/functions of the company. 'Why would we do something for finance, as this process does not contribute to any value to our department?' They see extra work as an (administrative) workload for a department, while its employees do not see the benefit.

Offshore company 2, mainly has to deal with its own internal organization. The integration of streams of information between information systems; the very basic standards of these systems and their time consuming operations are conflicts in this company. Around the world, this company uses many different systems, in which only intervention through Excel is possible. A single central system is simply not possible with having so many geographical differences.

'It is not valuable to be doing SBM directed at your suppliers, when you do not have your own internal organization aligned.'

CPO offshore company 2

The respondent at the **aviation company** points out that conflicts concerning the purchasing function relate to the speed and user friendliness of the information systems being used. Analysts and salesmen of the organizations need certain information, but due to the complexity of the queries in the information systems, this information cannot be easily acquired. As a result, much is done manually and gathered through different operations.

The main conflict at the **oil company**, is the quality of goods delivered by their suppliers. Since the crisis in 2008, awareness raised about supplier quality, performance and risk management. Before 2008 they did not track this at all. Nowadays, supplier evaluation takes place once a year. These evaluations do not concern what kind of goods a supplier delivers, but what kind of systems they use. Does a supplier has a backup plan or is it even certified? How about the financial status of a supplier? It is only recently that the oil company tries to answer these kind of questions.

At the **electronic/telecommunication company** issues concern electronic information exchange with suppliers, late reaction to market developments and the huge amount of different stakeholders. Their information exchange is very traditional nowadays. A PO goes out on paper or email, and an invoice comes in via email or paper. This process could be supported digitally, through the use of information systems. Furthermore, their reactions to market developments occur too late. When a need, opportunity or risk is identified, a cross functional team is combined and starts working. This happens always after a certain issue has occurred, never

before. Continuous process development needs to be developed. Lastly, because the organization is huge, and therefore the amount of stakeholders and suppliers is also big, it is difficult to keep track of all these stakeholders. The interviewed manager pointed out that customers and suppliers each have a different view on the company, and thus have different expectations.

Issues in the **electronic/aerospace company** circumscribe the monitoring of supplier performance. Much information is kept in Excel files, and is therefore slow and not very professional according to the interviewed person. Restrictions of excel limit themselves not only to the speed of using information systems, but also to the possibility of making complex cross interfaces. There is a certain limit to the use of Excel whereby appropriate monitoring is not possible.
Much information needed by strategic levels in the organization, is not transparent or easily available, which could lead to less flexibility or missed opportunities. Often, projects exceed the budgeted time needed, chance of getting a financial claim rises or department get into trouble with their planning.

Concluding this paragraph, most companies acknowledged that they were dealing with poor IT systems. This results in a lack of communication and the difficulty of monitoring suppliers directly. The problem of ineffective and old systems is due to the different policies companies once had.

4.3 Comparison with reference model

The organization of the purchasing processes and issues of the participating organizations have now been described. The way in which the participating organizations deal with these issues will now be compared with the reference model. This comparison is discussed per business function, to make the differences more clear. The inbound logistics function will not be discussed (as stated earlier in this report), as the interviewed managers could not provide relevant and sufficient information about this business function.
This comparison is made in order to answer the general research question of this research; *How could supply base information sharing be organized in order to fulfill the needs of all functions that interact with the supply base?* The answer to this question is formulated in chapter 5 '*Conclusions*'.

4.3.1 Purchasing

During the interviews, it became clear that companies managed the main purchasing activities quite well. With activities is meant; the identifying and selecting of right suppliers, reducing costs in the supply chain and negotiate best offers with suppliers. Vendor performance checks were performed by most of the companies. The aim for these checks was to get as much useful information as possible about the suppliers. Reason for doing this, is that the companies could confront suppliers with problems or bad performances, to eventually gain a better negotiating position.
According to van Weele (1994), purchasing contains the specification (what), selection (who), contracting (how), ordering, monitoring and the after-care activities for acquiring certain goods or services for an organization. Compared with the information of the interviews, it can be concluded that the specification, selection and contracting of suppliers is managed well. However, companies should improve more on the monitoring and after-care activities.

Seven out of eight companies, find it hard and difficult to monitor their supplier's actual performance. By performance is meant; delivery times, quality of goods or other KPI's (Key Performance Indicators). Not a single manager could directly give/obtain information about the performance of a specific supplier over a certain period of time, with a symbolic 'single press on a button'. It took them at least one day or more to acquire information they needed. Often they had to instruct one of their subordinates to collect the information and make a report. According to the reference model, this information needs to be provided by operations.
The cause is that e.g. supplier vendor rating data is being collected at operational level. Companies have regulated their information (processes) very well at operational level. For example: A PO is delivered by a supplier. It is checked for missing parts, quantity, delivery time, etc. and all this information is put into a system at operational level. Often, a (digital) message of approval is sent back to the supplier. This is supported by ERP systems (SAP, BAAN, JD Edwards). According to the theory, these information exchanges need be monitored by purchasing as well.

The problem is the lack of a link of information systems to higher level management in the organization (integration of different IT systems). Supplier information from the ERP is often send by email or by excel

sheets to a purchasing manager. Information is not (digitally) automatically shared with all stakeholders. Much time is needed when monitoring supplier performance in this manner. The teams of purchasing managers have little time left to address other key processes within the purchase function.
When comparing these findings with the reference model, one can see that the information from operational level, is being shared with four different business functions. Thus, quality assurance, logistics and finance all encounter the effects of the poor line of sight as well as purchasing.

The payment details are well covered by the companies, often Dun & Bradstreet business information is used to check the financial status of suppliers and from finance the number of unpaid invoices are shared on monthly basis (in supplier reports).

Type	Created?	Shared?	Used?
Delivery details (delivery times, completeness etc.)	Yes.	Yes, but very slowly and inaccurate.	Yes, but with restrictions.
Quality audit reports	Very little, not enough time for QA and purchasing to do it.	If created, yes.	If created, yes.
Payment details	Yes.	Yes, done on a regular basis (mostly included in supplier reports	Yes, in suppliers reports.

Table 12: Comparison between reference model and interview results for purchasing

Lastly, audits are rarely done by the companies; their vendor rating is not optimal (should have been better, more information, do it more often) and that they have a supply base with thousands of suppliers. Thus, they are too busy with other activities, and see no possibility to do effective auditing. In practice it seemed that QA only supported purchasing in doing audits, if they were performed. So purchasing had not time and QA did not do it by themselves. In Table 12 is shown an overview of the information needs from the reference model and the conclusions drawn out of the interviews. Answering if the information was created, shared and used.

4.3.2 Quality Assurance

Obviously, the quality of goods delivered by a supplier is most important for quality assurance. Theory states that the use of supplier evaluations, collaborative product development (to ensure build-in quality into a product) and reducing supplier shortcomings (to improve supplier performance), is needed to ensure quality. Most of the companies did performance and evaluation management at a very intensive level. Quality was considered one the most important performance indicators and therefore many procedures and systems were developed to ensure good quality. The few quality problems in the supply base, is not only the result of good quality checks by the buying company. By further questioning during the interviews, methods to ensure quality which are used by suppliers, also contributed. Suppliers are becoming increasingly better in controlling their own quality.

The oil company was the only company which really struggled with the quality of purchased goods from their suppliers. **Food & Beverage company 1** even stated that the quality of delivered good for a certain product is excellent from all suppliers. Quality was one of the last criteria they used for rating vendors, other indicators were given higher priority because quality was always good.

Establishing long term relationships with suppliers, reduce costs and enhance new product development (NPD) also stimulate improving quality, according to the theory. But not all companies that were interviewed, had established good long term relationships with their suppliers. Some tried to select key suppliers, and build a close relationship. However, building a close relationship takes time, which most companies stated they did not have. There is no strong evidence for long term relationships to strengthen cost reductions and quality improvement.

The information needs of QA from other functions, is focused mainly on operational data and contract details. However, the right information was collected but the data was (or could be) poorly monitored. The contract details were well covered, most companies (especially the largest manufacturers) used special systems to facilitate contract management. In this manner, QA could easily access contract details. What QA exactly did with this information was not clarified. Generally, they used it to check deliveries or especially when mistakes or faults were made. The last point refers to quality issues, then the contract is checked to see if the supplier was wrong or if it was the company its fault. Table 13 concludes this paragraph.

Type	Created?	Shared?	Used?
Delivery details (delivery times, completeness etc.)	Yes.	Yes, but very slowly and inaccurate.	Yes, but with restrictions.
Certification and contract details	Yes and stored in contract management systems.	Yes.	Yes, in critical times.

Table 13: Comparison between reference model and interview results for QA

4.3.3 Asset Management

Optimizing the usage and manage all maintenance and repair efforts by making assets as accurate, reliable, and efficient as possible is what asset management is all about (Michael, 2005). Within this function, vendor rating is not a priority. The experience/knowledge of employees on the work floor and engineers is most decisive whether a supplier is chosen for the delivery or maintenance of (specific) machinery. Based on financial calculations, management decides which and from whom new assets will be purchased, taking in account the view of the work floor employees and engineers.
According to theory, this is not how asset management should be performed. A decision should be made on numbers, reports and ratings, not personal preferences. During the interviews, companies pointed out that they cared less to invest time and money in their asset management function because of the relative value. The amount of money which could be saved when optimizing asset management is less compared to optimizing the purchasing function for example. However, this is not true for the off shore companies, because of the high costs of assets in this kind of business. Most important for these companies, is that the assets they have or want to purchase are available.

Concluding, the asset management function did not interact with the supply base often in most companies, and it made decisions on another basis than recommended according to academic writing. The function of asset management could be improved by collecting data about suppliers themselves and interact more with the supply base. In Table 14 is shown what according to the reference model should have been shared, concluding this paragraph.

Type	Created?	Shared?	Used?
Asset financial details	Only in the offshore companies	Yes, included in project finance.	Yes.
Status of assets on the work floor (engineering & technical resource)	Poorly, only based on experience and subjective judgment.	Only thru man on man.	Not really, it is experience that counts.

Table 14: Comparison between reference model and interview results for Asset Management

4.3.4 Finance

Five out of eight companies participating in this research, use Dun & Bradstreet (D&B) information solutions, to financially check their suppliers. This do this to minimize risk in their supplier portfolio. The amount of suppliers of the companies is huge. From a few hundred, to a few thousands. To keep track of all information about these suppliers is almost impossible. However, companies which participated in this research stated that only a small part (5% <) is labeled 'key supplier' in their supplier portfolio. These key suppliers represent high value, complex products or have an important ability to the company. Optimizing the supplier portfolio is the responsibility of purchasing, the finance department only supports them in doing so. The results of the interviews indicated that finance really does check invoices and making sure payments are done from the key suppliers.

Type	Created?	Shared?	Used?
Payment details	Yes.	Yes, but very slowly and inaccurate.	Yes, but with restrictions.
Certification and contract details	Yes.	Yes, intensively.	After 2008, a lot.
Quality of delivered products	Yes, in ERP	Yes.	Yes automatically.

Table 15: Comparison between reference model and interview results for Finance

According to the reference model finance should get information about suppliers from operations, purchasing and QA. Finance does get this information, but as stated earlier, direct monitoring of suppliers is difficult for higher management levels . Again, this is due to the lack integration of information systems to higher level management in the organization. Supplier information from the ERP is often send by email or by excel sheets.

A restriction is that only a few suppliers can be (poorly) rated. On the other hand, purchasing seems to share information quite well with finance. A reason for this might the 'changing' global financial climate, as it was for all of these five companies reason to use D&B after the crisis in 2008. Table 15 summarizes all of these statements to give an overview.

4.3.5 Research & Development

Companies which were busy doing R&D projects were mainly **food & beverages company 1 & 2** and the **electronic/telecommunication company**. Most of the time, the companies created a cross functional team and invited employees from its supplier to join and collaboratively work on the project.

According to the reference model, this is the right thing to do. By 'the right thing to do' is meant ; invite your supplier to join in a project or stimulating collaborative product/process development. Set up a long term relationship and manage this combined team as a part of your company. How supplier collaboration is done at strategic level remains unclear. Almost all of the companies said, they wanted to innovate more collaboratively with their suppliers, but not clear policy or projects were started. To check whether innovation with suppliers takes place, one must look at the (financial) results of the combined cross functional teams.

Type	Created?	Shared?	Used?
Innovation related information (e.g. market developments)	More or less, it is captured in innovation projects.	Within the project, yes.	In the projects, yes.

Table 16: Comparison between reference model and interview results for R&D

4.4 Table of summaries

To summarize the comparison between the theory and the interviews, Table 17 is presented:

Function	Theory	Interviews
Purchasing	Identify best suppliers in the market, try to reduce costs in the supply chain and/or negotiate the best offers. The impact of purchasing is determined by the relative importance and corporate strategy of a company.	Main function: collecting data to make vendor ratings, identifying the best supplier takes a lot of time. Purchasing is an important function in the strategy of companies.
Quality Assurance	Maintain a close relationships with selected (key) suppliers, enable manufacturers to reduce costs, improve quality and enhance new product development. Use supplier evaluation and performance measures to identify supplier shortcomings.	All companies use evaluation & performance measures, but supplier shortcomings will not always arise due to the difficulties with internal communication.
Asset Management	Optimize asset use and manage all maintenance efforts involved by making assets as accurate, reliable, and efficient as possible. Use asset tracking and constant asset valuation to be able to react quickly to changes.	Asset management is done on financial basis, total cost of ownership is leading indicator to purchase or not. Other processes did not arise during research.
Finance	Do not be too dependent on your suppliers and let them not to be dependent on you. Single source and single suppliers should be excluded in the suppliers portfolio (if possible). Suppliers should be financially healthy, the risks of loosing stocks, money etc. is high when suppliers go bankrupt. Finance is therefore more or less risk management in the supply base.	Many respondents use Dun & Bradstreet to check the financial status of suppliers. Managers acknowledge the need for a good supplier portfolio but there is too little time for it to sort that out.
R&D	Make an set of strategic decision-making processes that help to create an alignment on the long-term with a supplier. Giving the supplier influence from the design phase in new product development increases the change to establish a long-term relation. Combined with a more strategic view on supplier management, firms can benefit more from their R&D.	The companies which innovate with their suppliers (about 50%) do this on a project basis. They start a cross functional team and invite suppliers from the beginning to the project. These are often very structural procedures, everything is captured in contracts.

Table 17: Summary of differences between theory and interviews

5 Conclusion

The sharing of information about and over the supply base was the main focus of this research. The goal was to contribute to the development of collecting, developing, sharing and exchanging information between the different business functions that interact with the supply base, so that it is useful for all these different parties. In that manner, companies can achieve more value from their purchasing function and IT systems.

Thus, when interpreting the results of Chapter 4, it can be concluded that most information about suppliers is documented within the information systems of the companies which participated in this research.
Most relevant finding in this research is that organizations do have much information they need about suppliers, but do not use this information effectively. This is due to the use of different IT systems and the activities of the different business functions. Historical, logical choices led to the fact that these organizations have once created functional business areas. This study showed that huge (manufacturing) companies are mostly decentralized. At operational level, a single plant, site or manufacturing facility is often responsible for its own in-and output. Operations request a certain product or service, formulate a PO and give this to the purchasing function. Purchasing ensures that operations receive the requested purchase order. This is how work is done in most companies. For (big) PO's and/or (R&D) projects, a cross-functional team is being established in most organizations. These teams arise when a certain need occurs. There can be seen that many solutions are end-use solutions; not to prevent a certain occurrence from happening in the first place. One of the managers actually said; 'When we hear nothing, everything is ok.'

At operational level most of the studied companies know exactly what they are doing. Information about ordered products is gathered; the quantity, input, output, quality and (performance of) suppliers. All this information is available. Much of this information is being documented or is being stored in (information) systems at the operating facility itself. But, at higher levels in the organization, this information is not easily available or can be monitored. Management has to contact the operating facilities, and ask them about it. There is no overall/single system, which provides information for all of the stakeholders of an organization. Not a single manager could state what, where and how much products have been produced by its company or producing facility on a certain day, week or month. Managers would like to have basic information about suppliers with one press at a button.

The purchasing function can be of much more value, but is restricted due to time consuming other tasks. This is because purchasing does most work manually; information is put into systems by hand, and communication is done via email or telephone and this takes time. Many organizations do recognize the need for close contact with suppliers. It is therefore that the purchasing function is put in front of the organization when it comes to having contact with suppliers. Though, the purchasing function is mostly busy with gathering and collecting (supplier) information. In one of the companies, two FTE's were used only to collect data out of their systems and make useful reports out of it. Vendors cannot be rated properly by the purchasing function, or other functions as well, because of these restrictions.
In most organizations, the different departments(s) or function(s) use their own point solutions (best of breed) or self made information systems. Companies pointed out that the use of information systems is time consuming and therefore an obstacle for other work activities. These systems only work well, if employees really use them, and keep information up-to-date. Systems are often slow, not user-friendly, and are poorly integrated with other systems.

The lack of time is a result of the fact that a silo organization is prevalent within the companies, but it is not that the different departments and/or functions work solely or on their own any longer. So the silo mentality is not present, but the silo organization is. It reveals itself in the form of restriction for work activities due to the use of (different) information systems. Thus, the managers interviewed only partly agree that different departments and functions still work as if their business function is the only one in the company.

Companies acknowledge the increasing role and influence of the megatrends as stated in chapter 1. Respondents recognized a progressively more demand for supplier performance and quality management due to these trends. To be able for a company to cope with these trends, the purchasing function plays a leading role. The purchasing function in most companies, loses much time because of monitoring (getting the right information) and communicating through many different communication tools. Their time for other more

valuable tasks (such as vendor portfolio selection) is being consumed almost completely.

To answer the main research question '*How could supply base information sharing be organized in order to fulfill the needs of all functions of an organization that interact with the supply base?',* companies should improve on the following; set up a purchasing function which adds real value to its company. By integrating information systems which are already in use or by implementing an IT system which is cross functional, easily accessible for all different stakeholders, in which direct monitoring by all these stakeholders is possible and which is fast in use, may provide a solution. But it is often a expensive choice to implement. Instead of a complete new system, a company could attempt to use Figure 11 to make the purchasing function a more value adding function, step by step. It is a very general guideline, but is summarizes the recommendations from academic theory and the findings of the interviews. Most of the interviewed companies were between 'understanding' and 'managing', no single one in 'leading'.

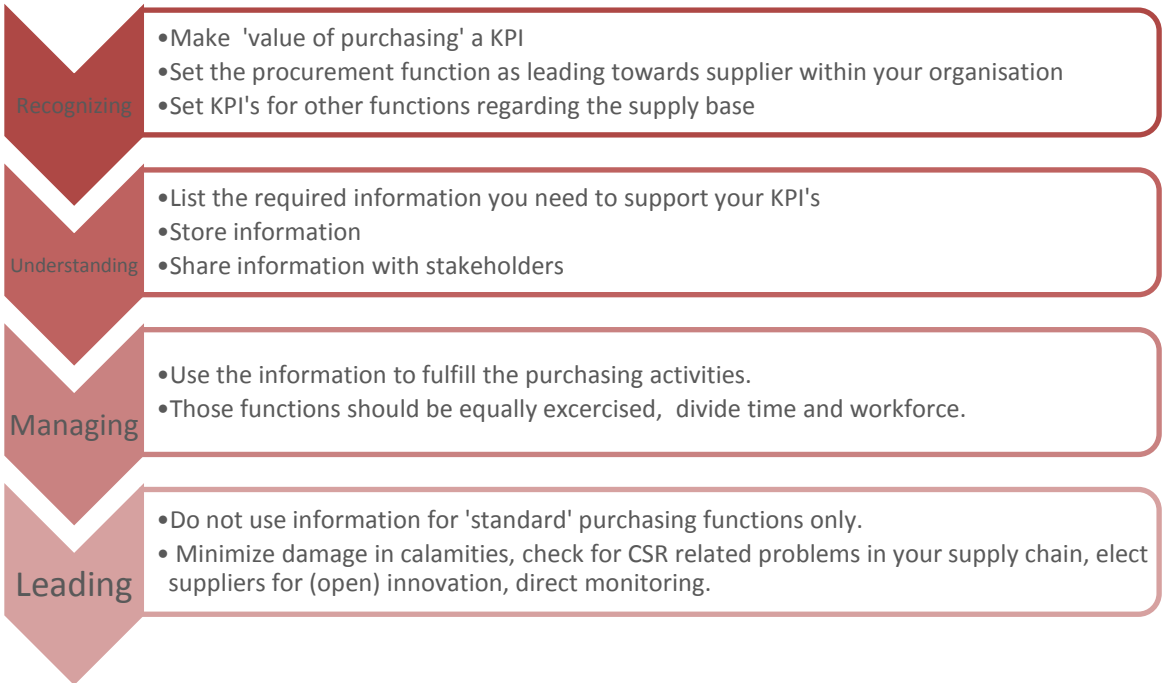


Figure 11: Maturing information sharing in the supply base Source: Burger & Pot (2011)

6 Discussion & further research

The goal of this research was to contribute to the development of a consistent and universal way of collecting, developing, sharing and exchanging information between the different business functions that interact with the supply base, so that it is useful for all these different parties. Due to the complexity of organizations and their supply base management function, this research is only a small part of a possible solution; to be able to give answer(s) on how to organize information exchange in relation to supply base management.

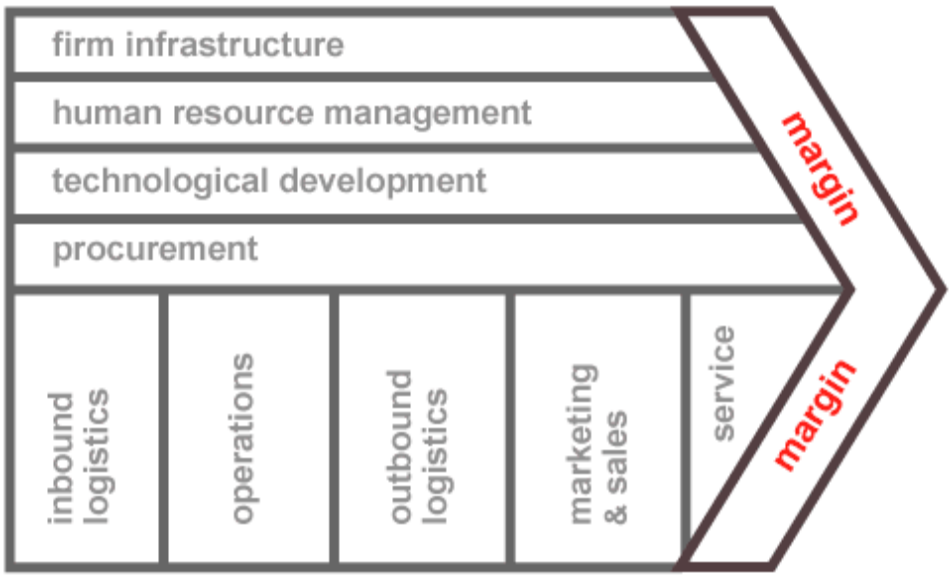
What could be the best solution for managing a company's supply base, depends on many factors. The level of integration between different IT systems, the business itself, and e.g. organization culture all influence the companies way of sharing information with its supply base. When these aspects are studied more specifically, their impact on firms performance could be tested. It became clear that integrating IT systems is very difficult, certainly when a company counts more than 50000 employees, has more than 2000 suppliers and uses more than 50 different IT systems. Thus at first, for further research we suggest that more variables are taken into account to see what is also affecting the right use of supply base information sharing. Moreover, this should be done on with a larger number of companies with preferable in the same industry to make comparison more significant.

The second part for further research lies in the current environment for companies; the impact of the megatrends. With now having companies with fully integrated supply chains it seems that the strive for faster and more production has come to a stop. Leading organizations in supply chain management such as Toyota face difficult times due to quality issues from suppliers. With a global supply base it appears more and more difficult to manage the risks it brings with it. Managing information sharing is one way to lower those risks, but to make really progress companies should look at their supplier portfolio, monitoring the performance closely and make sure their suppliers share their same values. So to answer the question of how to cope with the megatrends it is pivotal that companies not only manage their information flows but also take huge steps on a strategic level to minimize their number of supplier for instance.

Whether companies will do this depends on the demand of the customer, if green is what they want, green is what they get. Certainly now, where the customer has also a global supply base with the internet. One thing remains clear, the companies which are ahead of the rest will benefit the most. So with the megatrends now threatening the firms, the company that manages to get their purchasing function to tackle or even benefit from the challenges caused by the megatrends, will be the company that is the next leader riser in the fortune 500.

7 Appendixes

Appendix A: Porter's Model



Retrieved on 9th of June from: http://www.provenmodels.com/26/value-chain-analysis/michael-e.-porter

Appendix B: Interview survey

Name:

1. **Can we reference your company as a participant of this survey/use your (company's) name in our report? Your specific responses will of course be kept confidential.**

   O Yes O No

2. **Would you like to be invited for the seminar as feedback of our research results/findings?**

   O Yes O No

3. **If so, would it be possible to visit the seminar somewhere in mid/late August?**

   O Yes O No, (could you suggest other periods:

4. **What is your position in your company?**

   O CEO O CPO O COO O Head of Supply Chain Management

   O CFO O Procurement Managers/ Sr. Manager

   O Others (please specify)

5. **To whom does your function report at your organization?**

   O CEO O CPO O COO O Head of Supply Chain Management

   O CFO O Others (please specify)

6. **What is your organization's total third party expenditure of total revenues/ budget of your organization?**

   O < 20% O 21 – 30% O 31 – 40% O 41- 50% O 51- 60% O > 60 %

7. **What is the total headcount of employees in your**

   Organization:
   Procurement function:

8. **How many suppliers does your organization have?**

O < 10 O 10-50 O 50-200 O 200-500 O > 500

9. Among those suppliers, what % can be qualified as a key supplier?

O < 5% O 5 – 10% O 10 – 20% O 20-50% O > 50 %

10. List your 5 most important systems for your inbound supply chain:

11. What are your top 5 issues with those systems? (feel free to draw or put down single words)

Appendix C: Question matrix

Functie/Niveau	Strategisch	Operationeel	Praktijk
Quality assurance	-Waar willen jullie over een paar jaar zijn op het gebied van kwaliteit, en wat voor rol spelen leveranciers hierin? -Wat voor informatie houden jullie bij over de kwaliteit /prestaties en de ontwikkeling daarvan van de supply base als geheel? Waarom? -Welke informatie delen jullie met je suppliers? Waarom? En waarom juist deze informatie?	- Hoe meten jullie kwaliteit (interne of externe applicatie)? - Helpen jullie suppliers wanneer deze onder de maat presteren? Hoe en waarom? - Van welke informatie systemen maakt QA (voornamelijk) gebruik? - Als uw organisatie aan supply risk management, of supplier performance management wilt 'doen', welke informatie (vanuit de verschillende organisatorische functies) heeft QA/de organisatie dan nodig?	- Hoe vind momenteel inspectie plaats? Waarom op deze manier?
Procurement	-Make or Buy, inrichting van de supply base (veel/weinig supplier, First/second/third tier suppliers, etc.) en nature of customer-supplier relationship. - Criteria voor supplier selection? - Contractmanagement, voor hoeveel afdelingen staat er nu informatie vastgelegd in een standaard contract? - Wie/wat bepaalt hoeveel er wordt ingekocht?	- Waar zit de beslissingsbevoegdheid? Hoe veel mensen moeten/mogen (mee)beslissen in purchase vraagstukken? - Welke criteria hanteren jullie in supplier beoordeling/qualification? Hoe en waarom? Scorecard? (Risk, quality, delivery time, historical performance, guarantees/compensaties) - Van welke informatie systemen maakt de purchase functie (voornamelijk) gebruik?	-Hoe is jullie purchasing functie georganiseerd? -Is er veel overlap in data die je uit verschillende area's krijgt? -Hoe betrouwbaar zijn de gegevens van andere afdelingen? -Ontbreekt er wel eens data? -Waar worden gegevens van suppliers centraal opgeslagen?

Functie/Niveau	Strategisch	Operationeel	Praktijk
Manufacturing		-Tussen inkoop en ontvangst, wanneer wordt er gechecked, en adhv welke info, of alles in binnengekomen? - Hoe en welke (status) gegevens delen jullie mbt tot productieplanning?	- Vanaf waar worden goederen ingechecked in een ERP systeem bv?
Finance	- Is er een strategie voor/op risk management? Dat wil zeggen, is er een beleid voor suppliers met een te hoog risico op financiële problemen bv? - Supplier afhankelijkheid → Keuzes in gemaakt? - Welke rol speelt finance in het geheel, moeten contracten eerst langs finance voor controle bv? Of is het puur administratieve ondersteuning?	-Eventueel faillissement van supplier → wordt dit meegenomen in de supplier beoordeling? - Als een supplier niet levert, hoe snel reageert uw organisatie daarop gemiddeld? En hoe checkt finance of er geleverd is?	-Zo ja, hoe dan en in welke mate? - Op jaarbasis, hoeveel % van uw budget wat naar supplier gaat moet u afboeken vanwege failliete of wanbetalende suppliers?
R&D	-Is uw innovatiebeleid erop gericht om innovatie ook in uw supply chain te integreren en dan met name met uw suppliers? - Hoe open is uw organisatie in het delen van kennis? (patenten etc.)	-Wanneer wordt een supplier betrokken in het proces van New Product Development (NPD)?	-Welke informatie deelt u met suppliers als het gaat om innovaties (voorbeelden!)?

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