Support for the industrial packaging development process: Buyer and supplier perspectives

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Buyer and supplier perspectives

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Licentiate thesis

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To my beloved family,
for love, happiness and smile.

Every system is embedded in a larger system.

- C. West Churchman (1968, p. 48)

Acknowledgements

Looking back at the very beginning of my research career, I was faced with numerous challenges. What I did not anticipate at the time was that many and even more demanding ones were yet to come. In managing these, I have been fortunate to have colleagues, friends and family to support me. I am grateful to my two supervisors, Professor Annika Olsson and Emeritus Professor Gunilla Jönson for giving me this opportunity and for believing in me. There are so many colleagues in Packaging Logistics and the Department of Design Sciences who I genuinely wish to thank. To make sure I do not forget anyone, I will take it in alphabetical order: Annika, Bengt, Cilla, Daniel, Erik, Eileen, Fredrik, Gudbjörg, Gunilla J., Gunilla H. W., Helena, Henrik R., Henrik P., Hillevi, Jessika, Karolin, Märit, Malin, Marie, Mats, Maisam, Ola, Rose-Marie, Robert, Susanne, and Vahid. Once again, thanks to each one for sharing interesting talks and for supporting me when in need!

I would like to direct a special thanks to Karolin for wonderful laughs, for being frank, and for being inspiring! I still have difficulties with March… ☺. Helena, many thanks for your inspiration, words of advice, and good collaboration. I would also like to dedicate many thanks to Vahid for your great stories and many laughs! It has been a pleasure sharing an office. I would like to take the opportunity to thank my dear friends Karina and Caroline; it has been a true delight getting to know you. There will be many more equestrian experiences to come! Chestnut, thank you for tutoring me in true cooperation, mutual confidence, and warmth.

My family, how I have missed you all! There are no words to describe how glad I am to be close to you again. Dear Clas-Henrik, my fiancé, my love, my dearest friend, thank you for being there and for supporting me throughout my endeavor of creating this thesis.

Lund, May 2011
Sandra Silgård Casell

Abstract

Industrial packaging contains the parts of final products and is used in the handling and transport of them from the component supplier to the manufacturing company. An increased interest and emphasis on industrial packaging is necessary if the associated potential benefits in terms of costs, efficiency and effectiveness of packaging related activities are to be realized (related activities are those that have an impact on or are affected by the use of packaging). The fundamental conditions for these resource savings opportunities start in the actual development process of industrial packaging. On the whole, insight into how to bring about these savings, or even that there are savings to be made (and in terms of what), has not yet been acknowledged or clearly understood from the point of view of manufacturing companies.

In the research presented, two case studies were conducted at companies that are active world-wide. The first study encompasses two manufacturing companies; one in the automotive industry and one in the electronics industry. The second study encompasses three packaging suppliers delivering industrial packaging to these and other industrial segments.

The purpose of this research is to describe deficiencies of the industrial packaging development processes and to explore potential changes dealt with in the same. It was found that the establishment of interdepartmental collaboration between the stakeholders of industrial packaging in the areas of logistics, engineering/design, packaging and purchasing was favorable in terms of spreading knowledge of the activities and hence objectives of each of the stakeholders involved. This can in turn remedy the dominance of certain objectives over others, especially when the overall beneficial situation of efficiency and effectiveness of the stakeholder activities is not taken into account. The results indicate that the objectives of manufacturing companies' purchasing functions to decide on the most cost effective packaging solution were often found to downplay the objectives and priorities of other stakeholders' activities in the supply chain. Another

finding was the value of early supplier involvement, which was acknowledged by both actors as being important in terms of resource efficiency. Although the packaging suppliers argued that there has been an improvement in the timing of involvement, they claimed that manufacturing companies most frequently still involve the packaging suppliers at a late phase in the development process of industrial packaging.

These research findings can be used as support for further research into aspects that impact the developmental process of packaging, especially as regards industrial packaging directed to intermediary customers. This research raises the importance, from a systems perspective, of acknowledging these customers' needs as well as other stakeholders' needs. To practice the findings of this research favors manufacturing companies interested in developing their packaging development strategy with particular emphasis on industrial packaging used for transport and handling. The research especially raises the importance of integrative and collaborative efforts among functional units.

List of Appended Papers

Paper I *Towards improved reporting of case study research – an evaluation of articles in top tier logistics and management journals*

Authors: Olander-Roese, M., Lindh, H. & Silgård Casell, S.

Olander-Roese, Lindh and Silgård Casell contributed equally to the literature review and evaluation of articles. Olander-Roese and Lindh were the principal authors of the paper and Silgård Casell presented it at the conference.

Peer reviewed.
Presented at the 21st annual NOFOMA conference, Editor: Susanne Hertz, NOFOMA proceedings 2009, June 11-12, Jönköping, Sweden, pp. 615-633.

Paper II *The packaging selection practice – a case study*

Author: Silgård Casell, S.

Peer reviewed.
Presented at the 22nd annual NOFOMA conference, Editor: Jan Stentoft Arlbjørn, NOFOMA proceedings 2010, June 10-11, Kolding, Denmark, pp. 761-776.

Paper III *Hidden aspects of industrial packaging – the driving forces behind packaging selection processes at industrial packaging suppliers*

Author: Silgård Casell, S.

Peer reviewed.
Presented at the 18th CIRP International Conference on Life Cycle Engineering (LCE), Editors: Jürgen Hesselbach and Christoph Herrmann, LCE proceedings 2011 titled: "Glocalized Solutions for Sustainability in Manufacturing" May 2-4, Braunschweig, Germany, pp. 229-234.

List of abbreviations and terms

B2C	Business-to-Consumer
B2B	Business-to-Business
FMCG	Fast moving consumer goods
Trade-offs	Compromises of various kinds made in order to balance two or more alternatives or inputs.
PPS	Product and packaging system.

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1. Introduction

This chapter introduces the reader to the background reasoning of the research undertaken by briefly presenting the correlation of industrial packaging and business, previous research in closely linked areas, and the scope of the research.

1.1 Background

The central goal of a business is to accomplish maximized long-term profit or, in the case of non-profit organizations, to allocate the budget effectively (Stock & Lambert, 2001). The heart of a manufacturing company is its product development. The processes and activities associated with the developmental efforts need to be performed as efficiently[1] and effectively[2] as possible. Complementarily, in order to fulfill the overall business purpose, all the elements of the supply chain must serve and facilitate compatibility. Consequently, trade-offs must support the direction of the goals set by the company. Enhanced outcomes of the supply chain processes and activities need to be preceded by measures imbued by efficiency and effectiveness reasoning. The research field of *packaging logistics* addresses the interface between the packaging system (intrinsically including the packaged item) and the logistics system (Saghir 2002; Hellström 2007) for the overall purpose of enhancing efficiency and effectiveness in the supply chain as a whole.

The realm of packaging is an integral part of the product development processes (Bowersox & Closs, 1996). According to Christopher (2005, p. 30), competitive advantage is achieved by product excellence in combination with process excellence. The packaging domain has an impact on the product excellence (in terms of ensuring a protective environment for the product, marketing purpose, and enabling handling etc.) as well as on the process excellence (in terms of complying with the processes and encounters of the product and packaging throughout the supply chain). The latter aspects are addressed by Hellström & Saghir (2007) and Klevås (2005a). Traditionally, published articles and other

[1] Efficiency - performing things in the right manner.
[2] Effectiveness - performing the right things in order to accomplish the purpose.

academic literature about packaging reflect strong dominance of the domain of *sales packaging* (synonymous with *consumer packaging* and *B2C packaging*). This is supported by the literature review conducted (see *Section 2.7*) - sales packaging is the dominant area of research as well as interest. Jönson and Johnsson (2006) address the replacement of the commercial and informative functions of the sales staff by the sales packaging. This view is further enhanced by Olsson and Larsson (2009) describing the role of sales packaging upon the occasion of decision making. The role of packaging in a sustainability context is addressed by Verghese & Lewis (2007): *"Packaging contributes to the success of product supply chains, enabling efficient distribution of products, and reduced environmental impact of product spoilage and waste."* Saghir (2004) stressed the importance of marketing in relation to logistics aspects in the retail supply chain.

The scope of the research referred to clearly elucidates a research focus directed towards sales packaging. Research about the support of the development process of consumer packaging has been looked into. However, research regarding *industrial packaging* (packaging employed in business-to-business relations) and its impact on efficiency and effectiveness in the supply chain is to the best of the researcher's knowledge not to be found. Despite the insight that packaging could promote firms' efficiency and effectiveness as described above, according to Stock & Broadus (2006) packaging matters in relation to supply chain management and logistics remains an infrequent area of research. Johnsson (1998) reported that few packages are selected based on where and how the packaging is handled. Furthermore, previous research on integrated product and packaging development has surprisingly seemed to overlook the logistics aspects, e.g. Bramklev (2007). The need for industrial packaging, owing to the plentiful transactions occurring B2B, is implicitly addressed by van Weele (2005, p. 27): *"Most companies sell to other companies…. Business-to-business transactions often involve large quantities of goods and services and, therefore, large sums of money."* This leaves room for research on industrial packaging, to explore its prospective role in the search for its business potentials.

Industrial packaging is packaging used for facilitation of transport, handling, assembly etc. of items in an industrial environment. In addition, industrial packaging in the context of this thesis is to be considered as the packaging in direct contact with the product. This

packaging has traditionally been looked upon as a non-complicated item with a low degree of impact. In different phrasing, the “let go” mentality (whatever ’box’ will do) has long dominated the packaging scene at manufacturing companies. Unexpectedly, no research has been found illuminating these circumstances of industrial packaging. It could be that there are dependencies between different functions affecting the domain of industrial packaging. *Fig. 1* below could provide a descriptive frame of how the two dimensions of product and packaging complexity and degree of impact of and from the supply chain depend on four organizational functions, here denoted as *quadrants*.

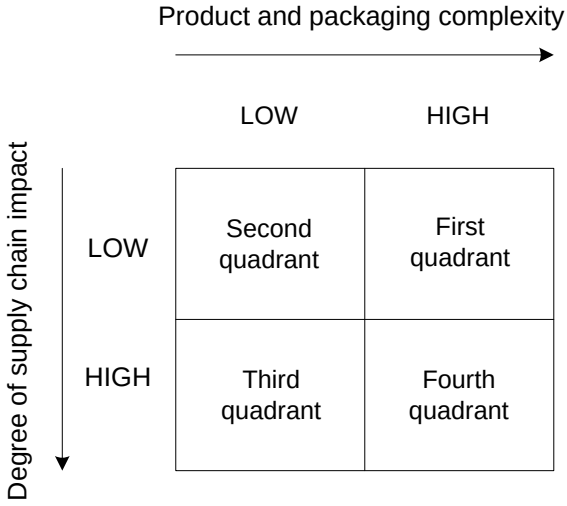


Fig 1. Illustration of plausible interdependencies of the dimensions of product and packaging complexity and the degree of impact of industrial packaging depending on different organizational functions. (Adapted from van Weele, 2005.)

The packaging development process employed for packaging that serves in the downstream supply chain (i.e. from the manufacturing company in the direction of the consumers) is not vastly different from the packaging development process for industrial packaging (the field of use of this packaging is elaborated on in the next paragraph). The differentiating aspects are not believed to be in the actual execution of the development process but rather in the functional resource set-up of the packaging development process stakeholders. Consumers have certain objectives and priorities and intermediary customers have others, which is reflected

in the different measures in the set-up of the stakeholders in the development process.

Verghese & Lewis (2007) argue that the type of packaging that remains in an industrial supply chain is denoted industrial packaging. A similar rationale in addition to a more detailed description of the field of use of industrial packaging is provided in the following for the purpose of serving the specific research conveyed in this thesis. The packaging dealt with in this research has the following characteristics. Firstly, industrial packaging should be interpreted as B2B packaging and not as B2C packaging. Secondly, as a consequence of this reasoning, industrial packaging is to be understood as a vehicle used between the component supplier and the assembly plant, serving the efficiency and effectiveness purposes of manual/ automatic handling, transport facilitator repacking, picking, sorting, and protection. The flows of the industrial packaging have two set-ups, *the returnable system set-up* and *the one-way system set-up*. The first set-up is bidirectional, i.e. in the downstream direction of the supply chain (i.e. from component supplier to assembly site) and in the upstream direction of the supply chain (i.e. empty packaging sent from the assembly site back to the component supplier). The second set-up is the one-way system where the flow is unidirectional downstream, followed by material recycling. The flow from assembly site to consumers is not included in the definition of industrial packaging investigated in this research (for a clarifying illustration see *Fig. 2*).

The problem posed in this research is as follows: Taking off from earlier research conducted within this field of expertise, there is no coherent and established procedure employed for executing an industrial packaging developmental process that integrates the concern of product, industrial packaging, and logistics. Insight into integrated efforts and aspects of packaging, product and logistics gained from previous research and this research can potentially serve as means towards a more coherent industrial packaging development process.

1.2 Research purpose and research questions

The purpose of this research is to describe the deficiencies of the industrial packaging development processes and to explore the potential changes dealt with in the same. This purpose gave rise to the three following research questions:

1. How is the development process of industrial packaging orchestrated at manufacturing companies (users of industrial packaging)?

2. How do packaging suppliers meet customer request for industrial packaging?

3. What aspects are argued to be enhanced and downplayed from the stance of different stakeholders of the industrial packaging development process?

1.3 Research focus and demarcations

This research builds heavily on the research by Klevås (2005a) and Bramklev (2007). In contrast to their research, this research has excluded sales packaging and hence the aspects of marketing. The research undertaken has focused on the development process of industrial packaging exclusively, emphasizing the processes and reasoning of the users and suppliers of industrial packaging. The type of packaging studied in this research, industrial packaging, has an impact on and is effected by the supply chain, particularly that between the Tier 1 suppliers to manufacturing companies. In addition, industrial packaging as used in the context of this thesis is the packaging in direct contact with the product to be packaged.

The manufacturing companies participating in this research mainly receive highly sensitive products from their suppliers, which suggests that their rationales for the packaging development process of industrial packaging might differ from manufacturing companies receiving and handling less sensitive products.

The manufacturing companies studied and the packaging suppliers studied were in direct business to business. Nonetheless, the information provided from the packaging suppliers is not to be interpreted as only applicable to the manufacturing companies included in the first study, but rather to their customers in general. The selection was based on users that had an outspoken priority within the packaging domain and packaging suppliers that offered the one-way and/or returnable packaging items. The suppliers participating in the second case study are suppliers of packaging (Tier 2 suppliers), not of components of the product to be processed per se. The industrial packaging is transported to the

component suppliers (Tier 1 suppliers) for filling, whereupon they are transported to the manufacturing company. The relations between the packaging suppliers and the manufacturing company have been investigated from a bidirectional information flow, and not a physical flow of packaging. Nor has the physical flow of packaging from the packaging supplier to the component suppliers been investigated. The specific supply chain scope of this research is depicted in the blue rectangle in *Fig. 2* below.

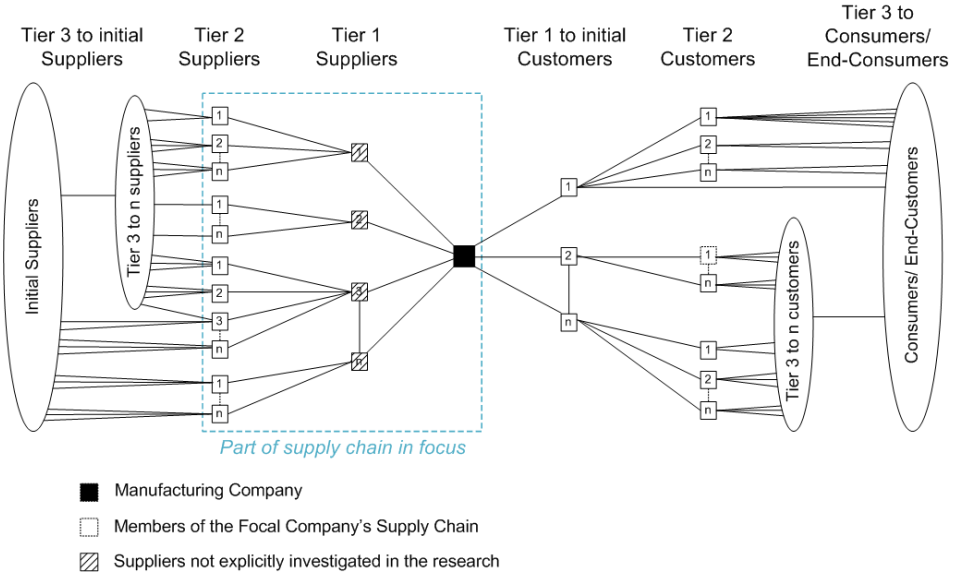


Fig. 2 Supply chain network structure. (Adapted from Lambert et al., 1998b.) The blue striped rectangle indicates the system boundaries of the research reported on in this thesis.

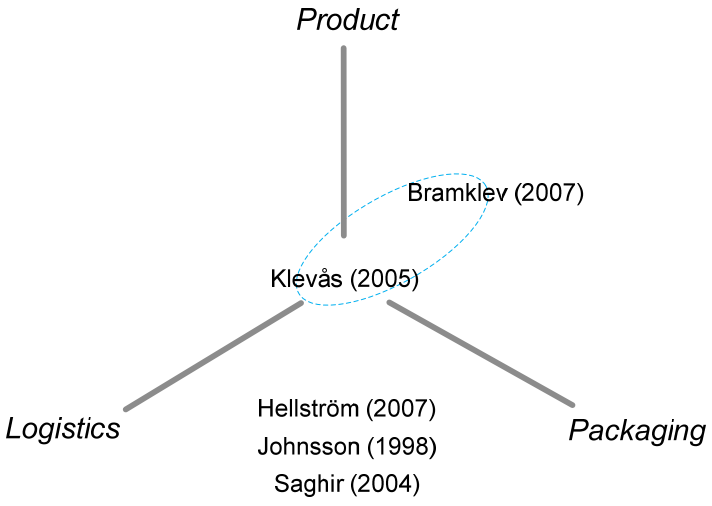


Fig. 3 Positioning of this research in relation to previous research on closely linked focal areas at the department.

The research focus of various packaging logistics researchers has varied over the years. This particular research draws most heavily upon the outcomes of the research by Klevås (2005a) in certain aspects and upon the research by Bramklev (2007) in other aspects. Klevås highlights the importance of integrated efforts of the three pillars of packaging logistics, packaging, logistics and product, whereas Bramklev highlights the integration of packaging and product development. The positioning of the most related research in relation to the research conveyed in this thesis is illustrated in *Fig 3*, the blue striped ellipse.

1.4 Thesis outline

Chapter 1 *Introduction*
The first chapter gives the reader a background, presents the research questions and describes the focus and demarcations of the research.

Chapter 2 *Methodology*
This chapter provides the theoretical reasoning underpinning this research.

Chapter 3 *Frame of reference*
The purpose of this chapter is to provide a basis of theoretical concepts underpinning this research.

Chapter 4 *Summery of appended papers*
This chapter provides condensed descriptions of the three appended papers.

Chapter 5 *Case findings*
This chapter presents a description of the findings of the first case study (manufacturing corporations) and second case study (packaging suppliers).

Chapter 6 *Analysis and discussion*
This chapter presents an analytical discussion of the results of the research in relation to theory.

Chapter 7 *Conclusions and contribution*
This chapter presents theoretical and practical implications of the research.

Chapter 8 *Further research*
The last chapter elaborates on opportunities for further research.

2. Methodology

This chapter provides the reader with a description of the research route and the approaches taken with respect to the case studies undertaken.

2.1 Scientific methodological reasoning

There are two extreme positions in the methodological scientific reasoning; the *ideographic* and the *nomothetic*. The ideographic stance stresses the importance of firsthand information and strives for letting phenomena emerge gradually while being studied. This view relies on the use of journalistic records, diaries, and biographies. On the contrary, the nomothetic perspective promotes systemization and consistent approaches. The latter methodological stance is advocated in natural science and in the social sciences where research techniques of quantitative character are strongly preferred, such as the use of surveys, questionnaires, standardized instruments and personality tests. (Burrell & Morgan, 1979) In this research the ideographic reasoning has been adapted in terms of utilizing firsthand information gathered through channels of interviews, non-structured observation and secondhand information (i.e. internal company documents), and feedback from participating cases.

2.2 Models of explanation

Models explaining research pursuits are commonly exemplified by the inductive approach and the deductive approach. Deductive and inductive are viewed as two extremes on a spectrum. The abductive approach is explained by Alvesson and Sköldberg (1994) as "*abduction starts from empirical facts as in induction but does not disregard theoretical reasoning and hence is more close to deduction.*" Chalmers (1999) provides an illustrative description of the induction-deduction reasoning (*Fig 3*).

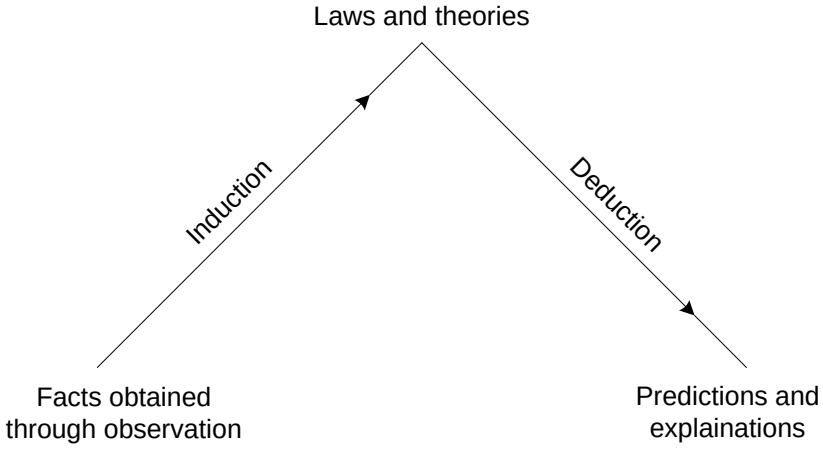


Fig. 3 Scientific reasoning of the relationship between inductive and deductive research approaches. (Adapted from Chalmers, 1999, p. 63.)

The inductive approach starts from empirical material (Alvesson & Sköldberg, 1994; Arbnor & Bjerke 1994; Chalmers, 1999; Kovács & Spens, 2005). Explorative studies are often conducted in an inductive manner (Wallén, 1996). Prior theoretical knowledge is not a prerequisite in the start-up of this approach. Logical reasoning will generate knowledge about gaps between empirical observations and existing theory, ending up in new knowledge. (Kovács & Spens, 2005) Inductive research is often qualitative since general statements are made from the conclusions of specific observations (Arlbjørn & Halldorsson, 2002). Unlike the inductive approach, the deductive approach takes its starting point in theory (Alvesson and Sköldberg, 1994; Arbnor & Bjerke, 1994; Chalmers, 1999; Kovács & Spens, 2005). This research was of an explorative nature owing to the scarce availability of theory and empirical findings in the particular scope framed in this research (as stated earlier). The actual research process was conducted by means of an inductive procedure. In other words, the researcher initially set out with a restricted pre-understanding and knowledge of the theoretical relations in the field of research and hence an unbiased mind-set.

2.3 Systems approach

Researchers have provided different descriptions of the implication of *systems approach*. Churchman was considered a pioneer in the field, stating that: *"Systems are made up of sets of components that work*

together for the overall objective of the whole. The systems approach is simply a way of thinking about these total systems and their components." (Churchman, 1968, p. 11) The *systems discipline* is a meta-discipline that by nature can discuss and be applied to other disciplines (Checkland, 2000). The systems discipline is applied through the lens of the systems approach, which is described by Checkland (2000, p. 5) as *"an approach to a problem which takes a broad view, which tries to take all aspects into account, which concentrates on interactions between the different parts of the problem"*. Expressed in other words, the systems approach is a way of understanding interrelationships, in terms of the impact from and on other activities where interaction occurs (Lambert et al., 1998a). Viewing packaging in isolation, without its context, is of no purpose of its own. Applying a systems approach in the research conveyed in this thesis is a prerequisite in order to conduct studies of its scope in the first place. The intrinsic characteristics of packaging logistics postulate studies on the interfaces, interactions, and relations between the components included in the system. Based on these arguments, this research has adopted the systems approach reasoning as described by Lambert et al. (1998a). Checkland (2000) describes an abundant variety of systems and provides a basic classification: *natural systems* (autonomous, e.g. living organisms), *designed physical systems* (man-made and the result of human objectives, e.g. physical items), *designed abstract systems* (product of human minds, e.g. mathematics), *human activity systems* (a set of activities linked together owing to principles or contexts).

For a researcher to understand an individual component it is essential to study the component in its actual context and not in isolation. The same reasoning can be applied to systems; in order to fully understand a system it is preferably investigated in its own context or environment. (Arbnor & Bjerke, 1997) This approach highlights the aspects of closed and open systems, respectively. *"Open systems are studied in the context of their environment; closed systems are not."* (Arbnor & Bjerke, 1997, p.112). The empirical data collection that builds the research reported on in this thesis has been conducted in the context of an open system. According to Arbnor & Bjerke (1997, p. 51) *"The assumption behind the systems approach, […] is that reality is arranged in such a way that the whole differs from the sum of its parts."* Indirectly, this implies that the relations between the parts are also necessary, since all parts exert synergy effects. Hellström & Saghir (2007) claimed that the process of packaging decision is an intricate process that involves consideration of

different stakeholders and diverse functions, demands, and conditions to fulfil. Based on this reasoning these researchers advocate a holistic approach. The synergy effects from having a systems view are expressed by Checkland (2000, p. 3): *"The central concept 'system' embodies the idea of a set of elements connected together which form a whole, this showing properties which are properties of the whole, rather than properties of its components parts"*. Approach is the way to deal with a problem. Hence, systems approach is a way to embark upon a problem in a broader sense where all aspects are taken into account, as well as enabling focus on interaction between the different parts of the problem. (Checkland, 2000)

2.4 Research process

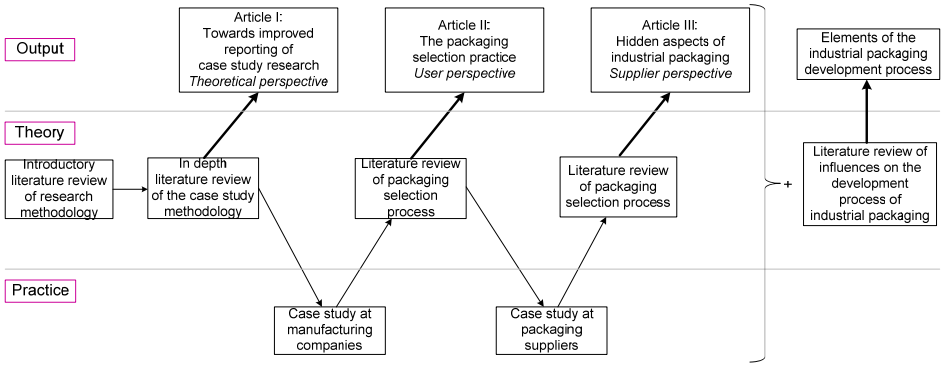


Fig 4. An illustration of the research process undertaken during fall 2008 to summer 2011.

My research journey started in the fall of 2008. At the time of departure the first assignment was to acquire methodological proficiencies, followed by theory on the specific research methodology employed in this research, *the case study methodology*. The literature review on case study methodology generated the first article, co-authored with two colleagues. Next, case studies in two manufacturing companies were conducted, followed by a literature review on the packaging selection domain found in theory. The combination of the empirical facts and the theoretical reasoning gave rise to the second article. Subsequent to the studies at users of industrial packaging, case studies of industrial packaging suppliers were embarked upon. Analogous to the first case study, a literature review was conducted in the fields of the empirically

identified realms. The empirical data and relevant theory generated the third article. The joint insight gained via sources of empirical information from different supply chain actors and acquired theory revealed the shortages of the development processes explored and advanced potential alterations in the same processes. The entire research process is depicted in *Fig. 4*.

During the late course of the research process, personal development and further insight and understanding of the investigated processes gave rise to a new approach. In other words, I came to realize that the processes depicted represented the packaging development process, of which the selection process is part of. The second paper emphasized the selection of packaging whereas the third paper emphasized the driving forces behind the selection of industrial packaging. The learning of the research process turned out to be that the processes studied reflect the development processes employed at the investigated case companies.

2.5 Research approach

The research has been approached by means of inductive reasoning in combination with a systems perspective mindset. The rationales and motivations of this approach have been presented in *sections 2.1, 2.2* and *2.3.* Studies in logistics have traditionally been approached by means of quantitative research methods. Nonetheless, the use of a qualitative approach in published research has broken more ground. (Craighead et al., 2007) To strive for high quality and rigor in the research, a theoretical paper on the case study methodology, its design, execution and reporting thereof was written (see appended *Paper I;* Olander-Roese et al., 2009 and *Section 4.1*). The process and learning of conducting and writing this paper were advantageous for me when performing the next two studies. Although the focus of *Paper I* was on the reporting of case study based research, the knowledge of what criteria I needed to strive for to fulfill the reporting assisted me in the preparations and the actual performance of the empirical studies, i.e. in the design and execution of the studies. The final framework developed and presented in the *Paper III* highlights four main criteria and 16 sub-criteria. The main criteria are: *research question/purpose*, *case setting*, *data collection* and *data analysis*. With respect to research evaluation the researcher has chosen the aspect of *credibility* (Lincoln & Guba, 1985). The reporting of the research conducted has been as explicit as possible with regards to the framework

(Olander-Roese, 2009). To the best of my awareness, deviations from the recommendations included in the framework have not been observed.

2.6 Research design

Two case studies were undertaken. Each case study was designed to include two and three cases, respectively. The cases studies were in other wording designed as *multiple-case designs*.

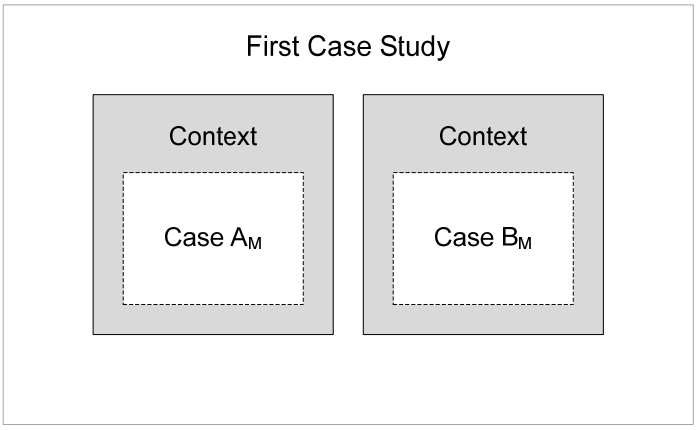


Fig. 5 The multiple-case design in the first case study. (Adapted from Yin, 2003, p. 40.)

According to Yin (2003), there are a number of rationales that justify the employment of a multiple case design (as opposed to single case design). One such rationale is the reduced risk of discovering that the case studied turn out to be different from what it was expected to be at the outset of the research phase. This risk prevails in a one case design since there is an obvious lack of a comparable case (-s). Furthermore, the use of a multiple-case design is promoted when the research undertaken is not of a longitudinal nature, which is the case in this particular research. Single case designs are advocated when the aim is to determine the correctness or the relevance of an already proposed reasoning or established theory. Nevertheless, since the theory of the research undertaken is scarce (see *Sections 1.1* and *2.7*), and the two case studies were conducted by means of induction, the latter recommendation of a single case design is not applicable to this research. In investigations of a representative and "typical" case the use of a single case design is promoted. However, the outcomes of this research were not expected to be typical and to generate generalizability, which further advocates the selection of the multiple

case design. Yin (2003) further suggests the use of a single-case design when the properties of the case are extreme or unique. None of these properties were assessed to apply to the cases.

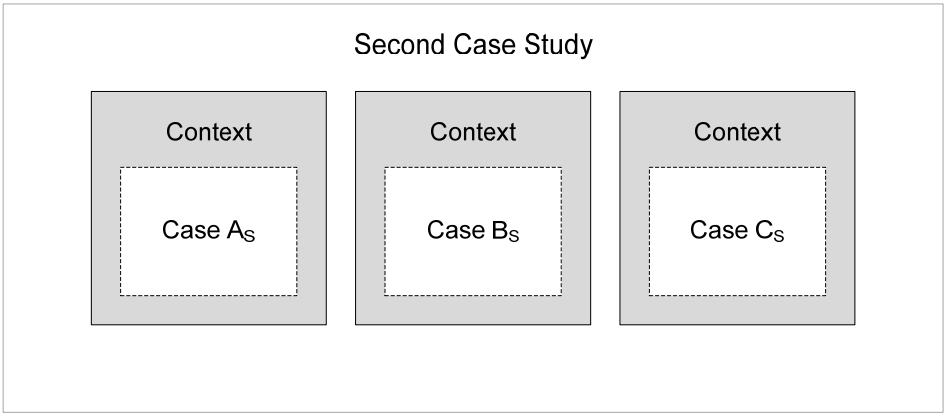


Fig. 6 The multiple-case design in the second case study. (Adapted from Yin, 2003, p. 40.)

In addition to the set-up of the case design in terms of numbers of included cases, Yin (2003) emphasizes the dimensional perspective regarded in the research. The supply chain context of the industrial packaging studied was depicted in *Fig. 1*.

Case study I
In the first case study the two manufacturing companies are denoted Case A_m, and Case B_m (see *Fig 5)*. In this study the cases represent one particular function at each of the two manufacturing companies. The contexts in which the studies of functions have been undertaken are the same: their manner of dealing with the considerations of design, implementation and suitability of industrial packaging with the supply chain activities and stakeholders that to a lesser or greater extent interact with the industrial packaging. From this positioning of the contextual conditions of the cases, the dimension in which they operate is *holistic*.

Case study II
In the second case study the three packaging suppliers are denoted Case A_s, Case B_s, and Case C_s (see *Fig 6*). In this study each case represents each of the three companies. The contexts in which the cases have been studied are the same for all the cases: the manner of handling a customer (manufacturing company) request for industrial packaging. In

turn, the manner considered by the supplier includes the aspects emphasized as necessary to succeed in developing an industrial packaging based on information about the customers' product and supply chain. That is, the investigation of the suppliers includes the entire spectrum of the customer supply chain where industrial packaging is used, and is therefore holistic.

Based on the above outlined rationales, the two case studies (constituted by two and three cases respectively) undertaken are designed as multiple-case designs with a holistic perspective (see Yin, 2003, p. 40, first quadrant).

Feedback from cases
The cases from each case study gave feedback on the analyses. Feedback meetings with the manufacturing companies were held, on separate premises with each. Uncertainties were discussed, and if necessary modifications were made to clarify the message. The feedback from the packaging suppliers varied in nature. One company responded that the identified elements of decision support and processes did indeed very much resemble the identified processes they employed. Interestingly, the company's stipulated processes had not been shown to me during the data collection phase, and hence, solely the available input, i.e. data collection, was the foundation of the characterized process. This response was interpreted as positive. The other two case companies reviewed the analyses, and based on their comments some minor modifications were made.

2.6.1 Research question/Purpose

Each of the two case studies serve the purpose of investigating the work methods employed by manufacturing companies and packaging suppliers when developing and selecting industrial packaging. The methodological logic of the research takes off in the inductive influenced approach combined with a systems approach lens. As research methodology the case study approach was chosen (see also *section 2.5)*. The rationale for selecting the case study approach was based on the explorative nature of the research questions posed, the focus on contemporary phenomena in their real-life contexts and the existence of uncertain boundaries between the context and the phenomena (Yin, 2003). Complementarily, Eisenhardt (1989) maintains that the use of the case study approach is beneficial in cases of insufficient theory or when the research field is in

its early stages. Each of the four research questions posed (two in each paper) support the overall purpose and research questions stated in this research. Previous research recognizes a need for expanded knowledge in the area of stakeholder impact from and on packaging activities in the supply chain. Yet most research in this area has been focused on the downstream direction as viewed from the manufacturing company. This opens up for research in the corresponding area in the upstream direction as viewed from the manufacturing company – the part of the supply chain where industrial packaging is used.

2.6.2 Case setting and Data collection

In the balance of this research two case studies have been undertaken, the first one at manufacturing companies (users of industrial packaging) and the second one at suppliers of industrial packaging, to investigate the input on decision making of industrial packaging. The first case study included two manufacturing companies and the second study included three packaging suppliers. The researcher herself orchestrated all contacts and appointments with the respondents, and data collection. The role of the researcher was to collect data, interpret the collected data, and contrast the findings to the existing theory in the domain of decision support of industrial packaging, as well as to expand the theory.

The unit of analysis is the same for both case studies conducted, i.e. all five cases: *the respective work methods in developing industrial packaging*, of the manufacturing companies in the first case study and of the packaging suppliers in the second case study. Hence, the unit of analysis is single.

Case study I

The two case companies included in the first case study were selected based on their expressed focus on the interfaces product-packaging-logistics and similar business-to-business relations. Both companies are players on the international arena. One company (denoted Department A in *Paper II)* is active in the automotive industry exporting cars to a global market. The second company (denoted Department B in *Paper II)* is active in the electronics engineering industry. Each company's magnitude of turnover and size are depicted in *Table 1* below.

Table 1 Background information about the participating manufacturing companies.

	No. of employees	Net average turnover (2007-2010)
Department A (Case Company A)	20,000	€ 30 billion (Note: year of 2010 N/A)
Department B (Case Company B)	90,000	€ 20 billion

Data collection in each company was carried out by means of multiple sources: *semi-structured interviews* with open-ended questions (see *Appendix 3*) to allow for flexibility for the respondent to explore and explain associated topics and issues; *secondary data* (internal documents); non-structured *observations* of confined areas at the operational sites. Credibility (Lincoln & Guba, 1985) was strengthened by *feedback meetings* with each case company to ensure there were no misinterpretations. All data collection was carried out on-site at the companies' facilities. The interviews were conducted with one respondent at a time, followed by on-site observations. The time spent on each site including interviews and observations was approximately three days for Department A and five days for Department B.

The collection of data took place from May to November 2009. In total six respondents were interviewed, then information saturation was achieved. Their positions ranged from technician/engineers, logistics developers, packaging concepts developers, and packaging experts. The criterion for the sampling of respondents having these positions was to be in command of the appropriate skills in order to provide answers and reflections in line with the purpose of the research and research question (RQ) 1. Individual feedback meetings with each company generated some additional insight. Following the feedback meetings with the companies and based on the internal documents including documentation, such as process maps, the researcher compiled own process maps of their respective development process of industrial packaging (see *Appendix A*). The results of the study was presented in the second appended paper (Silgård Casell, 2010) and *Section 5*.

Case study II

The sampling rationale of the cases in the second case study was based on the intention to include packaging suppliers offering one-way

packaging solutions, returnable packaging solutions, and both kinds of packaging solutions. This particular sample selection was selected to give insights into the reasoning behind diverse packaging development and selection processes at diverse packaging suppliers, in order to provide an answer to RQ 2. All three companies are suppliers of packaging on a global scale. The three case companies are denoted Company A, Company B, and Company C in p*aper III*. Company A provides traded products (i.e. packaging commodities) and company designed products (i.e. tailored packaging). The company has grown from a local packaging supplier to its current position as a global supplier to manufacturing companies. Company A has an abundant number of material suppliers spread around the world, and its customers represent manufacturing companies active in most market segments such as automotive, electronics, apparel, and third-party logistics firms. Company B provides returnable business-to-business packaging solutions to a number of different markets such as automobile, food and beverage producers, apparel industry, and delivery firms. Company C is a global market leader in its segment of packing solutions. The company provides business-to-business and sales packaging. Company C almost exclusively sells one-way packaging. Its customers and their products operate on a variety of markets, including food producers (B2C), appliances (B2C), and heavy industry (B2B). Often the industrial packaging has dual functions and is also used as sales packaging. Each company's magnitude of turnover and size are depicted in Table 2 below.

Table 2 Background information about the participating packaging suppliers.

	No. of employees	Net average turnover (2007-2010)
Case Company A	2,500	€ 0,24 billion
Case Company B	1,000	N/A
Case Company C	45,000	€ 11 billion

For the purpose of the research and RQ 2, the set-up of case study II was designed and performed in a manner like that in case study I. The nature of the questions in the interview guide was similar to the nature of the questions in the interview guide used for case study I, except that the questions were adapted to a supplier point of view (see *Appendix 4*). The data collection phase took place from May to August 2010. In total nine interviews were executed, and the majority of these were recorded. In

those few cases where this was not approved, notes were taken. The numbers of interviewees from Company A were four, from Company B two, and from Company C three. The selection of respondents was based on their positions and hence their assessed knowledge in the domain of industrial packaging decision support. The positions held by the interviewees included application development manager, returnable systems products manager, packaging design manager, key account manager, environmental manager, and development manager.

Besides collecting data through the multiple sources of *interviews*, *internal documents* (when given), and non-structured *observations*, the *case company reviews* of the findings (all three case companies approved of the findings) enabled credibility and hence strengthened the rigor of the research. The findings of the case study, presented in *Silgård Casell, (2011)* and *Appendix 2*, generated a rather common ground for decision support for all three packaging suppliers. Primarily based on data from the interviews, the researcher gained insight into the considerations and the way the suppliers dealt with the development processes of industrial packaging. With the help of this insight, the common ground of the packaging suppliers, and further analysis of the collected data, the researcher generated her own process maps (see *Section 5*, *Fig. 8* and *9*) of the suppliers' developmental process. Due to limited space in *Paper III*, these process maps could not be included.

2.6.3 Data analysis

All interviews were recorded (two exceptions where notes were taken instead) and transcribed. Subsequent analysis was carried out using open coding analysis according to Corbin and Strauss (2008). Open coding is a qualitative analysis tool for qualitative data. The collected data (transcripts, field notes, and internal documentation) was broken down into different concepts. These concepts were compared and based on the rationale of linking findings that represent the same area they were clustered into categories in accordance with Strauss and Corbin (2008) as well as to theories included in the theoretical framework (see *Chapter 3*). Derived from these categories, process maps (see *Section 5*, *Fig. 8* and *9*) were created.

2.7 Literature search

Below the general procedure carried out for all three databases is presented. After generating the total number of hits from each of the search phrases, the titles were manually evaluated based on their degree of relevance. Most frequently the titles spoke for themselves as to whether the article in question was to be further evaluated. When in doubt, the researcher followed up by reading the abstract followed by further evaluation of its relevance. Titles that immediately were judged as apt had their abstracts read, and if further relevance was judged, the entire article was read.

ELIN

Literature searches performed at an early stage of the research process, using the search words of *industrial packaging* and *business-to-business packaging* generated fewer than 10 hits of pertinence to this research. Out of these hits most were of a Packaging Logistics, Lund University origin.

LIBHUB

A literature search was conducted in the Lund University licensed database LibHub. The LibHub search database replaced the Elin search database and came into force in January 2010. The literature search in LibHub was restricted to the years 2000 to 2010 and was limited to articles and conference papers. In general, the generated hits were on the topics of consumer packaging, and mainly on food packaging viewed from different fields and perspectives. Another area generating a great number of hits was the production of packaging per se.

The search words *industrial packaging* generated 60 hits; fewer than five were identified as relevant. The vast majority of generated hits for industrial packaging were in the fields of consumer packaging, food packaging, company-specific assortment offerings, packaging technology, packaging production machinery, chemical additives/fillers in packaging materials, and microbiology. Relevant or somewhat relevant articles dealt with logistics aspects and operational efficiency in warehouses.

Separate searches on the terms *business-to-business + packaging* and *business to business + packaging* generated four; none were found relevant.

The terms *industrial packaging* + *decision* generated five hits; none were identified pertinent.

The separate searches *industrial packaging* + *total cost* and *industrial packaging* + *purchas** (including the suffixes -ing and -e) generated no hits.

The search *packaging* + *purchas** generated 186 hits, out of which fewer than five were considered relevant. The vast majority of generated hits were on consumer and food packaging.

The search words *industrial packaging* + *logistics* generated 11 hits; one addressed the use of environmental tools for decision making on packaging systems. The other articles dealt with consumer and particularly food packaging, RFID implementation and measures to minimize transportation cost.

COMPENDEX

Compendex is an Elsevier provided database licensed by Lund University. The literature searches were restricted to journal articles and conference articles in English and German and published during the time span of 2000 to 2010. The location of the search words (emphasized in *Italic font* below) were not specified to particular fields (i.e. title, abstract, introduction etc.) The number of hits was vast (in the magnitude of thousands of articles), which called for means of narrowing down. This was enabled by employing the function of controlled vocabulary relevant for the scope of this research.

The term *Industrial packaging* generated 104 hits; three articles were identified as relevant. The excluded hits dealt with topics such as development and implementation, packaging as containers of chemicals, computer software, material properties and production methods.

The terms *Industrial packaging* + *logistics* generated 61 hits; none was regarded relevant. The excluded hits dealt with topics such as use and development of computer software, numerical analysis studies, material properties and RFID technology.

3. Frame of reference

This chapter provides the reader with the theoretical framework considered in the research conducted in order to discuss and strengthen empirical findings, as well as to elaborate on and extend the body of knowledge.

3.1 Supply Chain Management and Logistics

Christopher (2005) offers an interesting definition of *supply chain management* (SCM), emphasizing stakeholder relations, applicable to this research seen from an umbrella perspective: *"The management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole."* Judging by the abundant number of definitions of supply chain management, there is no unified consensus of the definition of the supply chain management concept per se (Skjoett-Larsen, 1999; Halldorsson et al., 2007; Stock & Boyer, 2009). Halldorsson et al. (2007) elaborates on the applicability of supply chain management theories when arguing that: *"Depending on the concrete situation, one can choose one theory as the dominant explanatory theory, and then complement it with one or several of the other theoretical perspectives."* Stock & Boyer (2009) concluded from a comprehensive qualitative analysis that the majority of SCM definitions identified (out of which numerous ones are frequently cited) included the concepts of material/physical, finances, services and information flows as key activities. Based on this study Stock & Boyer (2009) provided a synthesis definition of supply chain management encompassing the main essences of the investigated definitions: *"The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction."* This definition is more descriptive and offers an in-depth understanding of the supply chain management approach embraced in this research.

In today's business environment competition is argued to prevail between supply chains rather than between individual companies (Vonderembse et al., 2006; Lambert & Cooper, 2000). Porter (1985) discussed competitive advantages in light of the value system, which embraces actors upstream and downstream of a firm's own value chain. How the activities are performed and the linkages among the activities determine a firm's competitiveness in the marketplace. The competiveness deriving from the linkages is in terms of coordination and optimization, often represented by trade-offs between activities. A more costly set-up might reduce costs elsewhere in the value chain. (Porter, 1985) System-wide implications of a coordinated supply chain are attained when all decisions are taken to enable the fulfillment of the system objectives. Deficient information or incentives that are incompatible with the system-wide objectives give rise to coordination shortage. (Sahin & Robinson, 2002)

The goal of *logistics* is to achieve high delivery service whilst striving for the lowest total logistics cost possible (Aronsson et al., 2004). As for the concept of supply chain management, there are an abundant number of definitions for the concept of logistics found in literature. Judging by the definitions provided, there seems to be a consensus of what logistics encompasses, although different researchers stress different aspects. Bowersox et al. (2002) provide an interesting linkage between SCM and logistics when defining logistics as *"the work required to move and position inventory throughout a supply chain."* Christopher (2005) emphasizes the intralinkage characteristics of logistics when describing that the mission of logistics management is to plan and co-ordinate all those activities necessary to achieve desired levels of delivered service and quality at lowest possible cost. In accordance to Christopher (1998, p. 4) logistics is defined as: *"the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organization and its marketing channel in such a way that current and future profitability are maximized through the cost-effective fulfillment of orders."*

The Council of Supply Chain Management Professionals, CSCMP, provides the following definition of the term *logistics management*: *"Logistics Management is that part of Supply Chain Management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information*

between the point of origin and the point of consumption in order to meet customers' requirements." (CSCMP, 2011, established 2005). Based on well-known logistics organs and researchers including the Council of Supply Chain Management Professionals, Lumsden (2005) provides a definition of logistics applicable to the research reported on in this thesis: *"Logistics encompasses the movement of individuals and materials. Its components are the activities that are associated with management of the right item or individual, in the right quality, to the right point, at the right time, and at the right cost. The aim is to satisfy all parties' interests and needs and wishes emphasizing the customer. Logistics is composed by planning, organization, and control of all activities in the flow of materials, resources, financial assets, information, and return flows. The concept embraces operative responsibility including; administration, operation, procurement, accreditation responsibility, reconstruction as well as detail layout."* (Lumsden, 2005, p. 24).

Although the definitions of logistics diverge, the schematic illustration of the logistics network is agreed upon. There are three levels of flows in the network structure linking activities and businesses: material (physical goods) flows, monetary flows, and information flows. (Lumsden, 2006) The direction of each flow is illustrated in *Fig. 7*.

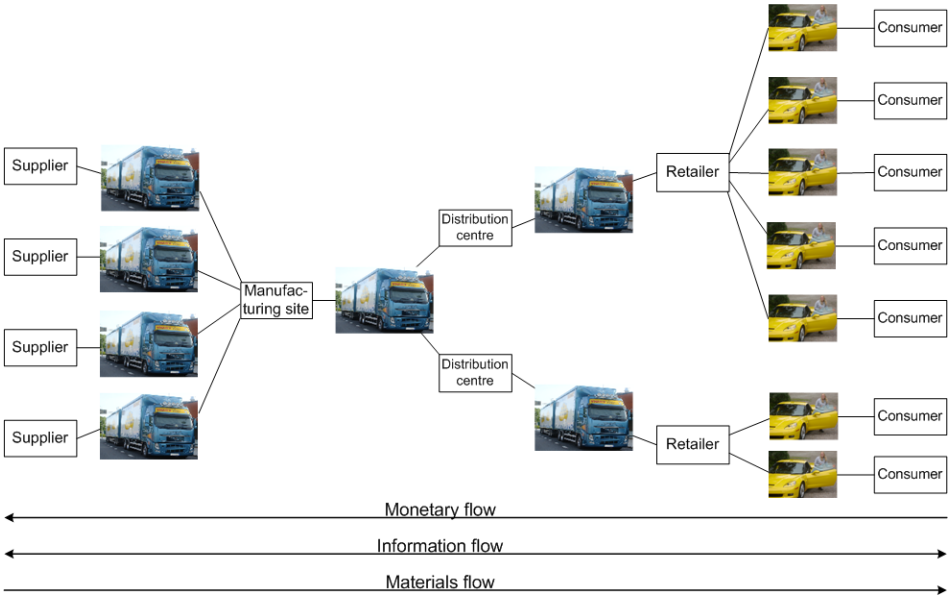


Fig. 7 A schematic logistics system and the three levels of flow; the monetary flow, the information flow, and the materials flow linking the logistics activities. (Inspired by Lumsden, 2005 and Ballou, 1992.)

3.2 Packaging Logistics

Research undertaken in the interdisciplinary field of supply chain management, logistics and packaging during the late 1990's and continuing in the 21st century has stressed the gains of considering packaging as a natural component in the product development and logistics arrangement. The integrative view of the realm of packaging, product, and logistics constitutes the area of *packaging logistics*, an area elaborated on by a number of researchers. Before discussing integration in greater depth, the statement by Hammer (1990) puts integration in the spotlight: *"Having people do development work simultaneously saves time, but at the dreaded integration and testing phase, the pieces often fail to work together."*, which expresses the outputs of parallel processes that are not compatible at the end of the day, leading to the inevitable need of costly modifications or redesigns. Benefits of integrated development efforts of product, packaging and logistics are found to be facilitated by cross-functional collaboration, in that it gains logistics performance and cost reductions (Klevås, 2005a). Bramklev (2003) took a different stance when she accentuated the potentials of integrated development processes of packaging and product to enhance resource

utilization. Surprisingly, the logistics aspects seemed to be overlooked. Klevås (2005a, 2005b) illuminated the need for further research into the integrative aspects, particularly emphasizing the advanced performance of the supply chain as a whole. Bjöörn (2008) elaborated this reasoning further, indicating that integrated packaging and product development that embraces logistics considerations enables a competitive and coordinated supply chain. In supplement, the involvement of packaging suppliers at an early point of the process has been identified as promoting the development process of packaging (Klevås, 2005a; Bramklev, 2009).

The logistics considerations in relation to packaging are framed in more detail, particularly by Hellström & Saghir (2007). Insight into the impacts from the packaging system on the supply chain might be realized by identifying and investigating the operational aspects of the packaging related activities in the supply chain (Hellström & Saghir, 2007). In addition, Ge (1996) argued that emphasis on the supply chain activities that are affected by packaging in the context of packaging design is rational, as this might give rise to cost savings. This argument is supported by several researchers (Johnsson, 1998; Hellström & Saghir, 2007; Olsson et al., 2008b), who claimed that a prerequisite to make accurate decisions on packaging is expanding the body of knowledge concerning the processes and impacts the packaging is exposed to along the value chain. The method of distribution includes consideration of impacts that will affect the product during the transport, storage, and distribution between producer and user, i.e. all kinds of likely hazards that might be expected on the journey.

Svanes et al. (2010) raised the need for a more holistic perspective when designing sustainable packaging and suggested among other things that consideration be paid to the external conditions that the packaging system will meet in the distribution chain, the distribution costs of the packaged product, the preservation of product quality, and user friendliness (ease of handling the packaging and its packaged product across the distribution chain to the consumer, across the value chain). While addressing logistics and packaging trade-offs associated with filling rate in transport vehicles and customer service in relation to storage and delivery frequency, Stock & Lambert (2001) did not emphasize the efficiency and effectiveness of logistics activities associated with the actual handling of the packaging or activities that impact on packaging from the viewpoint of the manufacturing corporation. In support of this, Johnsson (1998) reported that little

packaging is selected on the basis of where and how the packaging is handled.

Theory on the interdisciplinary research area of packaging logistics ought to be preceded by definitions and explanations of its fundamental building blocks: *logistics* and *product packaging*. Logistics was elaborated on in the previous section, and packaging will be tackled next. Ever since the beginning of mankind containerization of food and commercial items has played an important role. The development of packaging has progressed alongside the evolution of modern society and its increased demands. (Saghir 2004; Twede, 2009; Olsson et al., 2007) The traditional view on packaging has been as an isolated activity apart from the logistics activities made up of storage, transport and handling (Johnsson, 1998). One explanation for this point of view could, according to Johnsson (1998), have been that packaging costs conventionally used to include only the cost of packaging material; other costs arising due to its impacts with other activities were excluded. To enable accurate estimations of the costs incurred by packaging, the packaging ought to be viewed in the light of a systems approach, from the point of raw material to final disposal (Johansson et al., 1997). As Saghir (2004, p. x) puts it: *"Packaging represents the single most important interface between the product and the logistics system, and it can thus be used as a vehicle for enhancing operational efficiency."* Johansson et al. (1997, p. 7) support this stance when arguing that: *"The packaging plays a crucial part in making a logistics system efficient."*

According to Stock & Lambert (2001) the general functions of packaging are: *containment, protection, apportionment, unitization, convenience, and communication*. They focus on sales packaging in the context of the primary activities of outbound logistics and marketing and sales, and do not emphasize the functions in the context of business to business. On the contrary, Prendergast and Pitt (1996) claim there are three main functions clearly associated to the two target groups of marketing and logistics, respectively: the *protective function* is associated with the logistics activities, the *functions of attractiveness and usability* are considered marketing aspects and hence are associated with sales packaging, and the *functions of facilitation and convenience* are relevant to logistics as well as to marketing. The characterization of packaging functions in relation to its roles in marketing and logistics introduces the existence of different types of packaging at different points in the supply chain: the use of sales packaging from the manufacturing site and onwards to the final

consumer (i.e. downstream from the producing company), and the use of industrial packaging from different levels of component suppliers to the manufacturing site (i.e. upstream from the manufacturing company).

The definitions of packaging found attempt to embrace a totality approach to packaging. For example, Saghir (2002, p. 41) defined *packaging* as *"a coordinated system of preparing goods for safe, efficient and effective handling, transport, distribution, storage, retailing, consumption and recovery, reuse or disposal combined with maximizing consumer value, sales and hence profit."* Paine (1981, p. 3) presents three sets for defining packaging, each emphasizing somewhat different views:

1. A coordinated system of preparing goods for transport, distribution, storage, retailing and end-use
2. A means of ensuring safe delivery to the ultimate consumer in sound condition at minimum cost
3. A techno-economic function aimed at minimizing costs of delivery while maximizing sales (and hence profits)

Johnsson (1998) argued that the logistics system and the packaging system should be considered as a common system. Johnsson further claimed that separate analysis of these two components results in sub-optimization (Johnsson, 1998), which consequently according to Hellström (2007) results in unfavorable effects on the total cost and on the performance. Hellström (2007) elaborated these thoughts further and claimed that the logistics organization focuses on the logistics system, whereas the packaging organization focuses on the packaging system. Understanding each of the systems and their interactions with each other promotes decisions that take the impact and trade-offs of packaging along the supply chain into account (Hellström, 2007). Although the importance of packaging in logistics is highlighted, Stock & Lambert (2001, p. 462) elucidated deficiencies: *"Packaging trade-offs have frequently been ignored or downplayed in logistics decision making. However, like all logistics decisions, packaging affects both costs and customer service levels."*

Jönson (2001, p. 24) puts emphasis on the interface of packaging and its environment, arguing that: *"It is important to recognize that packaging makes up the interface between the product and the environment in which the packaged product will be distributed."* Hellström and Saghir (2007)

advocate the benefits of mapping the interfaces between the logistics processes and the flow of packaged product for the consumer market. They argue that this provides insight into how efficiency and effectiveness might be enhanced in the retail supply chains. Johnsson (1998, p. 114) elaborated on the implications of the packaging logistics reasoning and highlighted a more holistic and cross-functional view, arguing that *"Packaging logistics will help people to understand how the packaging interacts with the logistics system and vice versa. Packaging logistics will force packaging designers to analyze how the package is handled throughout the logistics chain."* In claiming *"Packaging has a key role to play in sustainable development."* Sonnevald et al. (2005) placed packaging in the context of sustainability research. The increasingly important role of packaging logistics and its intrinsically holistic approach are accentuated in light of the development of sustainable business (Olsson et al., 2008a). This was explicitly expressed in the words: *"Without an understanding of the influence of packaging on the performance of logistics, a valuable component in solving the logistics challenges for sustainable development will be lost"* (Olsson et al., 2007). This view was complemented by Verghese & Lewis (2007) who stated that: *"Packaging contributes to the success of product supply chains, enabling efficient distribution of products, and reduced environmental impact of product spoilage and waste."*

Simms & Trott (2010) argue that the negative view of packaging as a necessary evil originates from lack of knowledge of the important roles it plays (i.e. functional properties). The issue of sustainable packaging viewed from the packaging supplier standpoint has been raised by PriceWaterHouseCoopers, PWC (2010). In PWC's report it is argued that packaging businesses that continue to maintain a passive stance towards sustainable packaging will likely *"see market share ebb way to competitors that can develop compelling sustainable propositions that still meet the customers' fundamental functional and economic requirements"*. Verghese & Lewis (2007) link the sustainable dimension of industrial packaging to the implications of the supply chain, arguing that: *"environmental innovation in industrial packaging systems requires a cooperative supply chain approach to ensure that environmental and commercial costs are reduced and efficiencies optimized for the chain as a whole"*. Hellström & Saghir (2003) elaborated on the concept of packaging logistics and argued its focus is on *"the synergies achieved by integrating logistics and packaging systems with the potential of increased supply chain efficiency and effectiveness, through the*

improvement of packaging and logistics related activities." Extending from this definition, Hellström (2007) defines a packaging logistics activity as *"an operational activity which physically interacts with the flow of packaging system components."* Saghir (2002, p. 40) stressed that an accurate definition of packaging logistics ought to include *"the need of a combined strategy of reducing cost while maximizing consumer value and packaging performance."*

3.2.1 Industrial packaging and sales packaging development

By taking as a starting point that the preferences or priorities of the requirements of the packaging differ for different customers/users of packaging, a distinction can be made between packaging directed for end-consumers, *the sales packaging*, and packaging used more upstream in the supply chain between businesses, *the industrial packaging.* The point at which the packaging is used reflects the requirements it needs to satisfy. These requirements are different for different users. The differentiation of sales packaging and industrial packaging is based on the users' requirements and the associated processes in the upstream and downstream directions of the user in question. Industrial packaging is aimed at fulfilling the requirements of manufacturers and suppliers, focusing on customer satisfaction in the inbound logistics, not on the final costumers. As described in *Section 1.1*, the requirements of packaging in literature are more elaborated on in the case of consumers and the thereby-associated packaging system, sales packaging, than for the users of industrial packaging. Customers located at the upstream flow versus the downstream flow of the manufacturing company (see *Fig. 2*) have different requirements on the packaging due to different objectives. Based on the different needs, the same type of packaging system is not used throughout the entire supply chain. Simms & Trott (2010) relate the packaging levels of primary, secondary and tertiary packaging in relation to different stakeholders and their respective objectives.

3.2.2 Integrated packaging and product development

The baseline of integrated packaging and product development is to consider the packaging and the product as a unit, as the product. Based on Paine (1981), Johnsson (1998, p. 8) argued that *"the package is an important component of the product, with the same priority as other components"*. Drawing from this baseline, the packaging development and the product development become the final product development. The

dominating focus on consumer packaging and its products is strengthened by Simms & Trott (2010), who address the potential gains of running synchronized tracks of new product development and packaging development, in terms of adapting an integrative approach by letting the packaging become part of the product, especially in the case of *fast moving consumer goods* (FMCG). They further expressed that *"the impact of the unique role of packaging on the development of new packaging has not been fully addressed within the existing new product development literature."* In the case of fast moving consumer goods, FMCG, Simms and Trott (2010) have noted that there is a lack of research in new product and packaging development. A number of theories of packaging development were identified by Bramklev (2009) (see more in *Paper III*). Based on her categorization and the reasoning of the product development process by Ulrich & Eppinger (2007), Bramklev (2009) developed a generic packaging development process that incorporated the traditional measures and approaches of product development. Bramklev (2007) elaborated on an integrated packaging and product development process. She addressed the potential of the integrated process to enhance the use of resources; nonetheless, what resources and from what perspectives were not expressed. In addition, the integrated process did not encompass aspects such as cost and lead-time.

From the point of view of the manufacturing company and downstream in the supply chain, Simms & Trott (2010) emphasized the need for including the stakeholders in the case of FMCG. Their rationale is based on the benefits of adopting a wider perspective, encompassing an understanding of the needs of stakeholders' and the activities and conditions affecting packaging. They partly express their motivation in the following way: *"as it is the packaging of the product with which most channel members (not just retailer, but the entire distribution chain) will come into direct contact, and the packaging plays a number of key roles for these channel members."* In addition, they stressed that research on packaging in the past had been deficient in highlighting the benefits of packaging from marketing and business perspectives. Their view clearly indicated an emphasis on the interlinked properties of packaging and product, aspects clearly associated with consumer packaging. As indicated by the studies mentioned above, the impact of packaging on business has been a neglected area of focus in the business community. Furthermore, Zacharia & Mentzer (2007) argued that the implications of

considering the interface of logistics and packaging aspects are linked with company strategy.

The involvement of target customers, in terms of understanding their needs in order to achieve an enhanced level of satisfaction and increased performance of the products, is accentuated in the context of sales packaging (Simms & Trott, 2010). In parity with this, the aspects of understanding the activities (Hellström & Saghir, 2007; Johnsson, 1998) and conditions (Svanes et al., 2010) in the value chain where the packaging is handled are argued to promote the design and performance of the packaging. In addition to this view, Svanes et al. (2010) addressed the requirements of the packaging when proposing that the outcome of the assessments of the conditions in the distribution chain would serve as input in defining the specific requirement for packaging solutions in a sustainable packaging design. Furthermore, in order to achieve a successful integration of product and packaging development the product specification is of great importance. In line with this, van Weele (2005, p. 32) concluded that leading-edge companies in the automotive, computer, and consumer electronics industries are involved to a great extent in the product specification phase.

Paine (1981, p. 2) claimed that *"studies should be made to ensure the easiest handling achievable by manual and mechanical means is also best for the packaged product."* Paine (1981) argued that to develop/ identify effective packaging for a new or existing product, and ultimately cost effective packaging, three areas must be mapped:

1. facts about the product need to be known,
2. facts about the method of distribution and the journey involved, and
3. market considerations with regards to the product and the distribution method. All collected information is then aggregated to develop satisfactory packaging.

3.3 Cross-functional collaboration and supplier involvement

"Collaboration is a process of decision making among interdependent parties." (Stank et al., 2001). Supply chain collaboration can be divided into vertical and horizontal collaboration. Vertical collaboration

comprises collaboration with customers, internal collaboration (e.g. across functions), and collaboration with suppliers, among other things. Horizontal collaboration encompasses for example collaboration with internal competitors and collaboration regarding the sharing of manufacturing capacity. Key factors to successful collaboration are cross-departmental efforts, a commitment to work side by side, and a common goal or bond. (Barratt, 2004)

Bramklev (2009) found that packaging suppliers were involved after the manufacturing companies had decided on a packaging and product system. This finding contradicts theory arguing the benefits of a concurrent packaging and product development process (Klevås, 2005a, 2005b; Bramklev, 2009). In addition, van Weele (2005, p. 21) stressed the importance of early supplier involvement in new product development, NPD. *"As more and more innovations in industry come from suppliers, getting them involved early in the new product development process become an issue of prime concern."* He further noted the ability to work in cross-functional development teams that possess technical skills fit for the purpose at hand as essential. These aspects are also valid for development of packaging, and Twede (1992) concluded that the process of packaging innovation and packaging adjustments required team-work effort encompassing the specific competencies of packaging, marketing, logistics, engineering, and production.

Interdepartmental collaboration, as described by Mentzer & Kahn (1996), is facilitated by the use of teamwork, shared resources, and joint goals between departments. However, the formation of cross-functional (i.e. interdepartmental) development teams encompassing the purchasing function and the technical function might be impeded by the efforts of the purchasing function to enhance its position (Wynstra et al., 2001). Already in 1994, Leenders et al. argued that the purchasing function must open up for other functions in the company to have direct contact with the apt complementary functions in the supplier companies. Enhanced service performance and lower total costs are believed to be the fruits of vertical collaboration among actors in the supply chain; externally in terms of raw material suppliers and packaging suppliers to distribution of finished product, and internally in terms of collaboration within companies, for example between logistics and operations. (Andraski, 1998; Stank et al., 2001) The sub-optimization of functional areas was emphasized by Zacharia & Mentzer (2007), who claimed that: *"If*

logistics were involved earlier, it would be much easier to make cost trade-off decisions between the logistics implication of a particular design." In order to gain full potential collaboration performance, Barratt (2004) further emphasizes the need for collaboration at all levels in the organization: at the operational, tactical, and strategic levels of activity.

CSCMP (2011) provides the following definition of *functional silo*: *"A view of an organization where each department or functional group is operated independent of other groups within the organization."* Hennessey (1999) stated that these organizational groups (functional silos) characteristically have different goals. In order words, functional silos emerge when the functional units of a business focus on their respective functional objectives. As a consequence, these objectives might impede other functions' potential to perform in line with the overall business purpose. Moreover, according to Hennessey, identifying and scrutinizing problems from different perspectives stresses the shared business purposes (e.g. customer satisfaction, quality, and profitability) and downplays department objectives. Barratt (2004) touches upon the presence of functional silos prevailing within organizations, when stating that knowledge of other functions' activities is scarce: *"How many of us know what is going on throughout all the parts of our organisations that deal with or impact the particular product or activity that we are involved with as it passes through our organisation?"*. Hindrance of knowledge transfer in organizations was addressed in the Olsson et al. (2008b) study, where it was claimed that isolation of competencies to their original functions and disciplines posed obstacles. The same study also highlighted that organizations structured in functional departments tend to suffer from lack of insight into the requirement of other departments of the organization. In line with this reasoning, other researchers have shown that early involvement of cross-functional teams encompassing the competencies of packaging and product development promotes logistics benefits (Klevås, 2005a, 2005b; Bramklev, 2007).

Wynstra et al., (2001) suggest conditions for successful supplier involvement in product development. There are three main points for the manufacturing company to encompass;

1. Identification of specific processes and tasks that need to be carried out to support the supplier involvement. For example:
    i. Identification of core competencies that need to be included

ii. Defining product specifications for the product development

2. An organization must be formed that supports the cross-functional development team, including the technical and purchasing functions.
3. The organization needs people with the right purchasing, engineering and social skills.

3.4 Economic aspects

The activities that support the logistics processes drive and generate logistics costs. A prerequisite to effectively manage logistics processes is to embrace the total cost concept. (Lambert et al., 1998a) *"The goal of the organization should be to reduce the total cost of logistics activities, rather than focusing on each activity in isolation."* (Lambert et al., 1998a, p. 15). This is further emphasized by the statement: *"The packaging decision is truly one that requires the use of a systems approach in order to understand the true 'total cost' picture."* (Lambert et al., 1998a, p. 333). In a functional organization, each department works separately from the others. This leads to each function optimizing its own activities. In a flow oriented business, people from different competencies work together with the flow of a particular product or customer. As the goal of logistics is to accomplish a high level of delivery service, all stakeholders involved in logistics operations ought to strive to decrease the total cost of logistics. In other words, attention needs to be given to each activity without compromising the holistic perspective. (Aronsson et al., 2004) Twede (1992) concluded that purchasing of packaging and packaging operations are rarely considered as constituents of the total cost. Moreover, *"Total packaging cost is a combination of the costs for material, equipment, operations and labour."* (Ge, 1996).

Ballou claimed that management of trade-off analysis and the total cost concept (1992) and cost conflicts (2004) are central to logistics. Already in the 70's, Sheth (1973) stressed that investigation of the trade-offs arising with various activities and objectives creates customer satisfaction. It was suggested that such conflicts be coped with by balancing the activities in order to agree upon a consent optimum (Ballou, 1992). Ballou (1992, p. 40) further argues that *"cost trade-off is the recognition that cost patterns of various activities of the firm frequently display characteristics that put them in conflict with one*

another." CSCMP (2010) provided a somewhat more illustrative definition of the same concept: *"The interrelationship among system variables indicates that a change in one variable has cost impact upon other variables."* Reduction of costs in one area/variable may escalate costs in other areas/variables (Lambert et al., 1998a; CSCMP 2010), which is one type of sub-optimization. Packaging gives rise to direct costs (e.g. costs for material, purchasing administration, storage and internal handling of packages) and indirect costs (costs associated with logistics activities). Johansson et al. (1997) stressed that attention is most often given to the direct packaging costs, although the indirect costs make up a large portion of the total packaging costs. Instead of considering packaging as a pure cost item Johansson et al. (1997) argued it should be regarded as an enabler of achieving a more efficient logistics flow. Furthermore, discussions of packaging tend to focus on costs; nevertheless, it should not be ignored that packaging has the potential to reduce system costs by preventing goods damage and thus save waste of system resources (Olsson & Larsson, 2009).

"All activities need to be performed in such a way that the total value generated by the company is more than the sum of its costs." (van Weele, 2005, p.11). Porter (1985) describes *cost drivers* as the structural factors that influence the cost of an activity: *"Cost drivers determine the behavior of costs within an activity, reflecting any linkages or interrelationships that affect it."* (p. 63). It is further pointed out that the cost of a given activity can be determined by more than a few cost drivers (Porter 1985; CSCMP 2010). Porter (1985) defined a number of major cost drivers: *economies of scale, pattern of capacity utilization, interrelationships* and *integration*, among others. Of particular interest to this research is the interrelationship among the different intrafirm functions, since *"Interrelationships with other business units within a firm affect cost."* (Porter, 1985, p. 78).

CSCMP (2010) defines *cost allocation* as *"An accounting practice which assigns indirect cost such as overhead to products or services using a known factor such as pieces produced or direct labor costs/hours."* Christopher (2005, p. 111) described *activity based costing* as follows: *"The key to activity based costing (ABC) is to seek out the 'cost drivers' along the logistics pipeline that cause costs because they consume resources."* That is, costs are separated and allocated to the activities that give rise to them. The true costs are obtained by matching the costs of activities at different levels. *"The cost behavior of activities cannot be*

understood without simultaneously examining the costs of the inputs used to perform them." (Porter, 1985, p. 39).

The terms *purchasing* and *procurement* differ in scope; nevertheless, they are commonly used interchangeably (van Weele, 2005; Stock & Lambert, 2001). Purchasing encompasses the actual buying of materials and the activities related to the process of buying (i.e. supplier selection, arriving at a price, specifying terms and conditions, issuing contracts, and follow up delivery). Procurement is broader than purchasing in that it includes all the activities required to facilitate the flow of product downstream in the supply chain, from the raw material and component suppliers to the final end-point (van Weele, 2005). Procurement includes purchasing, transportation, warehousing, and reception and control of inbound material (van Weele, 2005; Stock & Lambert, 2001). Effective strategies in purchasing and supply offer a number of improvements for companies. However, to achieve improvements it is necessary to emend the collaboration between the different functional departments within the organization or company. (van Weele, 2005, p. 19)

Wynstra et al. (2001) address the issues of purchasers' lack of skills, when arguing that: [*experience governs*] *"a better understanding of the development and engineering process and of the demands and priorities that engineers put on certain issues, which enables the purchaser to 'speak the engineer's language' "*. In addition, van Weele (2005, p. 85) added: *"Purchasing decisions cannot be made in isolation, and should not be aimed at optimization of purchasing performance only. Purchasing decisions should be made taking into account the effects of these decisions on the other primary activities (such as production planning, materials management and transportation)."*

Sheth (1973) describes the nature of the industrial buyer behavior, from the objectives, motives, and viewpoints of the stakeholders involved in the decision making, to be in conflict. He frames it in the following way: *the buying motives and expectations about brands and suppliers are considerably different for the engineer, the user, and the purchasing agent* (Sheth, 1973). The nature of the firm, according to Sheth (1973), is likely to determine the mandate of the buying decision. He argues that a technology-oriented company is dominated by the engineers and hence they take the decisions. On the other hand, in a large company the decision making tends to be a joint decision among various parties. Product specifications for industrial packaging given for ordering and

buying are challenged when they are addressed by the purchasing function as to whether they are fit for the purpose. Features considered not necessary to fulfill the need, as perceived through the lenses of the purchasing department, of the product are omitted. This rationalization often leads to selection of a supplier providing a less expensive product. (van Weele, 2005, p. 14) Hence, the trade-offs among activities are often not taken into account.

3.5 Processes and activities / process mapping

The work of describing processes is commonly denoted process mapping (Ljungberg & Larsson, 2001). This approach increases the understanding of organizational activities (Argent, 2007; Pojasek, 2005) and illuminates previously invisible processes (Ljungberg & Larsson, 2001). More precisely, descriptions of business operations by means of process mapping enable accessible explanations to the relations and interplays between different parts in the organization in order to create customer satisfaction. (Ljungberg & Larsson, 2001) The same authors described the concept of process as *"a repetitively used network of activities linked in an orderly manner using information and resources for transforming 'input objects' to 'output objects', extending from the point of identification to that of customer satisfaction."* Christopher (2005, p.135) complemented the description of processes, when arguing that processes *"are cross-functional by definition and are usually best managed through the means of interdisciplinary teams."*

Regardless of the nature of the process, it is initiated by a need and is terminated by customer satisfaction (Ljungberg & Larsson, 2001). *"A process's right to exist is solely dependent on its ability to satisfy the needs of its customers."* (Ljungberg & Larsson, 2001, p. 44). Keller & Jacka (1999) describe a process as *"a combination of inputs, actions, and outputs."* The concept of process mapping can be applied to gain understanding and appreciation of critical relationships (Keller & Jacka, 1999). The implication of using especially interviews as a source of information is addressed by Keller & Jacka (1999) when claiming that: *"In process mapping, the precise purpose of interviews is to gain an understanding of how the process functions and to document that understanding in process maps."*

Different researchers elaborate the creation and use of process maps. The action of process mapping is explained by Keller & Jacka (1999) as *"a*

systematic approach for documenting processes and their related cycle times." Often, the activities, sequences and relationships that have been shared during data collection methods are represented by symbols, lines and words. (Keller & Jacka, 1999) A process map is presented as a flowchart or a worksheet where opportunities for improvement can be identified (Gourishankar, 2003). This suggestion is supported by Svanes et al. (2010), who state that in-depth knowledge and assessment of the conditions in the distribution chain might serve as input for improving the conditions that disfavor the packaging system.

4. Summary of appended papers

This chapter describes and relates the content of each of the three papers. The theoretical scope of the first paper is the methodological basis for paper two and three. The case studies reported on in paper two and three identify the processes and rationales behind the decision making of industrial packaging at the supply chain actors: the packaging users (manufacturing companies) and the packaging suppliers. Comparisons between the two actors address the approaches that are prioritized by each actor and the nature of the relation and cooperation between them.

4.1 Paper I

"Towards improved reporting of case study research – an evaluation of articles in top tier logistics and management journals"

The first paper creates the methodological foundation of the two following papers and is entirely a methodology paper. It addresses the case study research approach from an evaluative standpoint of the reporting of such studies and the suitability of the research approach to this research area. The aim of the paper was firstly to present a framework for assessing reporting of case study based research, and secondly to evaluate recently published case study based research within the area of supply chain management and logistics, and thirdly to categorize and suggest areas for improvement in the reporting of case study based research in the areas of supply chain management and logistics.

The result of the study was the identification of weaknesses and suggestions for the reporting of case study based research with regards to the proposed framework. The study was guided by three research questions:

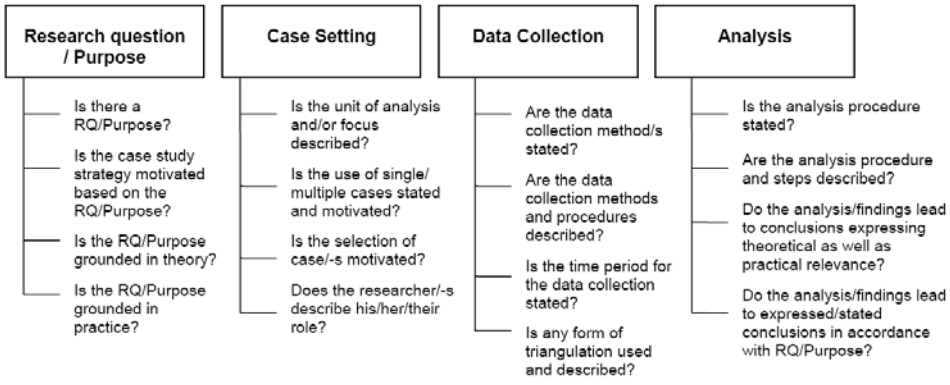
i. What are important criteria for case study design, conduct and reporting described in the literature?

ii. What is the current state of published case study based research within logistics and supply chain management?

iii. What are common weaknesses and areas for improvement in the reporting of case study based research within logistics and supply chain management?

The research process had seven distinctive steps. To answer the first research question and provide fundamental input to a draft list of criteria important for the design, execution, and reporting of such research, an initial literature review of qualitative and case study research methodology was made. The selection of literature was based on published work by authors who suggest criteria for design, conduct and reporting of case study based research or who are frequently referred to in case study based studies in the areas of supply chain management and logistics. In general, the list included the phases of defining the research question, developing the research instruments needed, collection of data, analysis of data, and the dissemination of the research. The second research question was embarked upon in the next step, where a number of 51 case study based articles published during 2006-2008 in five top tier journals were selected. To partly answer the third research question, a journal in the management area was included in the selection. The remaining answer for research question number three was found in the analysis of the selected articles based on the developed framework. Based on the draft list of criteria the selected articles were read and evaluated. Emanating from the draft list of criteria the framework consisting of four main and 16 sub-criteria was orchestrated (see *Table 5*). The sub-criteria were posed as questions to enable evaluation and comparison on how the selected articles fulfilled the criteria. The selected articles were read, cross-read and compared based on the framework developed. Subsequent to the reading, a joint analysis was made regarding the aggregated findings. As a final step the degree of fulfillment of each sub-criterion and suggested areas for improvement were summarized and presented.

Table 3 A framework with, in total, 16 sub-criteria – stated as questions – enabling evaluation of reported case study based research. (Olander-Roese et al., 2009)



4.2 Paper II

"The packaging selection practice – a case study"

The second paper reports on a case study that focuses on the packaging selection and guiding principles of the packaging selection processes at two international manufacturing business-to-business companies, i.e. users of packaging. The research was designed as a qualitative case study influenced by an inductive approach. The collection of data was achieved by means of semi-structured interviews, secondary data, and field trips.

The two research questions below gave rise to the case study approach, in accordance with the first paper and the literature on case study methodology. The research questions posed were:

i. How is the packaging selection procedure designed in the two case companies?
ii. What principles guide the packaging selection procedures?

The first research question is answered by describing the packaging processes and critical decisions at each department. Process maps complement the descriptions. The answer to the second research questions is framed by in-depth analysis of the influences at each point of decision in the process maps. The findings were that cost aspects, standardization, production philosophy, and degree of collaboration between the packaging department and other departments and functions

in the overall company (internal company collaboration), and collaboration with packaging suppliers, influenced the packaging decisions. Based on this, the two manufacturing companies' packaging selection processes were mapped. Both companies claimed that their packaging selection processes resemble the traditional development process for the development of the core products. The study also identified similarities and dissimilarities in the approaches of the packaging domain, e.g. the distribution of responsibility with regards to the packaging issues within each company and the approach towards integrated product and packaging development. The findings of the study were contrasted to the literature on packaging selection and design processes. In the literature it was found that there was a strong support from practice and academia to integrate the product development process and the packaging development process. Additionally, the literature emphasizes that packaging selection and design depend on various activities and factors along the supply chain, especially addressing costs arising.

This paper contributes more insight into the selection processes and reasoning behind packaging decisions from the packaging users' standpoints. These insights might have a positive financial impact, enhance efficiency and effectiveness in the supply chain, and provide more input into the decisions that directly and indirectly affect the environment.

4.3 Paper III

"Hidden aspects of industrial packaging – the driving forces behind packaging selection processes at industrial packaging suppliers"

The choice of industrial packaging has an impact on activities throughout the supply chain in a number of ways, for example in terms of costs, handling efficiency, transport efficiency and environmental considerations. The purpose of this study is twofold: to gain insight into the processes employed by industrial packaging suppliers in packaging selection, and to understand their interactions with manufacturing companies, in the context of the supply chain, in order to find a packaging solution that satisfies the demands of the customer.

The research questions used to fulfill this purpose are:

i. What processes and rationales are used when packaging suppliers suggest an industrial packaging solution?
ii. What is the nature of the ongoing dialogue and the state of involvement between the industrial packaging suppliers and the manufacturing companies to arrive at a satisfactory packaging solution?

Three case companies, all packaging suppliers to global manufacturing customers active in various fields, have participated in the study. In response of the first research question it was found that all participating case companies investigate the characteristics of the product to be packaged and perform process mapping of the customer's supply chain and logistics cost analyses to identify cost driving activities. The degree and approach of the in-depth analyses of aspects considered in the mapping of the supply chains differ somewhat between the three companies.

Additional answers to the rationales on packaging selection were of a somewhat tangible nature and linked to the second research question. The bottlenecks in the packaging selection processes experienced from the supplier side are recognized as barriers to a fully compatible product and packaging system, and are briefly described in the following. The packaging suppliers expressed that the knowledge gap and neutrality from the manufacturing companies regarding the relevance of the impact of packaging on the costs of activities generate low priority to packaging matters. That is, little analytical consideration with regards to the selection of packing that suits and eases the intended purpose and activities (except for protection) is given. From a managerial perspective, low priorities of the packaging related activities are likely to generate staff/persons with little knowledge and interest in working with these matters. The shortcoming of having the incorrect contact person at the customer company frequently generates incorrect and insufficient information. Furthermore, the packaging suppliers often come to realize that a mutual and successful packaging development is terminated by the purchasing function at the manufacturing company due to a dominating cost focus on the initial investment. Compatibility of the industrial packaging with its encountered environment during the logistics flow, based on trade-off reasoning of stakeholders' activities, is often

overlooked. In turn, the total cost savings that a certain product and packaging system potentially could give rise to are disregarded.

In order to reduce packaging related costs, in terms of the packaging development per se as well as product and packaging system compatibility in the supply chain, the packaging suppliers prefer involvement with the customers in an early phase of the development of the product to be packaged. Seldom are contacts made in advance prior to product launch, which escalates costs later in the process due to the need of rapid measures. According to the suppliers, manufacturing companies have become more aware of the influence of packaging on other activities, but still lack of knowledge is widespread. The packaging suppliers participating in the study recognize the benefits of having interdisciplinary knowledge present in the packaging selection, whether the competence derives from the packaging supplier or the different functions at the manufacturing company. For the packaging suppliers to meet the cost focus and to display gains in the total process, they performed mapping of the manufacturers' processes. Hence, to demonstrate the functions and value of the packaging in the physical flow of goods, the packaging suppliers map all the activities that have an impact on and are affected by the packaging and product system.

5. Case findings

The chapter provides answers to research question 1: "How is the development process of industrial packaging orchestrated at manufacturing companies (users of industrial packaging)?" and research question 2: "How do packaging suppliers meet customer request for industrial packaging?" Paragraph 5.1 elaborates on RQ 1 and paragraph 5.2 elaborates on RQ 2.

5.1 Case study - manufacturing companies

The input to the researcher generated process maps founded on the interviews and on internal documents (e.g. actual process maps) provided by the manufacturing companies. These process maps provide answers to the first research question posed in *Paper II*, i.e. the design of the packaging selection procedure. The process maps are placed in *Appendix 1*. Case A_M claimed that the routines and processes were well anchored and had the same formula as the overall manufacturing process for the core products at Case A_M. The case interviewees claimed that not meeting its deadlines could jeopardize the entire overall manufacturing process, and hence there were clearly set stage gates and milestones for packaging related activities. Case B_M strived to employ the same set-up for packaging related activities as for its products; in other words, the packaging would be looked upon and prioritized in the same light as other products. The rationale for applying the already known way of working at Case B_M was ease of implementation and adoption. Comparisons of the two case companies showed that the responsibility of the area of packaging use differed at different points in the supply chain. The explanation was identified to be the nature of the diverse core businesses.

In the illustrated process maps, the guiding principles (i. e. the decision support) of the selection procedure, as asked for in the second research question in *Paper II*, and used as determinants of the continuing processes are highlighted as:

- Collaboration between departments
- Product characteristics and specifications / demands
- Cost of packaging

- Cost of packaging related supply chain activities

Considerations identified as important are: wish for increased collaboration between departments at the manufacturing company and between manufacturing company and packaging supplier. The findings from both cases addressed the level of sophistication of the prevailing collaboration. A well functioning collaboration with the other departments was the case in Case A_M and a wish for a closer collaboration, especially with regards to the design department, was the case at Case B_M. None of the case companies emphasized the influence of the purchasing function on the development process to be of any considerable impact. The vertical collaboration with the supplier is not explicitly addressed as something in need of extra attention. In addition, the manufacturers do not explicitly state the different stakeholders' objectives as negative influences.

5.2 Case study - packaging suppliers

The case study performed at the packaging suppliers provided insight into the reasoning of the manufacturing companies' efforts and decision support through the lenses of the packaging suppliers. The three suppliers' working routines did not deviate to any remarkable extent, and therefore their processes are combined in one process map (see *Fig. 8* and *9*). However, Case C_S had a different scope in that consideration of sales packaging was part of its concept. Nonetheless, with reference to the research focus and demarcations of this research (see *Section 1.3)*, this aspect was judged to be outside the scope of this research.

The process map generated by the researcher emphasizes the responses to the first question posed in *Paper II*, which seeks to identify the processes and rationales used by the packaging suppliers. As depicted in *Fig. 8*, subsequent to the initial phase of identifying the manufacturing company's need, problem and/or objective, the packaging suppliers proceed with activities aimed at finding information about the product to be packaged and the product and packaging system's (PPS) encounters along the supply chain. Complementary details of the identified characteristics of product information and supply chain mapping are found in *Appendix 2*. The supply chain process mapping in *Fig. 8* encompasses the activities and the associated stakeholders that are encountered, in terms of having impact on or being affected by industrial packaging (see *Fig. 9*).

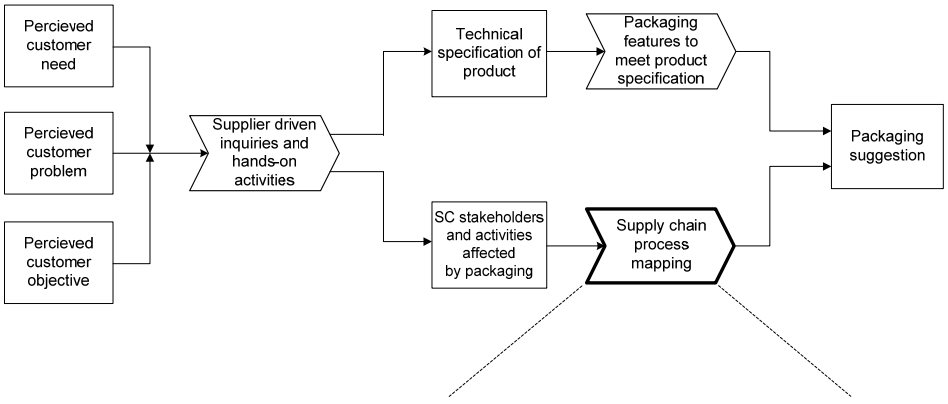


Fig. 8 An illustration of the working method undertaken by the packaging suppliers as comprehended by the researcher.

Fig. 9 illustrates the sub-process of the SC process mapping. The input of the objectives of the different stakeholders of industrial packaging gives rise to identification of their individual priorities. The packaging suppliers regarded these separate priorities as undermining a packaging decision based on the total lowest cost. Instead of employing trade-offs assessments, it was expressed by the packaging suppliers that dominating objectives and priorities prevent rationale reasoning, which turns out counterproductive to the overall benefit of the business. One supplier claimed to have experienced the power of the purchasing function in terms of ending successful collaboration efforts. The engineering/design function prioritizes the compatibility of the industrial packaging with the physical part in question in order to meet the protection requirements. The logistics function prioritizes the efficiency and effectiveness performances of the activities that are affected or exert impact on the packaging. The purchasing function prioritizes a packaging that meets the necessary requirements (as viewed from their perspective) at the lowest cost possible. Next, the activities prioritized are mapped in more detail, and activity based costing analyses are performed that provide information on the cost drivers. The cost and efficiency trade-offs that come with different industrial packaging alternatives are evaluated in relation to the current industrial packaging. The alternative that gives rise to the total lowest cost based on stakeholder rational trade-offs is presented as the packaging suggestion (see *Fig. 8*).

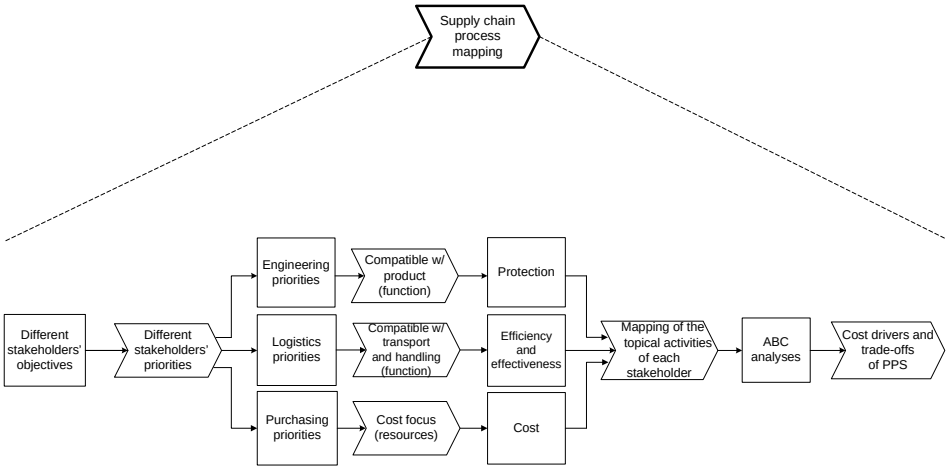


Fig. 9 A zoom-in illustration of the sub-activities of the SC process mapping.

The second research question in *Paper II* seeks to explore the interactions between the two supply chain actors. All three participating packaging suppliers claimed to see tendencies towards increased consideration in the approach taken by the manufacturing companies towards industrial packaging in terms of a somewhat better anticipation of packaging supplier involvement. The packaging suppliers acknowledged that their customers occasionally recognize the need for analysis of logistics activities that have an impact on or are affected by industrial packaging. However, the supplier argued that the general scenario was that the manufacturers had poor knowledge of the total cost of packaging related activities that are incurred upon use of a certain type of packaging. They claimed that the degree of sophistication of the integrated product and packaging development processes varied at the manufacturing companies. It was stressed that packaging was frequently considered to be ‘simple’ by the manufacturing companies, and that by adopting this approach several potential gains in the supply chain were lost. The suppliers addressed that there often was a knowledge gap and lack of interest from the manufacturers, particularly regarding the contact person. Besides providing the basic information, additional and necessary information with respect to packaging, logistics, and what impact the packaging has on the supply chain and vice versa was scarce. This scarcity of knowledge was also believed to restrain the insight of the costs incurred thereby. The suppliers emphasized the advantages of cross-functional teams as measures to enlighten insight into the activities

confined within the functions of the packaging stakeholders. This would in turn foster a systems perspective and reduce sub-optimization.

Furthermore, as previously mentioned, one of the manufacturing companies in the first case study was represented by the automotive packaging function that claimed to have a well-anchored packaging development process. The second manufacturing company was represented by the packaging function at an electrons engineering industry that was striving to achieve a consistent and established packaging development process. Findings from the packaging suppliers named companies in the automotive domain as forerunners when it came to anticipating packaging needs and design. Though, the case study at the packaging suppliers showed that well-established packaging functions did not employ the supplier competence to the same extent as the less established packaging functions. On the other hand, the well-established unit often kept the supplier informed in advance of coming efforts and demands, enabling a smooth involvement where room was left for iterative feedback.

6. Analysis and discussion

Based on the combined input from empirical findings and theory, this chapter presents an analysis and discussion of the implications of the findings in relation to theoretical reasoning on aspects to be enhanced or downplayed, thus treating research question 3: "What aspects are argued to be enhanced and downplayed from the stance of different stakeholders of the industrial packaging development process?"

Both respondents from the manufacturing companies and the packaging suppliers raised the matter of collaboration as an important area of improvement. The collaborative efforts were identified to be of two natures: collaboration between interdepartmental functions at the manufacturing companies and collaboration between packaging suppliers and manufacturing companies. The effects of these two types of collaboration are discussed in more detail in the following. *Fig.10* illustrates these two types of collaboration.

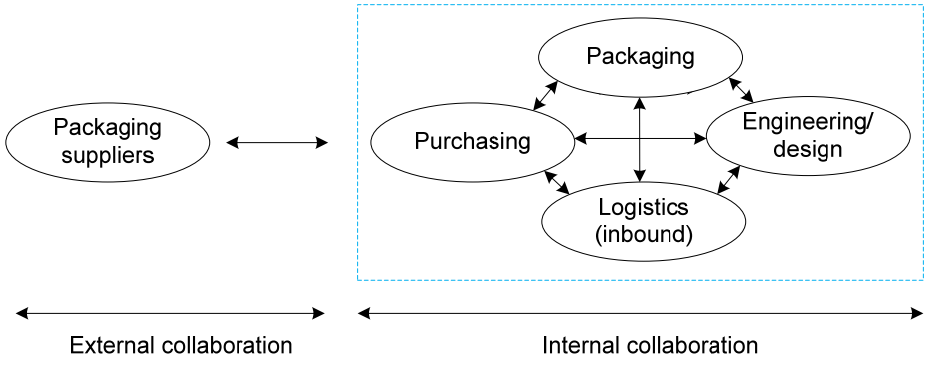


Fig 10. Functions of necessary internal and external collaboration. (Adapted from Barratt, 2004.)

The manufacturers' effort or accomplishment towards similar and integrated product and packaging processes is unanimous with the research conducted within the field of packaging logistics. Bramklev (2007) especially addressed the integrated development process of packaging and product by taking the traditional measures of product

development into account. As opposed to Klevås (2005a; 2005b), Bramklev (2003, 2007, 2009) does not consider the logistics implications of an integrated packaging and product development process. The manufacturing companies expressed that a close collaboration between the two development departments enables direct feedback on actual design solutions for the benefit of logistics performance as well as from cost standpoint. The manufacturing companies further acknowledged the benefits of a more integrated product and packaging development process in terms of having experienced cost savings in total cost. These findings are in accordance with Klevås (2005a), who argued that interdepartmental collaboration efforts (i.e. cross-functional) facilitate an integrated packaging, product and logistics development that generates positive effects in terms of increased logistics performance and cost savings.

In order to perform an integrated packaging and product development process successfully its output need to comply with the logistics activities. The goal of logistics is to deliver high service at a low total cost (Aronsson, 2004). Since the packaging development process is intimately linked with the product development process and the logistics process, the effects from any of these spills over on each of the other processes. Therefore, the statement: *"The packaging decision is truly one that requires the use of a systems approach in order to understand the true 'total cost' picture."* (Lambert et al., 1998a, p. 333) is highly applicable to this research. This reasoning also extends to the shortage of insight into other functional units' needs and requirements in the same organization, as expressed by the packaging suppliers. This was discussed by Olsson et al. (2008b), who argued that in a functional organization the competencies are isolated within their own disciplines, which poses obstacles to knowledge transfer within an organization. According to the packaging suppliers, this often seems to be the case at the manufacturing companies. This reasoning is in line with Hennessey (1999) who stated that organizational groups within an organization by nature focus on different functional objectives. In line with this, Barratt (2004) argued that for stakeholders not knowing the encounters or impacts of the products and related activities confronted elsewhere in the supply chain, except for that particular stakeholder's supply chain activity, is frequent. On the contrary, a flow oriented organization, according to Aronsson et al. (2004), is characterized by different stakeholders working together in dealing with individual activities without compromising the holistic perspective. The latter organization

would promote an integrated packaging and product development process. Furthermore, Hennessey (1999) suggested that identification followed by scrutiny of issues from different perspectives would downplay individual department objectives and hence govern the overall business purpose.

The working method of the suppliers in this study is in line with Paine's (1981) ideas of areas to be mapped in order to enable a suitable packaging development. These areas are firstly facts about the product, and secondly facts about the method of distribution and the journey involved. In addition, the mapping of interfaces between the packaging and its product and the logistics flow in the context of the consumer market was acknowledged by Hellström & Saghir (2007) as a promoter of efficiency and effectiveness. These aspects are, however, also applicable in the field of the flow of industrial packaging in its logistics flow, as is recognized by the packaging suppliers' actions to map the encounters and estimate the incurred costs. From these analyses the suppliers identify the cost drivers. The rationale of engaging in cost driver analyses is described by the Council of Supply Chain Management Professionals (2010) as *"In cost accounting, the examination, quantification, and explanation of the effects of cost drivers. The results are often used for continuous improvement programs to reduce throughput times, improve quality, and reduce costs."* In addition, according to Christopher (2005) identifying the cost drivers is the key in activity based costing (ABC).

There seems to be a gap between the manufacturing company and the packaging supplier of the desired skills of the contact person engaged in the cross-disciplinary area of logistics, product, and packaging. The contact persons at the manufacturing company who, according to the packaging suppliers, often possess limited skills in the areas of concern, would need to broaden their perspectives. Or, as Leenders et al. (1994) argue, support direct information sharing between the concerned functions at the manufacturer and the corresponding functions/ competencies at the supplier. This direct communication is said to explicitly take place at the packaging development process at packaging supplier C. Furthermore, according to the packaging suppliers, the contact person at the manufacturing company often belongs to the purchasing function. Research by Silgård Casell (2010) indicates that the purchasing department often dominates the packaging decision in manufacturing companies where the packaging function is not well

established. Fruitful collaboration between the packaging function at the manufacturing company and the packaging supplier was expressed by one supplier to have been cut repeatedly by the purchasing department. The efficiency and effectiveness of the supply chain activities are downplayed in favor of the strong focus on cost reductions. This could be related to Johansson et al. (1997), who claimed that the focus of packaging from a buying perspective is often on the direct packaging costs rather than the indirect costs or cost savings it gives rise to owing to its encounters along the supply chain. This is in line with what the packaging suppliers expressed, that not looking beyond the initial cost focus and widening the holistic lens might be a result of the deficiency in knowledge of the stakeholder objectives and priorities. There seems to be a shortage of skills in the purchasing department in that reductions of costs in one area might escalate costs in other areas (Lambert et al., 1998a; CSCMP, 2010). *Fig. 11* illustrates the researcher's interpretation of the often-encountered reasoning at manufacturing companies as viewed by the packaging suppliers.

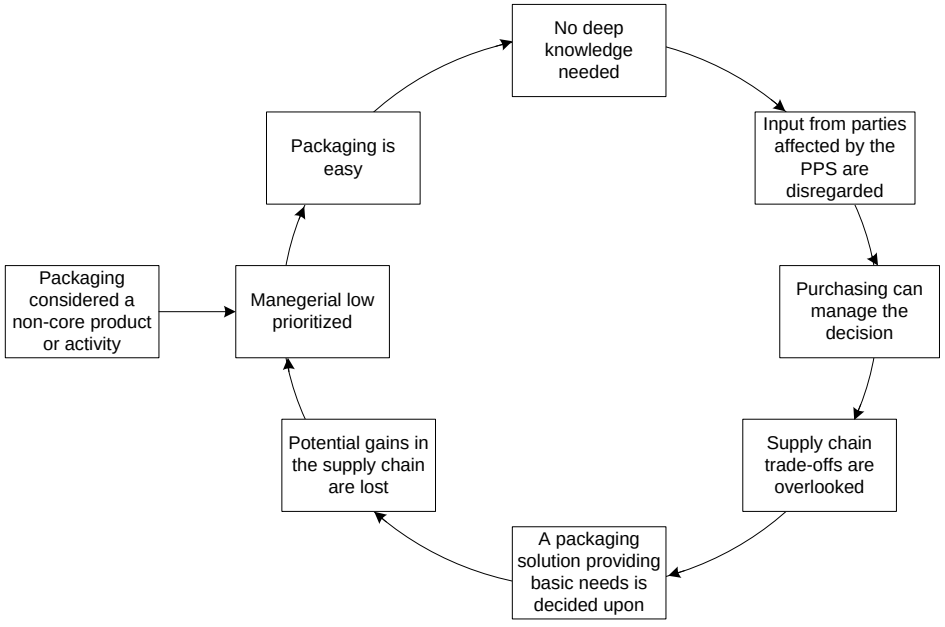


Fig 11. The general packaging supplier perception of the role/importance of packaging prevailing at the manufacturing companies. (The researcher's own illustration.)

Enhanced knowledge and understanding of the affected activities might serve as incentives of increased coordination. Wynstra et al. (2001) have stressed the issue of purchasers' lack of experience in the context of the development and engineering processes. Actions taken to increase the knowledge and understanding of other stakeholders' objectives and priorities would give rise to better equipped (in terms of adequate skills) contact persons and a decrease in sub-optimization. The issue of sub-optimization in relation to logistics considerations of compatibility was addressed by Zacharia & Mentzer (2007). They concluded that early involvement of the logistics function promoted rational cost trade-off decisions between design and logistics suggestions. In turn, this cross-functional knowledge promotes awareness of what trade-offs between the different stakeholders' activities are rational in regard to the total costs. The findings of this study suggest that there are imbalances between the influencing powers of different stakeholders. The reasoning for the importance of packaging to different activities versus the considered complexity of the packaging, as comprehended by the researcher, is illustrated in *Fig. 12*.

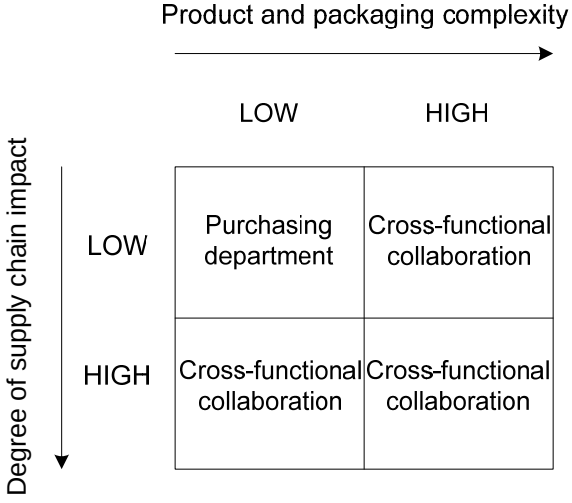


Fig. 12 The dispersion of stakeholder involvement at the manufacturing company based on the dimensions of product complexity (i.e. complexity of the packaging and product as a unit) and the degree of impact of the packaging on the stakeholders. (Adapted from van Weele, 2005.)

The traditional view of packaging items as products with low complexity and the lack of their impact on concerned stakeholders has governed dominance of the purchasing department. The compatibility with affected

activities has not been a priority, nor has efficiency based on trade-off considerations been a matter of business focus. Taken together, as the components of today's finished goods are growing more and more complex, there is a need for more complex industrial packaging in order to protect, transport and handle these items in an efficient and effective manner. In addition, the increased knowledge of the impact of the industrial packaging and its effect on the activities along the supply chain has raised the need for a change in reasoning about the competencies needed to develop a satisfactory industrial packaging. *Satisfactory* in this case is to be interpreted as meeting the requirement of the product as well as the encountered environment in order to accomplish the lowest total cost. As a consequence, the low-low situation (second quadrant in *Fig. 12*) has long been prevailing. For each of the other three situations (in *Fig. 12*) the effects on the product to be packaged are high and require collaborative efforts involving the packaging, engineering, purchasing and logistics[3] functions (first quadrant), or the impacts on the supply chain activities and stakeholders are high (third and fourth quadrants) and require more intense collaboration efforts between the four functions especially addressing the interests of the supply chain actors' activities.

Wynstra et al. (2001) provide an outline of conditions for successful supplier involvement: firstly, define what needs to be met, secondly, set-up of cross-functional development teams, and thirdly, ensure there are adequate skills in the teams. These three main areas coincide with the areas emphasized by the packaging suppliers. Timely involvement of packaging suppliers in the manufacturers' development process was a recurrent theme of the data collected from the packaging suppliers. Although the suppliers stated their involvement was anticipated to a greater extent than before, the occurrence of involvement well in advance was still rare. However, in those cases where involvement was announced in advance, the time before the product launch and hence the actual implementation of the packaging could be up to one year. This foresightedness was acknowledged as very positive by the suppliers, as it provided the best conceivable preparations. This is in line with the recognition by Bramklev (2009), who reported on the associated benefits of supplier engagement already at the conceptual development phase of the product in terms of resource efficiency.

[3] The logistics function often represents the interests of the personnel working at the assembly site.

In every business relation there is a customer, whether it be a B2B or a B2C relation. Customers at different points in the supply chain have - owing to the field of use, needs and requirements, and external conditions - different priorities. The functions and competencies needed to develop packaging are dependent on the customer of the packaging. When it comes to consumers (i.e. end-customers) emphasis must be given to marketing aspects. On the other hand if, as the above discussion focuses on, the customers of the packaging are intermediary customers who do not buy or value the packaging based on the same premises as does the consumer, the marketing aspect is downplayed. A study by Simms and Trott (2010) addressed the importance of including the understanding of the needs of the stakeholders when developing new packaging, especially for fast moving consumer goods (consumer packaging). Their findings indicate that the development process of sales packaging and industrial packaging shares the same base line, in terms of the need to consider the activities affected by and affecting the packaging. However, the aspect that separates the two kinds of packaging is largely the sales packaging's marketing perspective. In other words, different functional areas must be represented in the packaging development process in order to generate an output that meets the conditions of the supply chain and the objectives of the customer. *Fig. 13* illustrates the functions needed for each of the two packaging types.

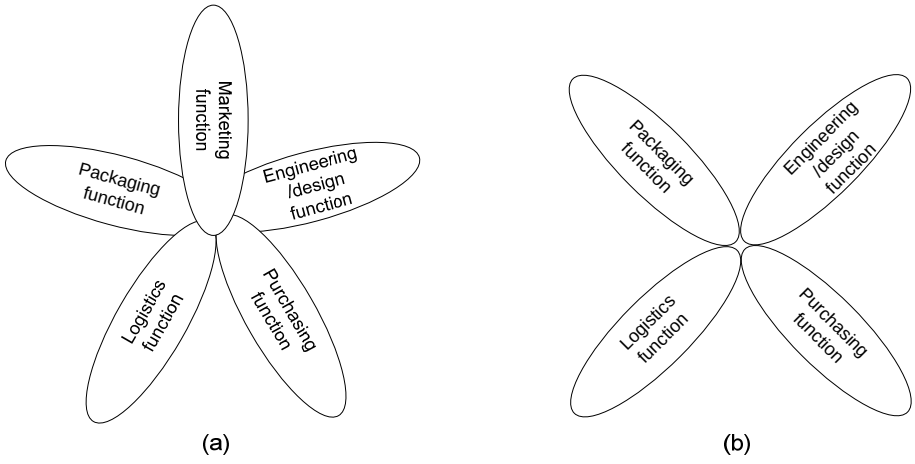


Fig. 13 The leaves represent the set-up of functional units representing stakeholder needs and requirements. (a) illustrates the functions included in the sales packaging development process and (b) the functions included in the industrial packaging development process.

7. Conclusions and contributions

This chapter presents the conclusions and the potential implications of the research for the theoretician and for the practitioner.

The purpose of this research was to describe deficiencies and potential changes of the development process of industrial packaging. This purpose has been met by gaining insight into the development process (including the selection process) of industrial packaging at manufacturing companies (i.e. users of industrial packaging) and packaging suppliers.

The research demonstrates that there are several aspects that influence the potential gains of an industrial packaging development process tailored to the conditions of an individual company's supply chain. It has been highlighted that the systems perspective is central to the domain of the industrial packaging development process. In the eyes of the packaging suppliers, stakeholder knowledge of other stakeholders' activities would lower the total cost of packaging related activities, by means of trade-offs regarding efficiency and cost. Other findings indicate that the functional objectives of stakeholders of industrial packaging surpass or might even conflict with aspects and efforts that would promote internal company goals. Dominating objectives, such as strong cost focus, seem to downplay other objectives important for the actual flow of packaged goods, and in turn end up in escalated total costs. Both supply chain actors involved manufacturers and suppliers stress the need for more collaboration between the packaging stakeholders to increase the knowledge base of everyone's objectives and priorities among the stakeholders. In turn, this would promote a development process of industrial packaging that takes into account the stakeholder needs and cost drivers. Not knowing the needs and requirements of the stakeholders whose activities are affected by the packaging or which have an impact on the packaging intrinsically implies that these are not taken into account during the development process, which in turn leads to sub-optimization. The suppliers' contact person at the manufacturing company often comes from the purchasing function and often lacks the necessary background and insight of the packaging stakeholders at the manufacturing company.

The imperative question for the future could be phrased as following: what is eligible for the development process of industrial packaging - *good enough and cheap* or *guided by trade-offs* to ensure the best overall fit, in terms of function and economics?

Theoretical contributions
This research can be used as support for further research into aspects that impact on the developmental process of packaging, especially as regards industrial packaging directed to intermediary customers. In addition, attention to the needs and requirements of the intermediary customers is lacking in the literature. This research has raised the importance, from a systems goal perspective, of acknowledging these customers' needs.

Realizing changes, and particularly changes concerning a traditionally low priority item such as packaging, takes courage and a will to continuously strive towards improvements. Not looking for ways to improve leads to a state of stagnation in the accustomed patterns, and in this context, an unvoiced decision not to adapt the packaged goods in the flow of its logistics context at the lowest possible total cost. The model presented in *Fig. 11* depicts the supplier-perceived reasoning of a company that has not yet realized the benefits of an integrated packaging and product development imbued by collaborative efforts among all the stakeholders of industrial packaging, as interpreted by the researcher. The model displayed in *Fig. 12* presents the need for increased inter-departmental collaboration as the products on the market become increasingly complex. These two models could potentially be important in future studies as they are apparently the first that describe the role of stakeholders in the context of the industrial packaging development process

Practical contributions
The research raises the benefits and importance of integrative and collaborative efforts among functional units. The findings favor manufacturing companies interested in developing their packaging development strategy with particular emphasis on industrial packaging used for transport and handling, especially with respect to activities from Tier1 suppliers to intermediary customers active within production. Furthermore, the outcomes contribute a better body of knowledge in areas making up the elements considered to be in need of enhanced focus. Raising the awareness and the multiple facets of these elements might improve industrial packaging's conditions in the inbound and

operations activities. The findings also indicate that the imbalance of power distribution between the functional units of the industrial packaging development process at the manufacturing companies would need additional attention in order to improve the efficiency of the process.

8. Further research

This chapter presents potential areas of future research in order for the area of industrial packaging to become better known and to aid businesses in making reasonable decisions based on empirically based research.

Firstly, as mentioned, most research performed in the area of packaging logistics has focused on the downstream part of the supply chain, in the direction of the end-consumers. Nonetheless, judging by the positive gains of the integrative packaging and product efforts at the manufacturing companies of complex products, such as automotive and electronics equipment, there is likely potential of gains even further upstream (at sub-suppliers) in the supply chain as illustrated in *Fig. 14.*

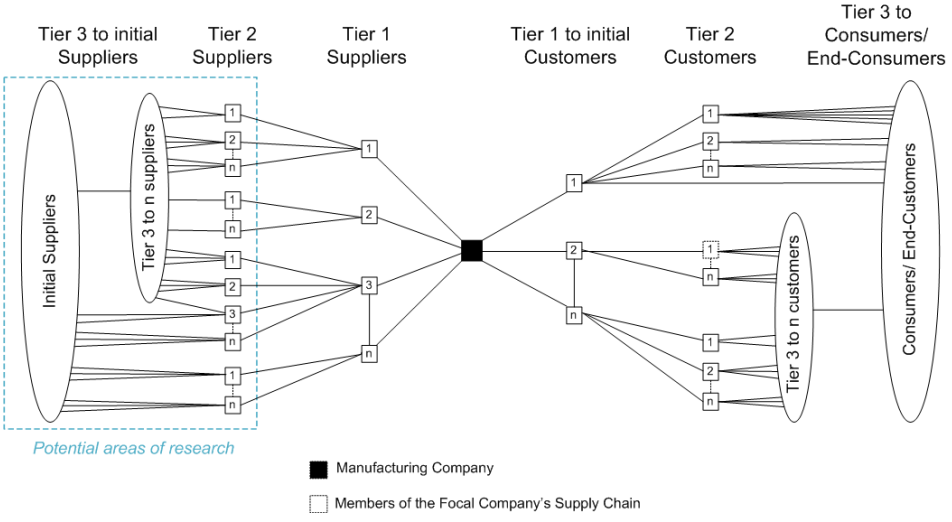


Fig. 14 Supply chain network structure. The striped rectangle indicates potential areas of research. (Adapted from Lambert et al., 1998b.)

Secondly, for the future, the action research methodology where the researcher is a part of the implementation could be an interesting and fruitful area for obtaining additional knowledge about the development process. In such research the actual implementation of discussed measures, in this thesis and in previous research, could enhance the

integrative role of packaging, product and logistics in the industrial packaging development process. Additionally, excellent company access to the case company is of utmost importance.

Thirdly, to be able to generalize, more research is needed in the field of industrial packaging, especially with regards to different business categories' reasoning and motivation.

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Paper I

"Towards improved reporting of case study research – an evaluation of articles in top tier logistics and management journals"

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TOWARDS IMPROVED REPORTING OF CASE STUDY RESEARCH

– An evaluation of articles in top tier logistics and management journals

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ABSTRACT

Purpose of this paper The purpose is threefold; to present a framework for assessing reporting of case study based research, to evaluate recently published case study based research within the area of logistics and supply chain management and finally to identify and suggest areas for improvement in the reporting of case study based research within the same field.

Design/methodology/approach The paper is based on an initial review of case study research in methodology literature, resulting in four main and 16 sub-criteria for evaluating reporting of case study based research. Thereafter four top tier logistics and supply chain management journals and one management journal were selected in which 51 case study based articles, between 2006 and 2008, were identified and evaluated.

Findings The study shows a great variation in the fulfillment of the suggested criteria for reporting of case study based research, identifies weaknesses and concludes with suggestions for improvements.

Research limitations/implications The study is limited to an evaluation of case studies published in four logistics and supply chain management journals and one management journal, covering a time span of three years.

Practical implications The findings have implications for reporting of case study based research in the logistics academic community as well as to practitioners and other target groups. It can further be used in teaching of PhD courses.

What is original/value of paper This paper contributes with areas for improvement in reporting of case study based logistics and supply chain management research.

Keywords: Case study research, Literature review, Logistics, Methodology, Supply chain management

1. INTRODUCTION

Logistics and supply chain management are applied academic research disciplines calling for research of high relevance for practice, without compromising the contribution to theory. Historically and still today the methodologies used in the logistics discipline are predominately quantitative, focused on survey-based research, simulation and mathematical modeling (Golicic et al., 2005; Craighead et al., 2007). In spite of the dominance of quantitative research, qualitative research strategies such as case studies in logistics and supply chain research, and action research, constitute a growing portion of published research (Craighead et al., 2007). This in turn has led to a discussion on the advantages and disadvantages of quantitative versus qualitative research in the discipline as well as an increased focus on the underlying paradigms guiding the research (Golicic et al., 2005; Näslund, 2008). More recently several authors have tried to bridge these differences by directing the methodological discussion to the need for multiple approaches and to the more central question of research *relevance* and *rigor* (Dubois and Araujo, 2007; Näslund, 2008)

The issues of relevance and rigor should be equally important in all research, irrespective of approach. However, qualitative research, and not in the least case-based research, have been the object of criticism. In general, case studies have been and still are often criticized for lack of rigor meaning that the researcher has not followed a systematic procedure or has unintentionally concluded something the research did not actually reveal, allowing for vague and interpretive evidence and conclusions that cannot be generalized (see for example Yin 2003; Voss et al. 2002; Mentzer and Flint, 1997). In addition, case studies are criticized for not measuring up to traditional means of evaluation. In terms of validity, case research is said to be strong in realism, internal validity and parts of construct validity (using multiple sources of evidence), but suffers from a lack of statistical conclusion validity, statistical generalizability and replication (Mentzer and Flint, 1997).

However, evaluating qualitative research such as case studies in the same way as quantitative has long been questioned. Lincoln and Guba (1985) suggest terms such as “credibility”, “transferability”, “dependability” and “confirmability” as opposed to the more conventional terms “internal” and “external validity”, “reliability” and “objectivity”. Arbnor and Bjerke (1994) suggest “credibility” and “truthfulness” as two important measures to validate that qualitative research findings are of practical and scientific value. Näslund (2008) claims that rigor should not only be based on traditional validity and reliability, but rather the entire research approach and the process from design to analysis and subsequently the reporting thereof. This is in line with Marshall and Rossman (2006) who with reference to Lincoln and Guba’s criteria point out the need for qualitative researchers to explicate the design and methods in detail so the reader can judge whether they are adequate and make sense. The importance of the actual reporting of case research is also highlighted by Eisenhardt and Graebner (2007). This is in line with Runeson and Höst (2009) who underline that an empirical study cannot be distinguished from its reporting as it is the main source for judging the quality of the study. However, as pointed out in a recent study by Seuring (2008), a frequent observation of case study research is that the description of the research process is poor, if existing at all.

Hence, not only should the process of case study research be designed and conducted in a structured way, but the reporting of the design and process in itself is of great importance to ensure and evaluate quality, relevance and rigor.

Several authors, from different research paradigms, have contributed to improving design, execution and reporting of case. However, there appears to be agreement that more can be done to improve the reporting of case studies (Benbasat et al., 1987; Eisenhardt, 1989; Yin, 2003; Dube and Pare, 2003; Seuring, 2008) in order to improve its quality and rigor. This is particularly true for the area of logistics and supply chain management research (Mentzer and Flint, 1997) where case studies are still relatively rare but growing in numbers (Gammelgaard, 2003; Halldorsson and Aastrup, 2003; Frankel et al., 2005).

The purpose of this article is threefold; to present a framework for assessing reporting of case study based research, to evaluate recently published case study based research within the area of logistics and supply chain management and finally to identify and suggest areas for improvement in the reporting of case study based research within the same field. The research questions guiding this study were:

i. What are important criteria for case study design, conduct and reporting described in the literature?
ii. What is the current state of published case study based research within logistics and supply chain management?
iii. What are common weaknesses and areas for improvement in the reporting of case study based research within logistics and supply chain management?

The paper is structured in the following way, firstly the methodology is described followed by the theoretical framework summarizing the initial literature review. In the following section, the findings from the initial literature review are summarized in a suggested framework for assessing the reporting of case study based research. This is followed by a presentation and discussion of the findings from the evaluation of the identified case study based articles derived from the selected journals. Finally, the conclusions are presented and areas for improving the reporting of case study based logistics and supply chain management research highlighted.

2. METHODOLOGY

Based on the purpose and research questions, the research approach was structured in seven steps (see Table 2.1). To answer the first research question and allow for developing a framework to be used in the analysis, an initial review of qualitative and case study research methodology literature was performed. The selection of literature was based on authors who propose criteria for design, conduct and reporting of case studies and authors that are frequently referred to in published case study based articles in the field of logistics and supply chain management. The selection of literature and authors reviewed are summarized in Section 3 together with the resulting summary and draft list of important criteria for the design and execution of case study based research (see Table 3.1). In compiling the draft list consideration has also been taken to the assumption put forward (Dube and Pare, 2003; Runeson and Höst, 2009) that the design and execution of a case study in itself should be represented in the reporting to allow for an evaluation of rigor. Hence, criteria for reporting should rest on criteria similar to the ones summarized in the draft list.

To answer the second research question ‘What is the current state of published case study based research within logistics and supply chain management’ the unit of analysis for the study was defined to case study based articles reported and published in top tier journals. Hence, as a second step four top tier journals in logistics and supply chain management and one management journal were identified and selected. The selection of logistics and supply chain

management journals was based on the ranking presented by Kovács et al. (2008, p. 322). The top three journals were selected: International Journal of Physical Distribution and Logistics Management (IJPDLM), International Journal of Logistics Management (IJLM) and Journal of Business Logistics (JBL), as was the sixth, Journal of Supply Chain Management (JSCM) to ensure supply chain focused research. To allow for a further evaluation of the reporting of case study based research in these journals, and to answer the third research question; The Academy of Management Journal (AMJ) was selected based on its position as a major journal in management and for its efforts "…*in spotlighting alternative methods that take advantage of rich empirical data*" (Eisenhardt and Graebner, 2007, p. 25). The choice of a journal outside the direct field of study is also supported by Stuart et al (2002) who argue that advances in other disciplines can provide an important input.

Table 2.1. An overview of the research process

Research activities
1. An initial literature review of qualitative and case study research methodology resulting in a draft list of criteria important for the design, execution and reporting of such research (see Table 3.1).
2. Selection of five top tier journals and identification of 51 case study based articles in the three most recent years (2006-2008).
3. A first reading and evaluation of five of the 51 identified case-based articles based on the draft list of criteria.
4. A development and operationalization of the draft list of criteria into a framework of four main criteria with, in total, 16 sub-criteria stated as questions (see Table 3.2) for enabling an evaluation and comparison on how these criteria were fulfilled in the 51 identified articles.
5. Reading, cross-reading and comparing the 51 articles based on the framework.
6. Joint analysis and discussion of aggregated findings.
7. A summary and presentation of the evaluation of the 51 articles highlighting the degree of fulfillment of respective sub-criteria and suggesting areas for improvement (see Table 4.1)

From these five journals, case study based articles were drawn covering the three most recent years: 2006-2008 (see Table 2.2). In total 528 articles were searched resulting in 51 identified case study based articles. The search was based on an on-line, or when not possible, a manual scan of the 528 articles, identifying articles explicitly stating the use of a case study approach through searching for the words "case study" and "case studies" in the title, abstract, methodology section and/or keywords. The identified articles were all subjected to final manual control in order to ensure that selected articles with the appearing words "case study" or "case studies" referred to the research approach used in the article at hand. Articles referring to the use of a "hypothetical" case study or a case study limited to a simulation or modeling were omitted. A list of the reviewed articles is provided in Appendix 1.

Table 2.2 Number of identified case study based articles in ratio to the total number of articles, in selected journals

	AMJ	**IJPDLM**	**JBL**	**JSCM**	**IJLM**	***Total***
2006	2/65	8/45	1/17	4 /20	6 /20	*21/167*
2007	4/85	10/44	1/16	0 /18	3 /21	*18/184*
2008	2/57	2/41	2/25	1 /35	5 /19	*12/177*
Total	***8/207***	***20/130***	***4/58***	***5/73***	***14/60***	*51/528*
% case studies	*4%*	*15%*	*7%*	*7 %*	*23 %*	*10%*

As a third step, one sample article was selected from each journal, five in total, for a trial application of the draft list of criteria developed in the first step. The articles were read by each author and compared with the draft list. This was followed by the fourth step, a further development, refinement and operationalization of criteria considered to be important for the reporting of case study based research, with consideration taken to the prerequisites for design and execution. This step resulted in a suggested framework of four main criteria: Purpose/Research Question, Case Setting, Data Collection and Analysis. Each criterion was in turn broken down into four questions, resulting in a total of 16 sub-criteria, framed as questions to enable an evaluation and comparison of how these criteria were fulfilled in the 51 identified articles (see Table 4.1). As a measurement of whether a sub-criteria was fulfilled or not, a positive answer resulted in one point, a negative answer in no point given. Hence an article fulfilling all the 16 sub-criteria may receive 16 points.

As a next and fifth step all 51 articles were read and evaluated based on the 16 sub-criteria. The articles were cross-read between authors to ensure an agreement on the fulfilment or non-fulfilment of the criteria in order to increase the reliability and rigor of the assessment process. Thereafter a joint analysis and discussion of the findings on an aggregated level led to a final step of summarizing and presenting the evaluation of the 51 articles highlighting the degree of fulfilment of respective sub-criteria and identifying areas for improvement (see Table 4.1).

3. THEORETICAL FRAMEWORK

The applicability and characteristics of a case study are described and elaborated on by many well-known authors including Yin and Eisenhardt who are often cited in the field of logistics and supply chain management. Eisenhardt (1989) advocates the use of case studies when an existing theory is insufficient or inadequate, or when a research area is novel. She defines the case study as a research strategy that focuses on understanding the dynamics present in single settings, typically combining different data collection methods. Yin (2003) argues that the case study approach is preferable when the research focuses on a contemporary phenomenon in its real-life context, with an unclear boundary between the context and phenomenon. It is suitable when the researcher has limited control and is asking *how* and *why* questions. Gummesson (2000) claim that case studies can vary in character and are suitable for deriving general as well as specific conclusions. Irrespective of definition, Ellram (1996, p. 95) state that "…*without proper research design, execution and data analysis, case study research will produce poor results*". However not only the design and execution of the case study has been identified as important areas, in order to increase rigor, but the reporting the same (Benbasat et al., 1987; Dube and Pare, 2003; Runeson and Höst, 2009).

3.1. Reporting of case based research

The most frequent mode of conveying the activities and results from a completed study and especially a case study is in written reports, typically in the format of an article. The content of the article is dependent on the authors' perception of what ought to be included in the reporting of the case study, as well as adhering to the guidelines of the publication. The steps in the case study design are aimed to go hand in hand with the actual execution and final reporting of the same. The research design in case studies are described by Yin (2003, p. 20) as

"… a logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions…"

A critical aspect of empirical research, such as case studies, is presenting it (Marshall and Rossman, 2006; Eisenhardt and Graebner, 2007). The importance of the reporting of case study based research is also emphasized by Runeson and Höst (2009, p. 158) since *"The reader of a case study report /…/ must judge the quality of the study based on the written material"*. Dube and Pare (2003) calls for better reporting of methods and procedures. Their study of case study research showed that 40 percent did not describe their data collection process and only nine percent provided a "*clear and detailed*" description on how the data were analyzed. Dube and Pare (2003, p. 626) concludes by stating that *"a minimum of information regarding key design issues must be provided if one wants to be able to distinguish scientific descriptive cases from journalistic work"* and proposing researchers to adhere to their suggestions for improvement. A draft list (se Table 3.1) gradually evolved from summarizing important aspects and steps in designing and conducting case studies imposed by different authors.

Table 3.1: Draft list of important criteria, in designing and conducting case study based research, interpreted and presented in the five stage research process model by Stuart et al (2002) *([1]Eisenhardt(1989), [2]Ellram (1996), [3]Stuart et al. (2002), [4]Voss et al. (2002), [5]Dube and Pare (2003), [6]Yin (2003), [7]Marshall and Rossman (2006), [8]Näslund (2008), [9]Runeson and Höst (2009))*

Phase	Criteria
Defining the research question	Define research question [1, 2, 3, 4, 5, 6, 7, 8, 9] grounded in theory [9] and practice [7, 8] Propositions [3, 6] Overall approach and rationale [7], what are to be studied and presumed relationships [4, 9] Justify the use of case study/ies on the basis of the research question [2, 3, 4, 5, 6, 8]
Research instruments development	Unit of analysis [5, 6, 8, 9] Case study protocol [1, 2, 3, 4, 6, 9] Rationale for single/ multiple case selection [2, 4, 5] Type of case (longitudinal, retrospective or current) [4] Site, sample or case selection [1, 2, 3, 4, 5, 7, 9] Logic linking the data to propositions [6] A priori specification of constructs [1, 4], criteria for interpreting the findings [6] Researcher role [3, 8] Pilot case to refine the design [5, 6]
Data Gathering	Data collection methods and procedures [2, 3, 4, 5, 7, 8, 9] Multiple methods for collecting data enabling triangulation [methodological triangulation] [1, 2, 3, 4, 5, 6, 8, 9] Time-period for the data collection [5, 8] Recoding of data [9], taking field notes [1, 5, 7], building a case study database [2, 6] Multiple sources of evidence enabling triangulation [data triangulation] [2, 4, 5, 6, 8, 9] Qualitative and quantitative data [1, 5, 8] Type of data (on-going and/or retrospective) [8] Draft review [2, 6, 8, 9] Multiple investigators enabling triangulation [investigator triangulation] [1, 3, 4, 6, 8] Access [8] and trust [3, 8]
Data analysis	Analysis and analysis procedures [1, 2, 3, 4, 5, 7, 8, 9] - Within-case analysis [4, 1] case description, write up or narrative [4, 6] - Organize and reduce data in categories [4, 5, 6], data coding processes [2, 5] open, axial and selective coding [2, 4] - Use pattern matching, explanation building, logical models, or time-series analysis [6] - Search for cross-case patterns [1, 3, 4, 6] Cyclical Approach [8] where data analysis overlap the data collection [1] Establish chain of evidence [2, 5, 6, 8, 9] Perspectives to the same data set [theory triangulation] [6], consider rival theories or alternative explanations [5, 6, 9] Shaping hyptheses [1, 4] Comparison with conflicting and similar literature [1, 4, 5] Team analysis [8]
Dissemination	Implications for practice [8, 9] Conclusions in correspondence to research questions [9] contributing to both science and practice [7, 8] Trustworthiness [7, 9] Anticipate and address common criticisms of case-based research [3, 9]

In order to answer the second research question on the current state of published case study based research within logistics and supply chain management, a further development and operationalization of the draft list presented in Table 3.1 was done to enable an evaluation. Hence after the first trial-reading of five of the 51 articles, four main criteria were formulated and further broken down into sub-criteria.

3.1.1. Research Question/Purpose

Defining the research question is considered to be one of the most vital steps in a research process (Yin, 2003; Dube and Pare, 2003; Näslund, 2008). The importance of also explicitly stating the intentions is emphasized by Stuart et al. (2002) as well as the type of research question, which is decisive as to whether or not case study research is an appropriate approach (Benbasat et al., 1987; Ellram, 1996; Handfield and Melynk, 1998; Stuart et al., 2002; Voss et al., 2002; Yin, 2003; Dube and Pare, 2003; Näslund, 2008). Furthermore, the importance of a solid foundation in theory is emphasized by, among others, Eisenhardt and Graebner (2007, p. 26) , *"Sound empirical research begins with strong grounding in related literature, identifies a research gap, and proposes research questions that address the gap."* As logistics and supply chain management are applied academic research fields, the importance of the practical relevance of the research is also highlighted (Näslund, 2008).

Hence, a clearly defined and stated purpose and/or research question, based on theoretical as well as practical problems appropriate for case research is the first suggested criterion.

3.1.2. Case Setting

Dube and Pare (2003) and Näslund (2008) elaborate on the importance of providing a detailed description of the case context**,** encompassing aspects such as where the research was conducted, time period for data collection, the nature of the collected data and if sufficient access was gained, which other authors refer to as an overall approach, rationale and instrument development (see Table 3.1). Before going onto the actual data collection stage, a few tasks are identified. The first is the unit of analysis (i.e. what the case 'is') (Yin, 2003; Dube and Pare, 2003; Näslund, 2008; Runeson and Höst, 2009). Although the importance of the unit of analysis is emphasized, the article reviews conducted by Dube and Pare (2003) and Benbasat et al., (1987) consistently reveal that the unit of analysis is not clearly stated in many of the published articles. According to Benbasat et al. (1987, p. 372) the research questions *"often indicate an appropriate unit of analysis."* Yin (2003, p. 24) accentuates the connection to the research questions by stating: *"If your questions do not lead to the favouring of one unit of analysis over another, your questions are probably either too vague or too numerous…*" In a case study, one or several units of analysis (often referred to as holistic versus embedded design) can be investigated (Yin, 2003).

The identification of where to execution the research (i.e. the selection and number of cases) is another task. Case study research can be based on either a single case or multiple cases (Eisenhardt, 1989; Yin, 2003). According to Gummesson (2003, p. 488), *"Anything from one case to several, even hundreds, can be justified depending on the research purpose and the research question."* Furthermore, the importance of including information about and reflections on the role of the researcher/s in the case description is stressed by Näslund (2008) and mentioned by Stuart et al. (2002, p. 426): *"We know that observation is shaped by the observer's prior experiences and background, including prior scientific training, culture, and*

system of beliefs." This is also echoed by Marshall and Rossman (2006) who point to the particular role of the researcher in qualitative research.

Hence, a clear and detailed description of the unit of analysis, how the case/s were selected, complemented with a motivation of why the research is based on a single or multiple cases and a discussion or description covering the role of the researcher is the second suggested criterion referred to in this study as the case setting.

3.1.3. Data Collection

Data collection is another important step in the design and execution but also in the reporting of case study based research. Näslund (2008) argues the significance of providing information on how the data was collected. The use of multiple methods for data collection is promoted by several authors as well as incorporating both qualitative and quantitative data (Eisenhardt, 1989; Dube and Pare, 2003; Näslund, 2008). Triangulation is, according to Ellram (1996, p. 100), *"The use of different techniques to study the same phenomenon, provides validity within the case study method."* Furthermore, the findings are considered more profound if based on various sources of information (Benbasat et al., 1987; Yin, 2003). Yin (2003) describes four kinds of triangulation: data, investigator, theory, and methodological. The importance of triangulation is also emphasized by Eisenhardt (1989, p. 538): *"…triangulation made possible by multiple data collection methods provides stronger substantiation of constructs and hypotheses."* Another important aspect in the reporting of case study results is the time period for the data collection (Dube and Pare, 2003; Näslund, 2008). Although its importance is emphasised: "*The case period defines the frame of reference under which phenomena are investigated*" they found, in their review, that very few state it (Dube and Pare, 2003, p. 611).

Hence, an explicit and clear description of the data collection encompassing information on how the data were collected and when and if triangulation was used is the third suggested criterion.

3.1.4. Analysis

The analysis leading to the conclusions is, according to Stuart et al. (2002, p. 427), *"to a great extent, a challenge of making sense from chaos."* Eisenhardt (1989, p. 539) agrees and states that it is "*both the most difficult and the least codified part of the process.*" However, she continues that since little effort is invested in discussing and describing the analysis "*a huge chasm often separates data from conclusions.*" A lack of a clearly described analysis procedure is according to Dube and Pare (2003, p. 616) a serious shortcoming since when provided it gives the reader a better understanding of the findings and an ability to judge "*whether or not the results are the fruit of a systematic and rigorous process.*" Although there is no standard procedure, within-case analysis, cross-case analysis and different forms of coding occur in the literature. Within-case analysis is commonly constituted of a description (also called a write-up) for each case, whereas in cross-case analysis the researcher tries to look *"beyond initial impressions"* and in different ways search for similarities and differences between the cases or groups of cases (Eisenhardt, 1989, p. 541). Voss et al. (2002, p. 212) describe the coding process as an effort to *"reduce data into categories."* The importance of providing the reader with a clear chain of evidence that makes it possible to follow the path from the initial research questions to the conclusions and back in the reporting from case-based research is highlighted by a number of authors (Yin, 2003; Dube and Pare, 2003; Näslund, 2008). In line with the research purpose and the criteria for submission to the journals studied here, the conclusions need to be of theoretical as well as practical relevance.

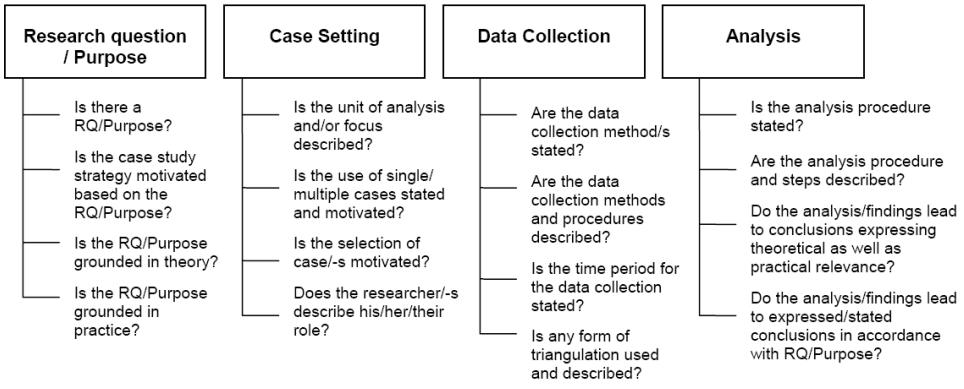
Eisenhardt and Grabner (2007) suggest the use of narratives interspersed with quotations from key interviewees and other important and supporting evidence, preferably also intertwined with the theory to demonstrate – with their theory building efforts – the close connection between empirical data and emergent theory. Reporting and presenting multiple cases may be more challenging not least of all due to spatial constraints which is why the use of extensive tables and other visual devices that summarize the related case evidence are suggested to show the depth and detail of empirical grounding. Näslund (2008, p. 113) in turn argues that, "*From a rigor point of view, other aspects that can increase the rigor of the analysis are to include quotes and in-depth comparison with both conflicting and supporting literature.*"

Hence, a clearly defined and described analysis procedure with conclusions based on the purpose and/or research question contributing to both theory as well as practice is the fourth suggested criterion.

3.2. A framework for assessing case study based research

In summary, based on the literature review and further development of the draft list (Table 3.1) the four main criteria have been complemented with 16 sub-criteria, stated as questions, to enable an evaluation as shown in Table 3.2.

Table 3.2 A framework with, in total, 16 sub-criteria – stated as questions – enabling evaluation of reported case study based research



4. FINDINGS AND DISCUSSION

Having answered the first research question in the theoretical framework, this section is devoted to the questions on the current state of published case study based research within logistics and supply chain management and the findings thereof showing the strengths, common weaknesses and areas for improvement in the reporting of case study based research within the same field. The summarized findings are presented in Table 4.1. For the complete list of reviewed articles see Appendix 1.

Table 4.1 A summary of the evaluation showing the degree of fulfillment of respective sub-criteria for each of the 51 articles, highlighting weaknesses and areas for improvement. (The numbers are referring to the article numbers in Appendix 1).

RQ/Purpose: 88%	**1. Is there a RQ/Purpose?**	**2. Is the case study strategy motivated based on the RQ/Purpose?**	**3. Is the RQ/Purpose grounded in theory?**	**4. Is the RQ/Purpose is grounded in practice?**
	Articles that fulfilled this criteria: 1-33, 35-51 AMJ: 88% IJPDLM: 100% JBL: 100% JSCM: 100% IJLM: 100% ***Total: 98%***	Articles that fulfilled this criteria: 1, 3, 6-14, 18, 19, 21-24, 26, 27, 29-32, 34-41, 45, 46, 48-51 AMJ: 100% IJPDLM: 75% JBL: 100% JSCM: 60% IJLM: 50% ***Total: 73%***	Articles that fulfilled this criteria: 1-10, 12-14, 16-18, 20-45, 47-51 AMJ: 100% IJPDLM: 95% JBL: 50% JSCM: 100% IJLM: 93% ***Total: 92%***	Articles that fulfilled this criteria: 2-20, 22-34, 36-38, 40, 42-48, 50, 51 AMJ: 38% IJPDLM: 100% JBL: 100% JSCM: 100% IJLM: 93% ***Total: 88%***
Case Setting: 55%	**5. Is the unit of analysis and/or focus clearly stated?**	**6. Is the use of single or multiple cases motivated?**	**7. Are the principles for case selection described/motivated?**	**8. Does the researcher/-s describe his/hers/their role?**
	Articles that fulfilled this criteria: 1, 2, 4-9, 13, 14, 17-19, 21, 22, 24, 25, 32, 34-44, 46, 48, 51 AMJ: 88% IJPDLM: 70% JBL: 75% JSCM: 60% IJLM: 43% ***Total: 65%***	Articles that fulfilled this criteria: 1, 4, 7-12, 16, 19, 21, 22, 24-27, 30, 32-41, 44, 46, 48, 49, 51 AMJ: 100% IJPDLM: 55% JBL: 100% JSCM: 60% IJLM: 43% ***Total: 63%***	Articles that fulfilled this criteria: 1, 3, 4, 6-8, 11, 12, 14, 21-24, 26-29, 31, 33, 35-41, 43, 46, 47, 49, 51 AMJ: 75% IJPDLM: 55% JBL: 75% JSCM: 80% IJLM: 50% ***Total: 61%***	Articles that fulfilled this criteria: 1, 10, 12, 18, 19, 21, 27, 31, 33, 34, 38, 40, 44, 48, 51 AMJ: 63% IJPDLM: 20% JBL: 25% JSCM: 0% IJLM: 36% ***Total: 29%***
Data Collection: 63%	**9. Are the data collection method/s stated?**	**10. Is the data collection methods and procedures well described?**	**11. Is the time period for the data collection stated?**	**12. Is any form of triangulation used and described?**
	Articles that fulfilled this criteria: 1, 2, 4, 5, 7-49 AMJ: 100% IJPDLM: 90% JBL: 100% JSCM: 100% IJLM: 86% ***Total: 92%***	Articles that fulfilled this criteria: 1, 2, 4, 5, 7, 8, 10-12, 14, 16, 17, 20-30, 32-47, 49-51 AMJ: 100% IJPDLM: 80% JBL: 75% JSCM: 100% IJLM: 71% ***Total: 82%***	Articles that fulfilled this criteria: 10, 12, 14, 16, 18, 19, 21, 22, 26-28, 31, 32, 34, 35, 47-49 AMJ: 63% IJPDLM: 35% JBL: 25% JSCM: 0% IJLM: 36% ***Total: 35%***	Articles that fulfilled this criteria: 1, 8-10, 18, 19, 21-24, 26, 27, 30, 35-40, 42, 43, 46, 48 AMJ: 60% IJPDLM: 50% JBL: 80% JSCM: 40% IJLM: 20% ***Total: 44%***
Analysis: 74%	**13. Is the analysis procedure stated?**	**14. Are the analysis procedure and steps described?**	**15. Do the analysis/findings lead to conclusions expressing theoretical as well as practical relevance?**	**16. Do the analysis/findings lead to expressed/stated conclusions in accordance with RQ/Purpose?**
	Articles that fulfilled this criteria: 1, 3, 4, 7, 8, 10, 11, 14, 16, 19-23, 25, 26, 28, 30, 31, 33-42, 44, 45, 47, 49 AMJ: 100% IJPDLM: 45% JBL: 75% JSCM: 100% IJLM: 57% ***Total: 65%***	Articles that fulfilled this criteria: 1, 4, 7, 10, 11, 14, 15, 17, 20-22, 26, 31, 34-36, 38-42, 44, 45, 49-51 AMJ: 100% IJPDLM: 40% JBL: 25% JSCM: 80% IJLM: 43% ***Total: 51%***	Articles that fulfilled this criteria: 1-10, 12-15, 17-19, 21-32, 34-36, 38-44, 47, 48, 50, 51 AMJ: 90% IJPDLM: 90% JBL: 80% JSCM: 80% IJLM: 80% ***Total: 84%***	Articles that fulfilled this criteria: 2-19, 21-33, 35-51 AMJ: 75% IJPDLM: 100% JBL: 100% JSCM: 80% IJLM: 100% ***Total: 94%***

4.1. The current state of published case study based research

As shown in Table 2.2, the number and percentage of published case study based articles in the respective journal range from 4% to 23% hence showing great variation in the share of case-based research publicized. However, the focus here has not been to go further into the analysis of the amount of or differences between journals with regard to published case-based research, even if the numbers per se may give room for interesting interpretations. The task has been to evaluate and compare the articles identified for the purpose of improving the reporting of case study based research in logistics and supply chain research. Nevertheless, it is evident that there are differences between the journals in terms of the most common research approaches in the articles accepted and published, as well as in the guidelines and requirements for contribution and submission.

The evaluation of articles based on the suggested framework, summarized in Table 4.1, show a great variation in fulfillment of the different criteria. On an aggregated level comparing the four main criteria in summary for all the evaluated articles, RQ/Purpose showed the highest degree of fulfillment (88%) followed by Analysis (74%). Case setting (55%) and Data Collection (63%) had a lower degree of fulfillment particularly with regard to sub-criteria 8, 9 and 10. However there is a great variation between the sub-criteria within Data Collection (9 and 10 vs. 11 and 12) and within Analysis (13 and 14 vs. 15 and 16) showing particular areas of improvement of articles published in logistics and supply chain journals also in comparison with articles published in management journal AMJ. It is of course noted that the AMJ, compared to the logistics and supply chain journals in this study, differ in theoretical research areas and target groups – however, the goal of improving the reporting of case study based research is hopefully shared across academic disciplines, which is why a comparison is valuable.

4.2. Strengths, weaknesses and areas for improvement

The strengths, weaknesses and areas for improvement are demonstrated through the degree of fulfillment of the respective sub-criteria – identified by article number (see Appendix 1) and summarized in degree of fulfillment in percent – on journal, sub- and main criteria level. The weaknesses and areas for improvement have been highlighted. None of the 51 articles studied attained the maximum value of 16, or 100% in itself. However, eight articles were given a total value of 14 or more (four in AMJ, three in IJPDLM and one in JSCM) and are referred to below as examples of best cases.

4.2.1. Strong areas

The first main criterion, *RQ/Purpose*, appears to be the easiest to fulfill, with regard to all sub-criteria with some variation. In comparison with the articles found in AMJ, purpose/research questions are in general more clearly stated in logistics and supply chain research articles as is the grounding in practice.

The two other sub-criteria that appear strong are particularly the statement of data collection methods used, number 9, (92%) and the expressed correlation between findings and the RQ/purpose, number 16 (94%). However these also leave some room for improvement.

4.2.2. Weaknesses and areas for improvement

In spite of *RQ/Purpose* being a strong area overall in the articles, the manner in which these are stated differs greatly. The motivation of the case study strategy based on the research question/purpose is clearly a weakness in the articles published in IJLM (50%) and JSCM

(60%) as is the grounding in theory in the articles found in JBL (50%). Going back to the literature review, several authors refer to Yin's claim that case study based research best answers questions such as *why* and *how* why it is suggested that these questions be considered and even integrated into the formulation of the research question/purpose to clarify the author's intention and understanding, as well as making it more understandable for the reader. What could be further improved, particularly in the supply/logistics articles, is the narrowing of the research questions as well as possibly the relation to other theoretical fields – particularly with regard to the fact that supply chain management is a multi-disciplinary area. To quote (Stuart et al., 2002, p. 423): "*Advances in other disciplines can provide a much improved starting point for defining the appropriate research question.*"

The criterion of *Case Setting* show areas of improvement overall, but particularly with regard the description of the *Role of the researcher*, number 8, with 29%, however lower for the articles in logistics/supply journals. The importance of the researcher in case study research is highlighted by Marshall and Rossman (2006, p. 72), who claim that: "*In qualitative studies, the researcher is the instrument. Her presence in the lives of the participants invited to be part of the study is fundamental to the methodology."* One good example of the description of the researcher's role is found in Pålsson (2007, p. 156): "*The role of the author was mainly to document and observe the progress of the project and secondarily to participate in discussions and some project tasks*."

Furthermore the *Unit of analysis*, number 5, appears to be a challenging aspect of case design. Even though not showing the lowest degree of fulfillment, the unit or rather focus of analysis, is described to varying extents and in a number of articles is it difficult to make out what it actually is (i.e. it is either not explicitly stated or is expressed vaguely). While referred to in many articles as a "company, function or department" – the unit of analysis in the analysis and conclusions appears to be the "process" instead. This is also apparent in the studies from Dube & Pare (2003) where only 8% of the examined articles clearly state the unit of analysis. Ogden (2006, p. 30), author of one of the articles in the study, devotes a figure and a paragraph to explicitly describing the impact of the unit of analysis on data collection: "*The unit of analysis has a direct impact on the type of information gathered and the sources used to gather the data*," and adds, "*… for purposes of this research, the unit of analysis was a subsection of a firm's suppliers*…".

The use of single/multiple case studies, the selection of case studies and motivations thereof are areas for further improvements where a good example is found in Jarzabkowski (2008, p. 624-625): "*I selected cases of three types in order to reflect the parameters of the U.K. university sector outside the ancient universities… Three cases that were within a realistic travel distance for rich qualitative data collection were selected on the basis that they offered equally high-quality access and were well-ranked examples of their types within the U.K. …*"

When it comes to the description of how and when and what data was collected, the criterion of *Data Collection* leaves room for improvement. The importance of well described data collection is supported by (Benbasat et al., 1987, p. 381): "*….a clear description of data sources and the way they contribute to the findings of the research is an important aspect of the reliability and validity of the finding*." In the study, the accounts of these aspects vary greatly from articles that have a detailed and elaborate description (particularly in AMJ and JSCM). This is especially the case when it comes to stating as well as describing and motivating the data collection methods used (JBL, IJLM, IJPDLM). Benbasat et al.(1987, p. 381) see a similar pattern in their study: "*Sometimes the researchers mentioned that they used documents and observations, but they did not provide any more detail about them."* Not

describing the data collection methods undermines the credibility of the research, according to Dubé and Paré (2003, p. 612).

However, the two sub-criteria which leave most room for improvement are *Time Period*, number 11, and *Triangulation*, number 12. Stating the time period and actual year of the study is an area for further improvement as it is an important aspect to orientate the reader. Jarzabkowski (2008, p. 625) and Faems et al. (2008, p. 1057-1058) state and describe the data collection methods used and also the order of it. Jarzabkowski (2008, p. 625) provides in addition a thorough description of the period for data collection: "*Qualitative data were collected for a seven-year period, six years of which (1992-97 inclusive) were retrospective and one year of which (1998) was 'real time'*". As for triangulation, many authors on case study methodology argue that this is an important criterion (Eisenhardt, 1989; Mentzer and Flint, 1997; Yin, 2003; Dube and Pare, 2003). Many articles refer to different data collection methods but do not motivate why or how these have contributed in the analysis.

The criteria of *Analysis* show variation between the description of the actual procedure and steps and the resulting findings and conclusions. The sub-criteria leaving most room for improvement is number 14 – describing the procedure and steps of the analysis also including an illustration of the findings. The articles in logistics/supply journals show a low degree of fulfillment with the exception of JSCM articles and again the articles published in AMJ. However it should be noted the AMJ allows for longer articles than all of the other journals. The importance and challenges of analyzing data generated from case study research are acknowledged by Benbasat et al. (1987), Eisenhardt (1989), Stuart et al. (2002) and Yin (2003). Dubé and Paré (2003) also mention the importance of elucidating the reader as to how the analysis was conducted and its importance for the reader's ability to judge whether the results spring from a systematic and rigorous process or not. Stating, referring to, and describing the methods and steps in the analysis articles in all logistics and supply chain journals leave room for improvement. Plowman et al. (2007, p. 523) give a good example in presenting the seven-step analysis procedure employed and describe each step in detail, as does Jarzabkowski (2008, p. 626): "*In this section, I explain the five analytic phases I undertook…*"

On the other hand a great majority of the articles in logistics and supply chain journals receive high values in presenting the conclusions of theoretical and practical relevance, and in accordance with the initial purpose/research question. As an academic reader, however, one is sometimes surprised on how the authors arrives at the conclusions presented as the description of the execution of the case study, and particular the analysis, is lacking.

5. CONCLUSIONS

The purpose of this article was threefold. Firstly to develop and present a framework for assessing reporting of case study based research. This framework was derived from the initial literature review and formulated in four main criteria with, in total, 16 sub-criteria stated as questions for enabling an evaluation and comparison of reported case study based research (see Table 3.2). The suggested framework could in the future also serve as a guide in the development of case study based reports and articles and is a further contribution to the existing literature and guidelines on case study research, with a particular emphasis on reporting the same. It can further be used in teaching of PhD courses. Additional improvements of the suggested framework will contribute to even more improved reporting of case study based research.

Secondly an evaluation of recently published case study based research within the area of logistics and supply chain management was conducted. The findings summarized in Table 4.1 show a great variation between the articles in the fulfillment of the suggested criteria for reporting of case study based research. They also indicate differences between journals which could be further explored with regard to specific journal focus and requirements.

Thirdly to identify and suggest areas for improvement in the reporting of case study based research within the area of logistics and supply chain management. In summary, as demonstrated in Table 4.1, there are in particular three main criteria and four sub-criteria which leave room for improvements:

- Case setting in general, and the *Researcher role* in particular
- Data collection with regard to the *Time period* and the use and motivation of *Triangulation*
- Analysis – *Description of procedure and steps for analysis*. This step should also include a presentation, and/or narrative of the findings.

In conclusion the findings presented here contribute to the further improvement of reporting of case study based research and hence its' relevance and rigor, particularly in the field of logistics and supply chain management. The findings show some particular areas which allow for improving the reporting of case study based research in the field. It should be noted that the analysis presented here is only based on the rigour of the *reported* research in accordance with the selected criteria, hence not the research itself. The research itself could have been conducted in a more rigorous way, although it is not reflected in the articles. This further proves the importance of the communication of the results since the reader only has the reported research as evidence and should be able to trace the conclusions of the study back to the initial research question or in the opposite direction. This is not only important for the academic reader but also for practitioners.

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Paper II

“The packaging selection practice – a case study”

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THE PACKAGING SELECTION PRACTICE
- A CASE STUDY

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ABSTRACT

Purpose of this paper The purpose of this paper is to present a comparative case study of the procedures and guiding principles in the packaging selection practice of two international companies.

Design/methodology/approach A qualitative case study with an inductive approach was conducted. The data was collected through semi-structured interviews, documentation, and field visits.

Findings The study indicates conceptual similarities and dissimilarities in the two companies' procedures, concerns and priorities with respect to the packaging domain. The packaging selection practice at the two companies appears to be highly dependent on total cost, standardization, production philosophy, and collaboration between different functions and units.

Research limitations/implications A study of two case companies implies limitations to generalization of the findings. Nevertheless, the case companies represent two diverse industrial branches providing a good basis for conceptual similarities and dissimilarities.

Practical implications The findings of the study have practical implications generated by increased understanding of the guiding principles and their influence on the packaging selection process with respect to different types of packaging. This in turn, has a positive financial impact, enhances efficiency and effectiveness in the supply and demand chains, and considers environmental issues.

Originality/value No previous similar study addressing the packaging selection approach in an engineering B2B industry context has been identified. This paper attempts to contribute to the theory-building of the packaging selection practice, point out the importance of considering the packaging selection and its guiding principles in order to make a deliberate and motivated packaging selection, and can be of value to other academic researchers in the field.

Paper type - Research paper

Keywords: Packaging selection practice, Decision guiding principles, Theory-building, Case study, International companies

1. INTRODUCTION

Competitive logistics performance and efficient and effective product development processes are cornerstones for companies to stay lucrative. One matter affecting these activities is the packaging (Bowersox and Closs, 1996). Klevås (2005) addresses the need for more research in the integrated area of product, packaging, and logistics in order to enhance the performance of the entire process of a product, from idea to final delivery. Johnsson (1998) stressed the lack of integration between the areas of the logistics system and packaging and the lack of focused efforts on these issues in companies. Johnsson (1998) concluded that companies that integrate their packaging approach gain benefits in the development of cost effective packaging solutions that support protection, handling, and distribution of the product. Packaging represents an important logistics activity as the packaging impact transport, storage, and handling in the supply chain (Saghir, 2004). Klevås (2005) deals with the interactions of logistics and packaging considerations during the course of the product development process at IKEA. The study indicates that cooperation among the three functions of packaging, logistics, and product development at a product developing company enhances logistics performance. Consideration of the activities in the supply chain that are affected by the packaging is beneficial from a packaging design perspective as this may provide great cost savings (Ge, 1996). The packaging solution chosen directly impacts the total cost in terms of such factors as packaging material costs, inventory of packages, handling of packages and indirectly in terms of handling efficiency and pallet utilization (Klevås, 2005). Bramklev (2007b) has developed a procedure model for the integration of packaging and product development and argue that an integrated packaging and product development has the potential of decreasing resource utilization, including costs. Bramklev (2007a) further has analyzed a number of packaging development processes, but no emphasis are given to the aspects of the packaging selection per se nor what influences decisions in the selection procedure. The limited body of knowledge of these aspects has given rise to this study.

The purpose of this paper is to present a case study of the procedures and guiding principles in the packaging selection practice of two international business-to-business companies. The research questions guiding this study are

i. How is the packaging selection procedure designed in the two case companies?

ii. What principles guide the packaging selection procedures?

The paper is structured as follows: The frame of reference of the study is presented first. Then the methodology, including research approach, reporting criteria, and the cases are described. Next the results are presented, followed by the analysis and discussion section, and the conclusions.

2. FRAME OF REFERENCE

In this section the concepts identified in the study, as recognized by other researchers, are described and discussed. The theory described here and in the introductory section shows gaps in the knowledge of the packaging selection and guiding principles. Theory about the packaging hierarchy is also provided.

2.1. The packaging hierarchy

There are three levels of packaging in the packaging hierarchy: primary, secondary, and tertiary packaging. The three levels are generally denoted consumer packaging, transport

packaging, and the assembly of several transport packages, respectively (Jönson, 2006). (An example of the assembly of several transport packages is what is placed on a load carrier wrapped with stretch film. For efficiency and effectiveness, the transport packaging ought to be adapted to fit the load carrier.) The main functions of primary packaging are to protect, make the product available to consumers, attract consumers, provide product information, and enable easy handling of the product. Secondary packaging contains a number of consumer packages and facilitates efficient and simultaneous handling of the same. The tertiary packaging, which mainly affects logistics functions (Saghir, 2004), enables transport, ease handling and stacking of the products and is highly dependent on the product to be packed and the lower levels of packaging used (Johansson *et al.*, 1997). The interactions among the packaging levels affect the performance of the packaging system (Hellström, 2007).

2.2. Packaging practice aspects

Bramklev (2007b) observes the necessity to develop a generic packaging development process, similar to the often well-anchored generic product development process. Bramklev (2009) identified four distinct phases of the packaging development process: 1) package planning – packaging concept portfolio is considered. (The concept portfolio contains packaging concepts that are available for later needs of packaging.); 2) package conceptualization – packaging specifications, generation of packaging concepts, and selection and decision on the final packaging concept; 3) package designing – generation of packaging design, detailed design, prototype, testing of prototype, and, if approved of technical documentation of the packaging, and 4) production ramp-up – planning, development, and realization of the packaging production.

Timely and accurate handling, transport, and storage of parts and final products to the lowest cost possible rely on logistics matter, as well as on an efficient and effective development of the packaging (Bramklev, 2009). Jointly, the product and its packaging satisfy the demands and needs required to enable transport, handling, and storage (Bramklev, 2007b). “When a package is needed, considerations are seldom devoted to it during the actual development of the product.” (Bramklev, 2009, p. 172). Zacharia and Mentzer (2007) address the benefits of including logistics early in the product development process, in terms of decisions on such aspects as transport, handling, and space utilization – activities that are affected by the packaging (Lambert *et al.*, 1998). “If logistics were involved earlier, it would be much easier to make cost trade-off decisions between the logistics implication of a particular design.” (Zacharia and Mentzer, 2007, p. 88). Nevertheless, the same authors argue that the beneficial gains of the involvement of logistics depend on *timing* (time of initial logistics involvement), *quality* (quality of involvement), and *relationship* (the strength of the relationship). Bramklev (2007b) experienced a strong support from industry as well as from theory to integrate the product development process and the packaging development process. Bramklev (2007b) proposes a package development process that, besides integrating well with the product development process also supports a more proactive development of new and innovative packages. Bramklev (2009) further suggests that the integration of the product developing process and the product developing process is best attained by employing a packaging development process that structurally resembles the structure of the product development process.

2.3. Packaging selection

According to Lambert *et al.* (1998) a good package design is governed by seven factors: standardization, cost, product and package adaptability, protective level, handling ability, product packability, reusability and recyclability. For example, the value and the sensitivity of the product to be packed motivate the shipping and storage costs of the packaging Lambert *et al.* (1998). "The packaging decision is truly one that requires the use of a systems approach in order to understand the true 'total cost' picture." (Lambert, Stock, & Ellram, 1998, p. 333). Lambert and Stock (2001) further emphasize the need for logistics managers to understand the role of material management, which includes packaging concerns and their impact on the organization's costs. By altering the packaging of a product where its features do not conflict with the functions of the product, companies have reduced transport, handling, and storage costs (Klevås, 2005;Lambert, Stock, & Ellram, 1998).

Mollenkopf *et al.* (2005) highlight the relevant costs of a cost model when determining the packaging choice with respect to expendable (one-way) packaging systems and reusable (returnable) packaging systems. The cost factors deemed applicable in the model are container cost, transportation cost, labor cost, disposal cost, and recycling cost. By the use of these cost variables in quantitative analyses, the relative cost difference between returnable and one-way packaging systems are estimated.

Garcia-Arca and Prado (2008) argue that in order to successfully develop a packaging design model, the four following characteristics are necessary to consider: 1) identifying design requirements and defining packaging alternatives (i.e. basic packaging decisions); 2) defining the organizational structure for the design; 3) identifying good practices in the design; and 4) establishing control mechanisms that enable packaging improvements. With reference to Johansson *et al.* (1997) and Henriksson (1998), Garcia-Arca and Prado (2008) highlight the need to identify design requirements based on the cooperation of the logistics, marketing, and environmental functions. Subsequent to agreed design requirements between these functions, the authors further argue that the alternatives are identified in terms of material, sizes, number of primary packaging in secondary packaging, and graphic design. The authors argue that to be able to identify these alternatives, the packaging hierarchy is to be employed. The second characteristic addresses the need to establish a suitable organizational structure and procedure. According to Garcia-Arca and Prado (2008), the organizational structure comprises three teams, *the design team*, *the implementation team*, and *the support team*. The product design and the packaging design departments are viewed as a collaborative team, the design team, that simultaneously designs the product and its packaging and governs all decisions made. According to Chan *et al.* (2006), the cost evaluation of the packaging determines the actions taken by the product and packaging design team. The implementation team operationalizes decisions made by the design team and plays the role of coordinator (e.g. testing packaging alternatives and caring for the relations with packaging suppliers). The support team, consists of representatives from packaging manufacturers and third party logistics firms, for example, and serves primarily as a technical advisory board to the design team. As for the third characteristic, Garcia-Arca and Prado (2008) list a range of good practices, of which the following are judged the most applicable to this paper: collaboration with packaging manufactures and their design units, documentation of the packaging design process, definition of maximum weight of unit loads, standardization of formats and quality of packaging, and standardization of dimensions in packaging. The fourth characteristic addresses the dynamic view of the packaging in order to have the best packaging alternative on different occasions. To achieve such a view, the authors employ Key Performance Indicators.

3. METHOD

Knowledge and theory within the area of packaging divisions' work and the foundation upon which the packaging decisions rest are poorly documented. The author has been able to find but a few studies aiming to investigate this domain. Eisenhardt (1989) advocate the use of the case study approach for creating theory from empirical investigations. Due to the lack of a theoretical foundation of the work of packaging divisions and the selecting procedures and guiding principles used for packaging selection, the inductive case study approach was judged applicable. The exploratory nature of the research question and the focus on contemporary phenomena at the case companies bring about the use of case studies (Yin, 2003).

The author has striven to fulfill the criteria *research question/ purpose*, *case setting*, *data collection*, and *analysis* and the sub-criteria of each criterion above in the framework proposed by Olander-Roese *et al.* (2009) to ensure and evaluate the quality, relevance and rigor as well as the reporting of the study.

The purpose of this study is to contribute to the limited body of knowledge on the packaging procedures employed and to understand the guiding principles used in these procedures. To gain this insight empirical data has been collected from two business-to-business companies. The packaging procedures in the case companies were mapped to identify procedures and guiding principles. The two case companies were selected because of their expressed focus and priorities on packaging issues. Moreover, the companies have similar business-two-business relations, which make them a suitable sample from a comparable view with respect to the posed research questions. The research was performed as a qualitative case study and the data collection was carried out by means of six semi-structured interviews at each of the two case companies' sites, with three respondents from each packaging department. Studies of documents provided by each company, observations, and feedback sessions also served as input. The respondents' positions in the two companies are packaging technicians/engineers, logistics developers, packaging concepts and packaging experts. The data collection took place from May to November 2009. The interviews were transcribed and the analysis was conducted using open coding analysis according to Corbin and Strauss (2008). The study was validated through the triangulation of interviews (six), observations (field visits), and documents. The analysis was complemented and reviewed through feedback meetings at each department.

The units of analysis of this study are the current procedures and decision determinants that dominate and govern the packaging selection process in the upstream flow of packages for each company and the downstream flow for one of the companies, from a manufacturer perspective.

3.1. Case descriptions

The packaging departments investigated at case companies A and B from here on are referred to as Department A (Dept. A) and Department B (Dept. B), respectively.

3.1.1. Case context Department A

Industry

Company A is an international company in the automotive industry and operates on a global market. Dept. A is a centralized packaging function for the inflow of goods only and is positioned in Scandinavia. Company A has numerous supplier relations and its assembled products are sold through a multitude of authorized sales offices. The company employs a

wide variety of components ranging from very sensitive to very solid and insensitive components. Its products are spare parts and larger systems.

Packaging flows

The packaging responsibility at Company A is divided into two separate organizations, one responsible for the inflow stream of material into the manufacturing site (Dept. A) and one for the outflow stream of materials, *Fig. 3.1*. The final product has no need of packaging, whereupon the department responsible for the materials outflow excludes that particular flow. Dept. A has the overarching aim to reduce the production costs (i.e. a cost oriented approach). The parallel organization working with the outflow stream of material (spare parts) is responsible for increasing the monetary inflow (i.e. a sales oriented approach). Moreover, the outflow stream of spare parts comprises an important revenue stream, which explains the need for a separate organization.

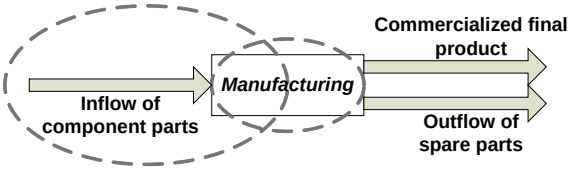

Figure 3.1 Focus of Department A. The dashed boundaries represent its areas of packaging responsibility.

3.1.2. **Case context Department B**

Industry

Company B is an international company in the electronics engineering industry and operates on a global market. Dept. B in Company B is a centralized packaging function and operates from Scandinavia. Company B has numerous suppliers and the products, spare parts and final complex systems are sold to customers globally. The number of relations up-streams (towards the suppliers) exceeds the total number of relations down-stream (towards the customers). The majority of the products in Company B's repertoire of components are more or less fragile.

Packaging flows

Company B has gathered the inbound (inflow), the outbound (outflow), and the reverse streams of material in the same organization, Dept. B. Dept. B is positioned as a sub-organization to Research & Development at the company. Until now, individual packaging solutions have been implemented independently of each other – with no centralized packaging responsibility. Dept. B has been assigned the overall responsibility *for all packaging for all products in all flows*, by serving the needs with as few types of packaging as possible (*Fig. 3.2*). By centralizing the packaging responsibility this is deemed possible.

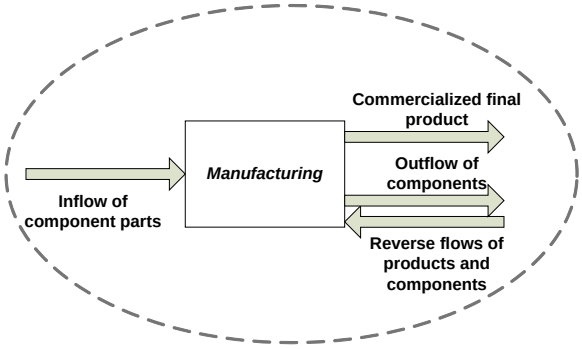

Figure 3.2 Focus of Department B. The dashed boundary represents its area of packaging responsibility.

4. RESULTS

The first research question posed was, 'How is the packaging selection procedure designed in the two case companies?' The answer is framed by describing the packaging procedures found at Dept. A and Dept. B. Research question number two, 'What principles guide the packaging selection procedures?' is dealt with in *section 4.2*.

To enable comparisons between the two procedures, comparable structures have been achieved by omitting detailed and specific information. The crossroads in the procedure maps represent decision points and are given more attention in *section 4.2*. Each procedure was initiated by an observed need for packaging. The activities following the need differ in sequence as well as in content between the two departments.

Judging by the use of packaging in the two business-to-business departments, the conventional packaging hierarchy is not used. Department A primarily strives to use as large types of packaging possible. The preferably order of packaging types at Dept. A is at first hand load carriers followed by transport packaging. Dept. B considers packaging as complementary units and does not categorize them.

4.1. The packaging procedure

4.1.1. Department A

The packaging procedure followed by Dept. A complies with Company A's overall manufacturing scheme. In this scheme, there are defined tollgates and deliverables for Dept. A. Hence, failures in Dept. A's deliveries end up with standstills in production.

The packaging procedure depicted in *Fig. 4.1* is applicable for inner as well as outer packaging. All packaging Dept. A purchases and possesses belong to the dedicated packaging category. All types of standard packaging are rented out by Dept. A's logistical provider.

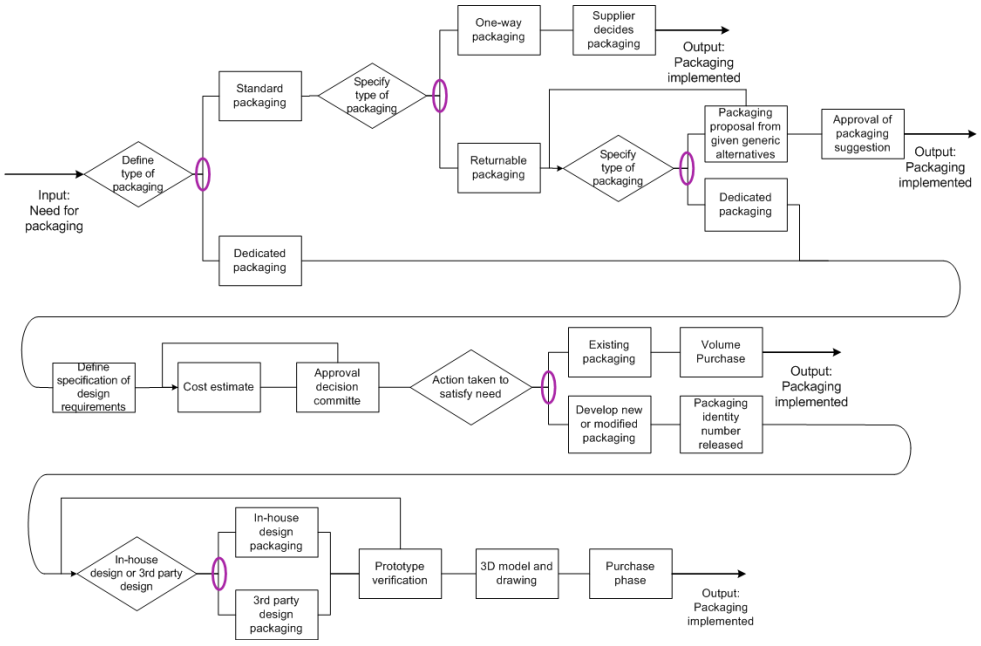

Figure 4.1 Packaging procedure at Department A. The five decision points are circled.

A *packaging selection guide* (see *section 4.2* for a thorough description) assists the component suppliers to suggest suitable packaging, based on the frame stipulated by Dept. A. The frame is based on its logistical provider's zone price setting and the LEAN production philosophy permeating company A. In the first decision point, the packaging selection guide is employed for determining whether to choose a standard packaging or a dedicated packaging. Selection of the standard packaging is usually the first choice. Upon selection of standard packaging, the second decision point determines whether to select one-way packaging or returnable packaging. The one-way packaging is the responsibility of the supplier in terms of design and applicability with the supplied component, and is included in the product price. Selection of one-way packaging is primarily chosen if there are no established forward and reverse material flows. In case of established flows, a dedicated packaging is selected and the procedure follows the path. The selection of standard returnable packaging is followed by the next option found in the packaging selection guide, whether to proceed with letting the supplier suggest a generic alternative, or if the rules set in the guide do not comply with a generic alternative, choose dedicated packaging (decision point three). Next, requirement specifications of the packaging, the product, and from the supplier are set. These specifications differ widely between different products. A project budget is drawn up and sent for financial approval. After budget approval the fourth decision point is reached. The two plausible alternatives are existing packaging solutions or new/modified packaging. The first option is topical in cases where there already is an existing compatible packaging concept, and the second option in all other cases. Selection of a new packaging solution or the modification of an existing one is followed by a release of its identification number. Subsequently, the fifth decision point is arrived at providing the option of in-house packaging design or outsourcing of the packaging design. In most cases, the packaging design is delegated to an outsourcing third party design unit. The outsourcing decision does not,

however, exclude Dept. A from taking part in the design work. Upon the decision to outsource, complementary information is provided in terms of technical specifications. Dept. A never provides the third party design unit with drawings or other "do-this" directives; these are, instead, created in collaboration. Upon reaching an agreed packaging solution, a packaging prototype is produced by the third party design unit and sent to Dept. A for verification. An approved verification is followed by a three dimensional model and drawings, followed by the purchase phase. An unsatisfactory prototype directs the project to a re-evaluation of the fifth decision point.

4.1.2. **Department B**

The packaging procedure in *Fig. 4.2* applies only to inner packaging. Outer packaging is standard packaging for the most part and there is no stated procedure for that selection. The packaging procedure is applicable for "white box suppliers" only (suppliers with which the department has a transparent relationship). For the "black box suppliers" (suppliers that are assigned to develop packaging with few requirements placed from Dept. B.) there is no established procedure of how to select packaging due to lack of know-how of how to work with them.

The choice of standard or dedicated packaging is not considered in the procedure in *Fig. 4.2*, which is for dedicated packaging only. There is no active option for standard packages. Dept. B strives to have the same view of packaging as of any other of Company B's products and hence employ the same processes. In practice, this means applying the same processes and procedures to packaging as to other products. Traditionally, packaging matters at Company B have until recently been considered separately from other products. The organizational positioning at the R&D department is expected to promote the collaboration between the product design department and Dept. B.

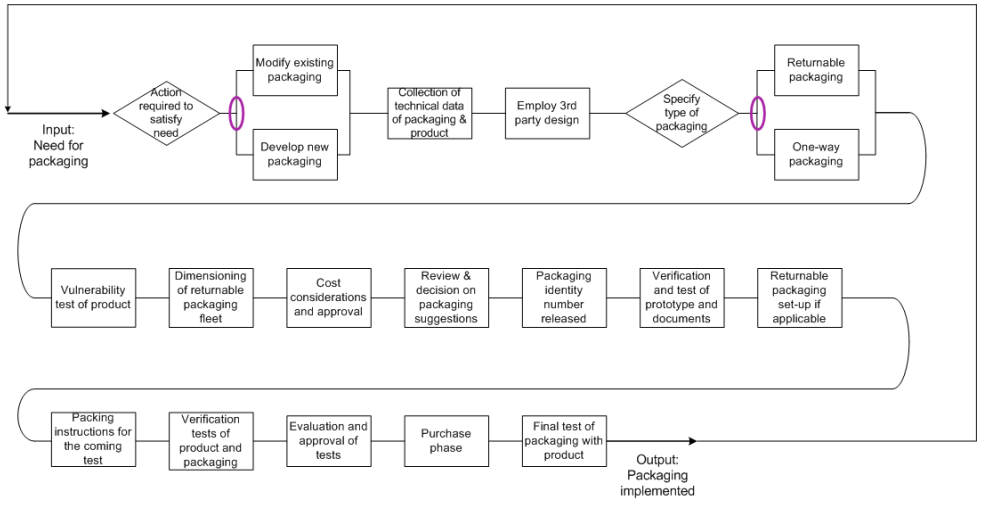

Figure 4.2 Packaging procedure at Department B. The two decision points are circled.

The need for packaging is immediately followed by the first decision point. The choice of action is based on the particular packaging need. A modification of existing packaging is chosen if a given packaging has proven to be insufficient in any way. If the need does not originate from dissatisfaction, but has evolved as a need from a new component, new packaging is developed. Regardless of the initiating reason, the same outlined procedure is followed. The next activity, collection of technical data of packaging and product comprises basic information of the project, basics of the packaging set-up and packaging drawings and basics of the product fragility. Next, the third party design unit is chosen and the packaging suggestions are developed in collaboration with Dept. B. Subsequently the choice of packaging type is decided upon based on a *lowest total cost estimate* of material cost, handling cost, transport cost, and storage cost. The chosen packaging suggestion arises from compromises of the aforementioned factors. Despite the trade-offs among these factors, the packaging must be compatible with foreseeable situations throughout the material flow. Next, fragility tests of the product follow to simulate its handling environment. Subsequently, if applicable, the dimensioning of the returnable packaging fleet is calculated based on storage and set-up configuration. The costs are considered and approved by the purchasing department followed by review and decision on packaging suggestions. The suggestion decided on is given a packaging identity number. Having decided on a design suggestion, the prototype and its documents are verified and tested. If the second decision made at an earlier point resulted in returnable packaging its set-up is arranged at this stage. Next, packing instructions on the functionality of the packaging are provided to the external test unit. The packaging and the product in question are verified for functionality and compatibility followed by evaluation and approval. A positive outcome of the verification leads to the purchasing phase. In case difficulties are encountered with the selected packaging, the procedure starts from the beginning.

4.2. Guiding principles

At each decision point briefly described in *section 4.1.*, there are two available options, each of which terminates in equal output (i.e. the selected packaging is integrated with its product). This study has identified the guiding principles governing the decision making at each of these points. In the packaging procedure of Dept. A, five decision points were identified and in the packaging procedure of Dept. B, two decision points were identified. The decision points at Dept. A are illustrated in *Fig. 4.1* and the ones at Dept. B in *Fig. 4.2*. Next, each decision point is identified and its guiding principles are elaborated on.

4.2.1. **Department A**

The *packaging selection guide*, developed by Dept. A, plays a major role at decision points one, two, and three. The purpose of the guide is to standardize procedures and to clarify Dept. A's expectations for the suppliers. Working according to the guide, the suppliers provide Dept. A with packaging suggestions to consider. The supplier's knowledge and first encounter with the component per se are considered valuable at these decision points.

The frame of decision is based on a zonal price setting rationale. The location of terminals from where empty standard packaging is shipped to the suppliers (i.e. the infrastructure) determines the transaction cost (packaging rental charge) per standard packaging item. This cost per item escalates the further away a supplier is from its terminal (i.e. source of packaging). The distances between suppliers and their closest packaging terminal are classified into three zones. The transaction cost is highest for the zone furthest away and is reduced closer the packaging terminal. Hence, to cut packaging and transportation costs, there is a decrease in the spectrum of available standard packaging with respect to one-way,

dedicated packaging, or different sizes of returnable packaging, with increasing distance between packaging terminal and the supplier.

Decision point I:

The packaging procedure map is initiated by the decision whether to employ standard or dedicated packaging. The governing guiding principles are the geometrical shape of the component in question (i.e. if the shape is suitable for the available standard packaging options or not) and the fulfillment of specified requirements such as sensitivity to superficial damage if the part in question is visible on the final product. Generic standard packaging is selected if these conditions are met by the available options; if not, dedicated packaging is decided on. Dept. A strives to use standard packaging to the greatest possible extent whenever applicable.

Decision point II:

At this decision point the packaging selection supplier guide again plays a key role in terms of the characteristics of geometry, weight and desired workload. Besides these constraints, the geographical distance between the supplier and its most adjacent packaging terminal and hence, the total cost of packaging and transport determines the range of standard packaging alternatives available for each supplier. One-way packaging is used when no transport infrastructure exists at the distance in question or when the components are too bulky for standard packaging.

Decision point III:

At this point, with the help of the guide, the supplier suggests a standard returnable packaging that already exists in the standard packaging range, or has decided that the product requires standard dedicated packaging. More specifically, standard dedicated packaging applies when the geometry of the product is incompatible, the quantity of product packaged in the returnable packaging is not sufficient for the set time of labor and/or exceeds the set weight limits, the returnable packaging choice is ruled out, and the outlined dedicated packaging procedure is followed.

Decision point IV:

Either a volume purchase of an already existing packaging concept is placed or a new or modified packaging is generated. The prerequisite enabling a volume purchase is a fruitful collaboration between Dept. A and the product design department.To keep the types and number of packaging at a minimum level, Dept. A tries to influence the product development department to design products in the same categories with equal features, without compromising the functionality. In doing so, the need for new and diverse packaging is decreased and the efficiency of the combined product-packaging system is increased. Dept. A can also adjust the packaging to products of the same category, though with slightly different features, by developing several unique fits in the same packaging. In other words, the existing packaging fulfills multiple needs and simultaneously reduces packaging costs. The suggestions from Dept. A to the product development department often go hand in hand with the desires of manufacturing (i.e. improvement of the packaging enables a more effective and efficient manufacturing site). Advances made in co-operation decrease the packaging costs. In case a slight modification of an already existing packaging concept is necessary or a brand new packaging is required, the outlined procedure is implemented.

Decision point V:

The decision on whether to outsource or not is highly dependent on resource utilization, not in monetary terms but in terms of personnel resources and core competence. The predominant

choice is, however, the employment of a third party design unit. Nevertheless, the design is developed in a collaborative manner.

4.2.2. **Department B**

Decision point I:

The packaging procedure starts with a decision on the action necessary to meet the packaging need. The rationale for modifying an existing packaging is the observation that it does not meet its requirements. In contrast, the development of new packaging stems from the need of a new component.

Decision point II:

Cost calculations are essential for the selection of packaging at this point. The decision on returnable packaging versus one-way packaging is determined by the overall lowest total cost of packaging with regards to material, handling, transport, and storage.

5. ANALYSIS AND DISCUSSION

The study reveals that the two departments have similar procedures and guiding principles in certain matters and different one in others. Below the packaging procedures and guiding principles at the decision points will be discussed.

5.1. The packaging procedures

The two packaging procedures presented differ in the order of activities as well as in how they correspond to theory. The package planning phase suggested by Bramklev (2009) is not included in Dept. A's packaging procedure (*Fig 4.1)*, however, the department claimed to have a database of former packaging selection procedures where inspiration is taken for coming activities in the procedure. The activities following the third decision point in the packaging procedure (*Fig. 4.1*) are comparable to Bramklev's (2009) second and third phase of the packaging development process, except that financial considerations are not included in her phases. However, in *Fig. 4.1* there is no clear distinction of what activities that belong to the second or third phase; they are instead intertwined. The fourth phase of the packaging development process, production ramp-up, is included in the sub-activities of the purchase phase in *Fig 4.1*. The package planning included in Bramklev's (2009) first phase is not included in Dept. B's packaging procedure. However, the department addresses the need for such a forum. Such a forum might reduce the number of dedicated packaging developed and assist in the desire to serve the need with as few packaging types as possible. The activities following the involvement of the third party unit and ending with the packaging number identity (*Fig. 4.2*) are comparable to Bramklev's (2009) package conceptualization phase. The subsequent five activities are included in Bramklev's (2009) package designing phase. The purchase phase in *Fig 4.2* incorporates the activities included in Bramklev's (2009) third phase, package designing.

Moreover, the procedures employed by Dept. A are fundamentally equal to the procedures in the overall manufacturing system at Company A. Dept. B aims to apply the product design department's processes to the development and selection procedures for packaging. In other words, Dept. B's current packaging procedure will change in the future. The set-up of using a packaging process that is structurally similar to the already well-established product development processes is supported by Bramklev (2009).

The two departments differ in their degree of requirement specification of what packaging type is to be delivered by the supplier to the company in question. Dept. A has set requirements based on the packaging selection guide, the prevailing production philosophy, and the factors affecting the decision points. Packaging selection problems are overcome by creating an understanding among the suppliers of the input components in the processes at Company A. Dept. B, on the other hand, claims to have issues in the cases of black box suppliers in defining what type of packaging is to be delivered by the supplier to the company. These differences imply that the two departments view suppliers in different ways.

The total cost estimation plays a salient role in the selection of packaging at both departments. At Dept. A, the second decision point is affected by the total cost of transport and packaging. These cost considerations are in line with two of the five costs considered by Mollenkopf *et al.* (2005). Dept. B's second decision point is dominated by the total cost of one-way packaging and returnable packaging with regards to material, transport, handling, and storage. According to Mollenkopf *et al.* (2005), a cost model used for the selection of packaging type should include the container cost, transportation cost, labor cost, disposal cost, and recycling cost. In the case of Dept. B the material cost, transportation cost, and handling cost correspond to the costs considered necessary in theory. The costs of disposal and recycling mentioned in the literature are not included in the cost calculations for the second decision at Dept. B. Chan *et al.* (2006) state that the actions taken by the packaging and product design departments are determined by the cost evaluation of the packaging system.

Both departments aim for standardized procedures. Dept. A has already implemented them, whereas Dept. B is in the process of doing so. According to Garcia-Arca and Prado (2008), successful development of a packaging design model is facilitated by standardization of formats, dimensions, and quality of packaging.

Dept. A's early engagement in product design development is supported by Bramklev (2009) and Zacharia and Mentzer (2007). Additionally, collaboration between the product design function and the packaging function is considered necessary to develop a successful packaging design model (Garcia-Arca and Prado, 2008). The cooperating activities between the product and packaging design units correspond well to the opinions of Klevås (2005) and Zacharia and Mentzer (2007) for achieving cost reductions and higher effectiveness. Dept. B is in the process of establishing collaboration with the product design department. Collaboration between the supplying actors and the packaging department is more prevalent at Dept. A than Dept. B.

Garcia-Arca and Prado (2008) discuss the set-up for implementation of a successful packaging design model on a more strategical level, whereas the case study packaging departments deal with packaging activities on a tactical level. The case study reported on in this paper addresses the phenomena on the tactical level. The four basic decisions made in the packaging design model presented by Garcia-Arca and Prado (2008) do not deal with the choice of different packaging types or the influences of the selection, but on the external features and functions of an already selected packaging. Garcia-Arca and Prado (2008) also address the necessity of relying on the packaging hierarchy to identify packaging alternatives. The findings of this study do not support this belief, since the packing hierarchy is not considered in either of the two companies in packaging selection. The correlation made to the packaging hierarchy at Dept. A was rather to adapt the packaging to the load carrier to facilitate transport.

5.2. The decision points

The lack of theory with regards to the factors influencing the decision points calls for comparisons between the two packaging departments studied. The first decision point at Dept. A does not have a corresponding decision point at Dept. B. Adding this type of decision point to Dept. B's working procedure might call for a procedure not exclusively ending up in dedicated packaging. In the current state, all packaging developed at Dept. B is dedicated. This further implies that the cost and effort of the entire packaging procedure at Dept. B could be reduced by initially considering standard packaging. The second decision point at Dept. A corresponds to the second decision point at Dept. B. At Dept. A, this decision resulted in an implemented packaging solution at an early stage, or to proceed with the returnable packaging path outlined. The third decision point at Dept. A has no analogous decision point at Dept. B. Nevertheless, the engagement of Dept. B's component suppliers in the selection of packaging could strengthen the supplier relationships and thus remedy the lack of knowledge of how to deal with black box suppliers. Dept. A's fourth decision point is akin to Dept. B's first, except that Dept. A also considers the suitability of already existing packaging solutions. A regular collaboration between Dept. B and the product design department as well as the aforementioned forum could give rise to consideration of already existing packaging solutions. The reasons for modifying a packaging, however, are different between the departments. In Dept. A, a modification is carried out to add necessary features to an existing packaging. At Dept. B modifications are carried out to remedy dysfunctional packaging. The fifth decision point at Dept. A does not have a stated equivalent decision point at Dept. B. However, despite the lack of this point at Dept. B, both departments have a close collaboration with the outsourcing unit. *Table 5.1* depicts the decision points and their guiding principles.

Table 5.1 Each decision point and associated guiding principles.

Decision point	**Guiding principles**
A1	• Geometrical shape • Fulfillment of specific requirement
A2	• Total cost o Packaging and transport
A3	• Set time for labor • Weight limit • Geometrical shape
A4	• Multifunctional purpose o Outcome of collaboration • Cost
A5	• Resources • Collaboration across functions
B1	• The origin of the need
B2	• Total cost o Material, handling, storage, and transport

Neither of the departments focuses exclusively on environmental benefits as guiding principles. Dept. A states that the use of stackable and/or foldable returnable packaging gives rise to less voluminous transport of empty packaging and hence is environmentally beneficial. The environmental considerations at Dept. B deals with reduction of the amount packaging material and use of returnable packaging.

6. CONCLUSION AND FURTHER RESEARCH

Parts of the activities in the two packaging departments are comparable to the packaging development phases suggested by Bramklev (2009). Nevertheless, the relevant theory does not in depth consider the guiding principles that govern the packaging practice and ultimately the selection of packaging. The theory as well as the case study described in this paper indicate that the selection of packaging is influenced by several factors. The case study presented in this paper shows that the predominant guiding principles influencing the selection of packaging are total cost, standardization, production philosophy, and collaboration between functions. The factor that is most salient as well as common is the total cost of packaging related activities. The factors that separate the departments the most are the degree of established working methods and the attitude towards collaboration between different interested parties. Unlike Dept. B, Dept. A involves its component suppliers in the selection of packaging. This involvement is enabled by clearly stated regulations on the type of packaging to be used and the conditions that should prevail to employ a certain type of packaging. Similar relationships are lacking at Dept. B.

This paper contributes knowledge of the packaging selection procedures and guiding principles employed in two different businesses. The author intends to perform a corresponding case study at packaging manufacturers. Further research of the common denominators and the differences found is needed to complement and expand the findings, preferably in other businesses in order to broaden the perspective and enhance the body of knowledge in the area.

The practical implications of the study include an increased understanding of the guiding principles and their influence on the packaging selection process. This can have a positive financial impact, enhance the performance of the supply and demand chains, and decrease environmental impact.

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Paper III

"Hidden aspects of industrial packaging – the driving forces behind packaging selection processes at industrial packaging suppliers"

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Hidden Aspects of Industrial Packaging

The driving forces behind packaging selection processes at industrial packaging suppliers

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Abstract

The choice of industrial packaging has an impact on activities throughout the supply chain in terms of costs, handling efficiency, transport efficiency and environmental considerations. The aim of this study is twofold: to gain insight into the processes employed by industrial packaging suppliers in packaging selection; and to understand the effect interactions between customer and supplier have on selection. In addition, bottlenecks in the packaging selection process are highlighted. The research findings emphasize the process mapping and logistics cost analyses performed. Three companies, all packaging suppliers to global manufacturing customers active in various fields have participated in the case study.

Keywords:

Industrial packaging; packaging suppliers; process mapping

1 INTRODUCTION

"Packaging contributes to the success of product supply chains, enabling efficient distribution of products, and reduced environmental impact of products spoilage and waste." [1] A literature review of the research in industrial packaging indicates a lack of focus on industrial packaging. In support of this, [2] claimed more than ten years ago that the literature in the area of packaging was dominated by consumer packaging from a marketing oriented perspective. This still holds true. [3] investigated packaging from a retail supply chain stance, where marketing aspects play a predominant role. [3] claimed that without examining the marketing aspects no considerations of the logistics aspects of packaging were possible. This research points towards a research focus on sales packaging. [4] includes sales packaging and industrial packaging in the basic theoretical aspects of packaging logistics.

Research on packaging has also focused on the producing company's (i.e., the packaging customer's) processes of managing packaging matters. [5] put packaging in the light of sustainability research, claiming that "Packaging has a key role to play in sustainable development." [6] showed that the interplay between the packaging, the logistics, and the product development functions can have a positive impact on logistics performance and cut costs. [7] elaborated this reasoning further, indicating that integrated packaging and product development that embrace logistics considerations enable a competitive and coordinated supply chain. [8] discussed the potentials of enhancing resource utilization by integrating the development of product and packaging to run in parallel.

Industrial packaging is often addressed from an operational view of the producing companies, such as deficient handling aspects [4]. However, none of this research focused on the work of the industrial packaging suppliers, nor on the central interactions between the customer and packaging supplier in developing a packaging solution to serve customer satisfaction. [9] addressed the packaging development process at sales packaging suppliers, but did not emphasize the supply chain context and cost aspects. [10] investigated the packaging selection processes and the influences on packaging decisions at two producing companies. Nevertheless, insight into the processes at industrial packaging suppliers is not reported on. To reduce this gap this research was carried out.

The purpose of this paper is twofold; to gain insight into the processes employed by industrial packaging suppliers in packaging selection and to understand their interactions with manufacturing companies, in the context of the supply chain in order to find a packaging solution that satisfies the demands of these customers. The research questions used to fulfill this purpose are:

i. What processes and rationales are used when packaging suppliers suggest an industrial packaging solution?

ii. What is the nature of the ongoing dialogue and the state of involvement between the industrial packaging suppliers and the manufacturing companies to arrive at a satisfactory packaging solution?

This paper presents a frame of reference followed by the research methodology and descriptions of the cases. The results are then presented, followed by the discussion and conclusions.

2 FRAME OF REFERENCE

2.1 Industrial packaging and PPS set-up

The packaging type in focus is intended to fulfill the functions of protection, enable handling of the product, and be the vehicle used between factories, distribution centers etc., and not primarily for individual consumers (i.e., as sales packaging). In the packaging hierarchy [11], this type of packaging would correspond to secondary and in some cases tertiary packaging. Different terms are used in the literature for this type of packaging; **business-to-business** packaging, **transport** packaging, **distribution** packaging, and **industrial** packaging. The packaging term used for these functions in this study is **industrial packaging**. [1] denote the packaging which remains in an industrial supply chain industrial packaging. This view also applies to the study reported on here. As [9] pointed out, the terms **packaging** and **package** are considered synonyms. In this research, the abbreviation for **product** and **packaging system** is **PPS**, referring either to an existing PPS or to

a potential PPS. The term PPS set-up should be interpreted as the **supply chain context** in which the product and packaging system is handled and its **encounters** with the **logistical layout**. In turn, the logistical layout should be interpreted as the arrangement of the logistics activities on operational and executional levels.

2.2 Process mapping

The use of process mapping is important as a tool for process improvement by gaining an understanding of the activities performed by an organization [12,13]. This tool is powerful in discovering interactions and relationships between activities in different functions [13,14], in defining the current state of operations, and in identifying problem areas where improvements can be made [12]. Enhancement in process performance and thus customer satisfaction can be achieved by identifying activities that increase productivity and reduce inefficiencies, duplications, process cycle times and costs [13]. [14] describe a process as "a repetitively used network of activities linked in an orderly manner. The activities employ identified information and resources for transforming 'input objects' to 'output objects', extending from the point of identification to that of customer satisfaction." The work of describing processes is commonly denoted process mapping, where previously invisible processes are brought forward [14].

2.3 Packaging purchase

The packaging design can influence the productivity and cost efficiency of materials handling [4]. More than 10 years ago, [4] showed that the dialogue with the packaging supplier on new packaging solutions and decisions were taken care of by a purchaser or a designer. [4] noted a need for developing the organization around the transport packaging. The study also demonstrated that most companies view packaging as a cost driver, instead of realizing the cost savings it can give rise to along the supply chain. [4] also found that there is often a lack of knowledge on how packaging affects the logistics system and vice versa.

2.4 Theory on the packaging development/selection process

[9] identified a number of theories of the packaging development process and found that they were not generic, were inconsistent in the distinguishable phases of processes, were composed of fragmentary interrelations between activities in the process, differed in decision gates, and were too old to be compatible with today's technology. Based on the review of existing literature on packaging development processes, [9] provided an interesting approach to them for packaging manufacturers (i.e., packaging suppliers). Her aim was to present an integrated packaging and product development process [15]. She proposed a generic packaging development that deals strictly with applying the traditional aspects of product development on the packaging development process [9]. Considerations of underlying aspects such as cost and lead-time aspects for each stage are absent. Neither supply chain and logistics considerations nor their associated costs are included in her reasoning to obtain a packaging solution. [8] claimed that the integrated processes had potential to enhance the utilization of resources, however, with regards to what resources and from what aspects are not elaborated on. In addition, [15] argued that an ultimate product and packaging system meets the demands on transport, handling and storage, however, the perspective of the demands are not clear. According to [4], few packaging are selected based on where and how the packaging is handled. Results from the [10] study discussed practitioners' views of the processes used for packaging selection and indicated that the employment of an integrated product and packaging development process at manufacturing companies reduced costs. The empirical findings that packaging suppliers are involved after the manufacturing companies have decided on a PPS, are discussed by [9]. This time of involvement is not in line with the theoretical rationales and benefits of a concurrent packaging and product development process discussed by [6,9].

[16] addressed the aspect of sub-optimization of functional areas: "If logistics were involved earlier, it would be much easier to make cost trade-off decisions between the logistics implication of a particular design." The system-wide assessment of the trade-offs brought about by logistical and packaging activities are emphasized by [1]. A packaging that is incompatible with its product and encountered environment in terms of poor adjustment and insufficient protection causes consequenses such as poor filling rates and product damages, all of which have economical and environmental impacts on individual activities as well as on the overall supply chain. [16] provide illustrative examples of incompability. For the selection of industrial packaging [1] addressed consideration to efficient use of materials, low environmental impact, and product protection. However, compatibility with the encountered environment was not stressed in relation to the selection.

3 METHODOLOGY

3.1 Research methodology

Case studies were used to gain insight into the industrial packaging suppliers' processes and driving forces. This approach was selected given the scarcity of theory elucidating these processes in the literature. This gap in insight gave rise to research questions of an explorative nature and the decision to apply a case study approach with multiple cases. It was felt that such an approach would best answer the two research questions, since the case study approach is advocated when the present theory is insufficient or when a research field is new [17]. Case studies are highly suitable when the research focuses on contemporary phenomena in its real-life contexts, and when the boundary between the context and the phenomena is uncertain as [18] maintains. These circumstances are true for the processes investigated in this study.

In order to answer the RQs empirical data was collected from three major packaging suppliers that offer industrial packaging on a global scale. It was carried out by the use of semi-structured interviews, secondary data (internal documents), and observations (field trips), which enabled validation through triangulation. There was a total of nine interviewees: four from Company A, two from Company B, and three from Company C. After completing the data collection, the interviews were transcribed and data analysis was carried out. Analysis was performed in line with [19] open coding and relational analysis.

An inductive influenced research approach was used to investigate the processes and rationales behind the industrial packaging selection process. The case sampling was based on the desire to include packaging suppliers offering one-way packaging solutions, returnable packaging solutions, and both kinds of packaging solutions. This particular sample selection was selected to give insights into the reasoning behind diverse packaging selection processes.

To ensure and evaluate the quality, relevance, and rigor as well as the reporting of the study per se, the author has striven to consider the framework developed by [20].

3.2 Case descriptions

This section presents the characteristics and activities of the three participating case companies.

Case Context Company A

Case Company A provides traded products (i.e. packaging commoditites) and company designed products (i.e. tailored packaging). The company has grown from a local packaging

supplier to its current position as a global supplier to manufacturing companies. Company A has an abundant number of material suppliers spread around the world and its customers represent manufacturing companies active in most market segments such as automotive, electronics, apparel, and third-party logistics firms. Its design center is located in Scandinavia. Company A's major strength is in its competence to develop highly specific customer tailored packaging solution. The offering of generic packaging solutions is limited. The packaging solutions offered are one-way and returnable B2B packaging solutions. Its packaging solutions are employed in the customers' inbound flow of small items and outbound flow of larger processed items.

Case Context Company B

Case Company B provides returnable business-to-business packaging solutions to a number of different markets such as automobile, food and beverage producers, apparel industry, and delivery firms. It has its own design center located in Europe. Company B advocates that its deep knowledge of packaging-related issues in numerous markets enables cross-fertilization and thus gives it a competitive advantage. Its packaging solutions are used for inbound transports, for example deliveries between the customers' component supplier (tier 1 supplier) to its customer's production plant. The packaging solutions provided by Company B are also frequently used for outbound transports, for example from distribution center to retailer.

Case Context Company C

Case Company C is a global market leader in its segment of packing solutions. The company provides business-to-business and sales packaging. Company C sells almost exclusively one-way packaging. Its customers and their products operate on a variety of markets, including food producers (B2C), appliances (B2C), and heavy industry (B2B). Often the industrial packaging has dual functions and is also used as sales packaging. The trend is towards sales packaging since the transport packaging is assigned a dual function in terms of fulfilling marketing *and* protective purposes.

4 RESULTS

The following section provides answers to the first research question: **What processes and rationales are used when packaging suppliers suggest an industrial packaging solution?** The answers to the second research question, **What is the nature of the ongoing dialogue and the state of involvement between the industrial packaging suppliers and the manufacturing companies to arrive at a satisfactory packaging solution?** are dealt with in 4.2.

4.1 Process mapping of the logistics flow

The particular activities observed in the process mapping for each of the industrial packaging supplier are presented in Table 1. The processes for finding an industrial packaging for a new product introduction or an existing product are not separated in this study.

Company A

Upon a request to find a packaging solution for a customer's product, the approach is to identify the perceived needs or problems. This is followed by collection of facts by means of process mapping and assessment of the existing **characteristics of the product** to be packed and **the PPS's encounters and set-ups that are affected by the industrial packaging set-up**. Aspects that include the PPS encounters and set-up are conditions during transport and handling (i.e., supply chain data collection). The more specific information the customer provides, the better the packaging solution. Following the mapping of customer information and an understanding at Company A for the current PPS set-up (see Table 1 for investigated aspects) Company A contrasts the processes activities and associated costs with potential PPS set-ups that would **mitigate the identified cost drivers**. Company A experiences that its customers are often not in control of the costs of transport that arise due to packaging. Thus, the reduction of transport volumes, a concrete measure that implies reduction of the costs, is especially addressed by Company A. By means of the financial assessment cost drivers and potential cost reductions are identified, a final PSS set-up proposal is presented and further refinements of the solution are discussed with the packaging technician at Company A. The information provided by the producing company and the professional experience of the sales person directs him or her in the direction of one-way or returnable packaging. In those cases where the choice between a returnable and one-way PPS set-up is uncertain, the results of the logistics cost analysis displays the break-even point for the two set-ups and enables a factually based selection. In addition to the logistics cost analysis, Company A wishes to depict environmental savings in the processes of developing an industrial packaging explicitly for its customers. This is to be done by the use of an **environmental tool** that enables calculations of the amount of carbon dioxide emissions in relation to the different packaging solutions and their associated activities. The implementation of this system is meant to give the customer facts in order to make a conscious decision.

The decision on a generic versus tailored industrial packaging is largely determined by the cost of constructing and manufacturing. From a Company A point of view the potential industrial packaging ought to be cost effective from the standpoints of the manufacturing per se, transport and handling. Employment of the logistics cost analysis includes these activities with associated costs. A number of 500 packing items is considered a large order and hence warrants a tailored packaging solution.

Company B

Company B's efforts are initiated by identifying the problem or a changed/new flow and the associated causes and effects that the customer experiences. The company typically found that the customer's description of the problem is most often not as comprehensive as needed for full insight and/or includes less relevant aspects. Hence, the information is extracted that is considered important. If needed, additional information is collected by Company B in order to understand the parts of the customer's supply chain through which the PPS will pass. The information collected by Company B is classified in two categories; **characteristics of the product** to be packaged and **flow analysis of the prevailing PSS encounters and operational activities**. Company B often assesses and evaluates the existing activities in the supply chain by on-site observations.

In the logistics cost analysis two or more PPS set-ups are scrutinized and compared to demonstrate the most profitable PPS. From a profitability point of view in terms of the operational activities mapped, either returnable set-ups with different features are compared with each other or a returnable and a one-way set-up is compared. Company B stresses that the customer is often not aware of the pay-off time and initial investment of the prevailing PPS. Going further into details, the process mapping of the flow analysis identifies the activities occurring at each supply chain actor. Subsequently, by means of a logistics cost analysis, the costs each activity incurs are identified and appraised. The costs for the same types of activities are aggregated and placed in the specific cost pools of operational cost, cost of handling, fixed costs, technical cost, and economical cost. The process mapping and the data on the product make up the basis for constructing and suggesting a first packaging solution to the customers. Further dialogue between the packaging supplier and the customer that

result in the final PSS decision is described in 4.2. Company B stresses that customers often keep track of the costs of material and transport but lack knowledge on the costs of handling.

The production tool needed for a new packaging solution consumes considerable resources in terms of initial investments and a long lead time. If the product to be packaged and its supply chain require extensive transport protection, the machinery for a new tool is invested in. On the other hand, if the product to be packed allows, Company B directs its customers to already existing packaging solutions enabling financial leverage. Additionally, evaluations of the needed annual amount of industrial packaging guide in the direction of generic or tailored industrial packaging.

Company C

Company C provides industrial packaging which often is synonymous with sales packaging, that is, the same packaging is used for transport as well as for display at the retailer. This combined field of use puts additional conditions on the packaging in terms of marketing features (graphics, information, etc.) and product protection. To succeed in developing a satisfying packaging solution, the customer has to reveal the goal for which it is striving for. Company C collects **characteristics of the product** to be packaged, maps information about **its market place**, and **information on its supply chain** from the origin to point of delivery with an emphasis on the functional areas at the customer company that are affected by the PPS set-up. Table 1 presents data collected about the product and information about the activities concerning the mapping of the supply chain set-up. The development of a packaging solution is partly dependent on the activities that emanate from the different functional areas in the customer company, (i.e., production, construction, logistics, marketing, and sourcing). Trade-offs of the activities serve as the basis for a proposed packaging solution (see more on this in 4.2). Hence, the packaging selection is based on function versus cost. Company C argues that the process of investigating and evaluating the prevailing packaging solution is an iterative process, and thus is after some time reinitiated.

For Company C to meet its customers' expectations, needs, and requirements and yet be cost effective, a tailored industrial packaging solution is considered the appropriate route. For a generic packaging solution the service dimension and tailored competence is somewhat lost. The annual amount and demand for industrial packaging determines whether a generic or tailored industrial packaging is ordered. An edition of 500 industrial packaging items per annum is considered a low number and the tailored packaging solution design may be too costly.

	COMPANY		
Product information	**A**	**B**	**C**
Type of product	X	X	X
Weight	X	X	X
Dimensions	X	X	X
Sensitive features			X
- Scratches	X	X	
- Bumps	X	X	
- Static electricity	X	X	
Mapping of supply chain			
Market Characteristics			
Type of market			X
Market analysis			X
Competitor analysis			X
General Process Characteristics			
Overall mapping of SC activities		X	X
Product encounters along SC	X	X	
Unique characteristics		X	
Origin & Destination	X	X	X
Packaging solution	X	X	X
Mending		X	
Dim.of existing packaging		X	
- Thickness of walls	X		
- Volume	X		
- Length/height/depth	X		
No. of items per packaging	X	X	X
No. of packaging annually	X	X	X
Project duration	X		
Savings post project	X		
- *Returnable packaging*			
Initial investment	X	X	
Cycle time	X	X	
Cleaning		X	X
Pay-off time	X	X	
Technical life expectancy	X	X	
Dim. of packaging solution	X		
Collapsible property	X	X	
Non-collapsible property	X	X	
Volume of return transport	X	X	
Moist milieu			X
- *Transportation*			
Mode of transport	X	X	X
Filling rate	X	X	
Transport distance	X	X	X
Transportation duration		X	
Cost due to packaging weight	X	X	
Dim. of transport vehicle	X	X	
Cost of transport	X	X	
Packaging pattern	X	X	
Third party logistics provider			X
- *Handling*	X	X	X
Unfolding	X	X	
Filling/Packing			
- Human	X	X	X
- Automatic		X	X
Transporter	X	X	X
Transhipment			X
Distribution center		X	X
Unpacking		X	
- Human	X		X
- Automatic			X
End of life			X
- *Sales packaging*			
Visual exposure			X
Information			X
Differentiated features			X

Table 1: A summary of the product characteristics and mapping of supply chain activities and parameters.

4.2 The supplier – customer dialogue and phase of involvement

All case suppliers stress the need for a close and continuous dialogue with the customers for a successful PPS set-up. Additionally, all three suppliers emphasis the benefits of letting their competences work out a packaging solution in parallel with the construction of the product to be packaged, or at least before the intended date of launching the product. Often the customer companies provide specification of requirements of the product to be packaged and if there is a need of complementary data, the

packaging suppliers gather this. The more restrictions they are given, the less creative they can be.

Company A

Given the diversity of Company A's customers and each product's individual demands on its packaging solutions, an individual set of information is needed to serve these demands. The main orders at Company A are for tailored packaging solutions. To be able to construct a tailored solution the information provided by the customer needs to be comprehensive. Company A stresses that in cases where the customer does not provide the necessary information, the packaging supplier possesses skills and experience to estimate plausible parameters. However, lack of correct data extends the lead time. Often, the different functional areas at Company A discuss with the corresponding functions at the customer company. This approach reduces misunderstandings since there are no intermediaries. In this way, the response is immediate and the lead time decreases.

Company A would like to be involved in collaboration with the customer company's construction department at an early stage. Improvident orders may impose higher costs than necessary, particularly when there is a need for an advanced packaging solution and the material used is traded.

Company B

During the ongoing dialogue between the customer and Company B, the supply chain mapping falls into place piece by piece. In discussion between the two parties about concrete packaging solutions and their feasibility with the supply chain, light is shed on additional aspects that have not been taken into account earlier. This case often appears since the professionals working with them consider the PPS set-up to be general and well known and thus taken for granted. Further discussion and refinement of the packaging solutions enables a better degree of accuracy and finally the optimal packaging solution is identified. In case of insufficient information from the customer, Company B feels that the experience from diverse business areas many times enables them to make reasonable and often surprisingly accurate assessments and estimates of costs of supply chain activities.

Additionally, Company B often experiences that the contact person at the customer company is not the correct one. The person shares the basic information about the product, but often lacks the logistics aspects. Company B is aware that the customer company's sourcing function often terminates the business opportunity based on price arguments, even though the collaboration has proved to be fruitful. Company B is often involved late in the customers' production phases, though more and more companies have realized the benefits of involving the packaging supplier early on in the chain to enable optimization of transports, production etc.

Company C

To open up for contemplation and to direct focus away from the cost of investment of the packaging in the customer company's sourcing function, Company C has a tradition of actively involving the different functional areas of production, design, logistics, marketing, and sourcing in the customer company. In doing so, the needs and requirements of each of the functions are emphasized. By making the costs that are incurred along the supply chain activities visible during the conditions of different packaging systems, people in the sourcing function become aware that escalated costs for some activities result in reduced costs elsewhere in the supply chain, and that the total sum ends up lower than for the current packaging. According to Company C, this approach achieves the most optimal packaging solution based on the trade-offs of the different functions' requirements and needs.

Company C perceives that the interest in largely involving the packaging supplier in the process has grown. Yet, the most common case is that the customer companies come to realize a need for packaging after the product has been developed.

5 DISCUSSION

5.1 Process mapping at the packaging suppliers

In accordance with [9], the findings of this study identified that the packaging suppliers do not acknowledge the use of theoretical packaging development and selection processes. Instead, their experience provides good guidance on how to progress in the process of developing packaging solutions for customer satisfaction. Judging from the findings from the three packaging suppliers, there are differences in the way of mapping the supply chain activities. The companies provided different levels of details on the mapping of the supply chain (Table 1). In line with [13,14], all three packaging suppliers use the process mapping technique to comprehend interactions and relationships between the activities of different functional areas. All three packaging suppliers focus on the aspects of costs in the mapping, though from different angles. The desired output result is common for all three companies; to cut the customers' direct and associated packaging costs as regards the supply chain activities. The need for the logistics cost analyses seem to originate from the lack of knowledge at the customer companies on what drives costs. This finding is in accordance with what [4] addressed. Company B categorizes different activities and associated costs. These costs are interpreted as being linked to different functional areas for the use of a particular PPS set-up. Company C employs a somewhat different approach in that the compromises agreed on between the different functional areas are the foundation for the packaging selection. Comparison of the current PPS set-up to a potential one suggested by the packaging supplier is the main focus in the three industrial packaging suppliers' mapping processes. The rationale to involve supply chain actors, that are affected by the packaging in the packaging decision is in line with [1].

As found in the study, when there is an uncertainty whether to select one-way or returnable packaging, the output of the logistics cost analyses at Company A and B display the break-even point for the two alternatives. Except for the analysis of the cost driven activities the selection of one-way or returnable industrial packaging may be influenced by other driving forces, such as what set-up is most cost effective and profitable from a packaging supplier's production point of view. None of the industrial packaging suppliers claim to be purely a provider of commodities, but of tailored packaging solutions. All suppliers stress that their added value comes with a tailored packaging solution and not with a commodity. The cost of construction, manufacture, and the requirements of the product to be packed partly determine whether a tailored or generic industrial packaging is to be used. It is constantly a matter of function versus cost.

The three packaging suppliers can be split in two groups that represent differences in the opinion on what quantities of packaging items justify scale of economy. Interestingly, the sales packaging perspective at Company C clearly distinguishes itself from the industrial perspective at Company A. Company B indicates the same stance as Company A. Hence, it can be assumed that the cost level for developing an industrial packaging is higher per item than for developing a sales packaging.

5.2 Intercompany dialogue and involvement

Regarding the engagement of different functional areas in the development of an industrial packaging, Company B seems to have a reactive approach, Company C a proactive approach and

Company A somewhere in between. The findings of [9] that the manufacturing company decides on the PSS and then involves the packaging supplier do not correspond to the findings of this study. Rather, depending on the degree of advancement of the packaging function at the customer, there is a continuum of information given by the customer. An advanced packaging function might provide a well-specified order and the need for the suppliers' investigative competence is outplayed. At the other end of the spectrum, customers are found that possess little knowledge in packaging matters and rely on the packaging supplier to provide all input. The intercompany priorities and commitment to packaging, and the priority of its function often reflects the knowledge of packaging professionals dealing with the packaging suppliers and the level of existence of a logistics organization advanced in packaging matters. Companies A and B explicitly argue that not too seldom the contact person at the customer company lacks adequate and necessary insight to provide the answers needed. Often purchasers are asked to arrange for an industrial packaging solution; this experience is supported by [4]. The purchaser focuses on what suppliers qualify, but do not have skills in trade-offs that come with the different PPSs offered by different suppliers. The price of the packaging solution is often why the business opportunity fails; companies do not look for trade-offs in different areas.

All case companies claim that their involvement early on in the development of the product is cost beneficial especially as regards the utilization of resources. This is in coherence with the findings of [8] that argued that an integrated product and packaging development process would increase resource utilization Company B expresses that one way to ensure early involvement is by building relations and trust. The manufacturing customer's insight into the positive supply chain effects that come with the collaboration of the packaging and product development functions is supported by [6].

6 CONCLUSIONS AND FURTHER RESEARCH

The lack of a PPS set-up perspective at the customer companies, in addition to the mindset of the function of the packaging and the importance of its impact, seem to play a role in the priorities of the packaging skills at the manufacturing company. How important is it to have a fully compatible PPS?

The industrial packaging suppliers must ask the right questions to find out all the relevant conditions, to be able to design a packaging that satisfies all the needs for the intended encounters and activities in the flow. The data collection would speed up and be facilitated if the customer companies prioritize having people and functions with the right competence engaged in the work. Management needs to ensure that competent staff is dealing with packaging requirements and the dialogue with the packaging supplier. Otherwise, lead time and costs increase. Manufacturing companies that view packaging and the packaging selection as prerequisites to manage to get their products to the right place, in the right time, in the right condition, and at the right price, open the door to potential cost savings.

For further research it would be interesting to investigate which function influences the industrial packaging selection the most. According to [21], the sales packaging decision is mostly influenced by the marketing function. Regarding the industrial packaging decisions, however, this study indicates that the opinion of the sourcing function seems to carry the main weight. If this is the case, is that the adequate way?

7 ACKNOWLEDGEMENTS

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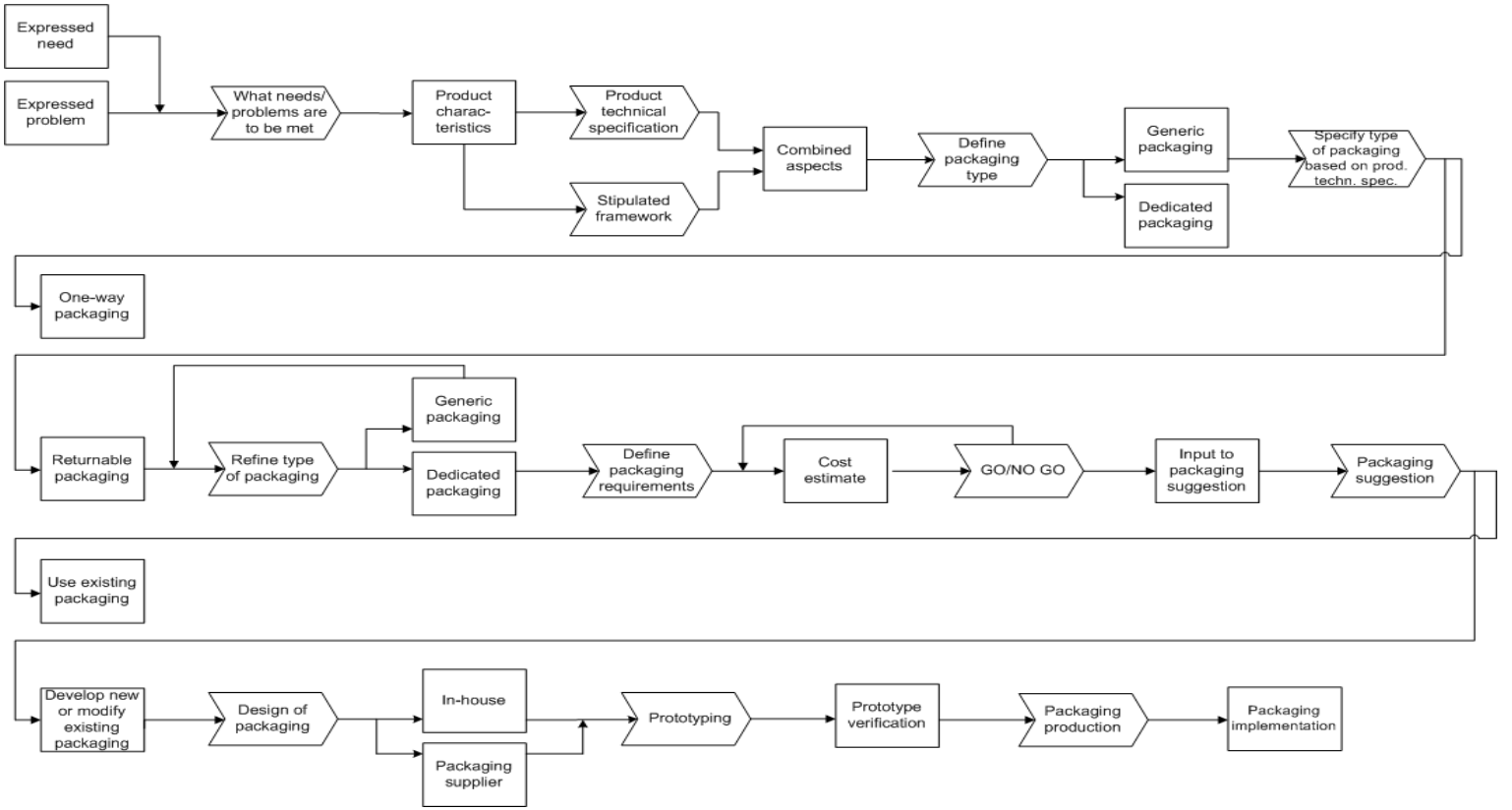
Appendix 1

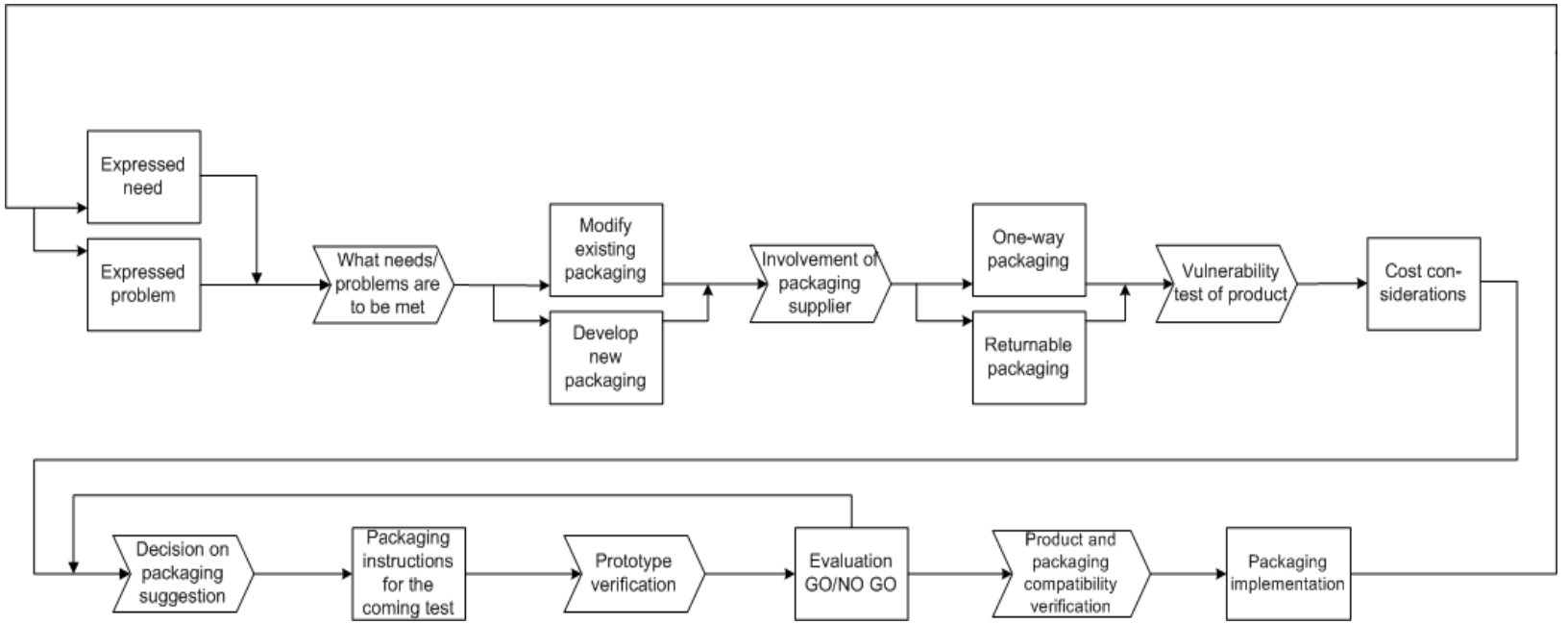
First case study

Manufacturing companies – industrial packaging users

Company A


Expressed need
Expressed problem
What needs/ problems are to be met
Product charac-teristics
Product technical specification
Stipulated framework
Combined aspects
Define packaging type
Generic packaging
Dedicated packaging
Specify type of packaging based on prod. techn. spec.
One-way packaging
Returnable packaging
Refine type of packaging
Generic packaging
Dedicated packaging
Define packaging requirements
Cost estimate
GO/NO GO
Input to packaging suggestion
Packaging suggestion
Use existing packaging
Develop new or modify existing packaging
Design of packaging
In-house
Packaging supplier
Prototyping
Prototype verification
Packaging production
Packaging implementation

Company B


Expressed need
Expressed problem
What needs/ problems are to be met
Modify existing packaging
Develop new packaging
Involvement of packaging supplier
One-way packaging
Returnable packaging
Vulnerability test of product
Cost con-siderations
Decision on packaging suggestion
Packaging instructions for the coming test
Prototype verification
Evaluation GO/NO GO
Product and packaging compatibility verification
Packaging implementation

Appendix 2

Second case study

Packaging suppliers

A compilation of the the product characteristicsand its supply chain, as identified by each of the three packaging suppliers.

	COMPANY		
Product information	**A**	**B**	**C**
Type of product	X	X	X
Weight	X	X	X
Dimensions	X	X	X
Sensitive features			X
- Scratches	X	X	
- Bumps	X	X	
- Static electricity	X	X	
Mapping of SC			
Market Characteristics			
Type of market			X
Market analysis			X
Competitor analysis			X
General Process Characteristics			
Overall mapping of SC		X	X
Product encounters along SC	X	X	
Unique characteristics		X	
Origin & Destination	X	X	X
Packaging solution	X	X	X
Mending		X	
Dim.of existing packaging		X	
- Thickness of walls	X		
- Volume	X		
- Length/height/depth	X		
No. of items per	X	X	X
No. of packaging annually	X	X	X
Project duration	X		
Savings post project	X		
- Returnable packaging			
Initial investment	X	X	
Cycle time	X	X	
Cleaning		X	X
Pay-off time	X	X	

cont. ⬇

Technical life expectancy	X	X	
Dim. of packaging	X		
Collapsible property	X	X	
Non-collapsible property	X	X	
Volume of return transport	X	X	
Moist milieu			X
- Transportation			
Mode of transport	X	X	X
Filling rate	X	X	
Transport distance	X	X	X
Transportation duration		X	
Cost due to packaging	X	X	
Dim. of transport vehicle	X	X	
Cost of transport	X	X	
Packaging pattern	X	X	
Third party logistics			X
- Handling			
Unfolding	X	X	
Filling/Packing			
- Human	X	X	X
- Automatic		X	X
Transporter	X	X	X
Transhipment			X
Distribution center		X	X
Unpacking		X	
- Human	X		X
- Automatic			X
End of life			X
- Sales packaging			
Visual exposure			X
Information			X
Differentiated features			X

Appendix 3

First case study

Interview guidelines

Manufacturing companies

Appendix 3: Interview guidelines - Manufacturing companies

Packaging Management Practice – en nulägesanalys/beskrivning

Jag behöver en beskrivning av hur de (logistiker eller andra) som är engagerade i arbetet med förpackningar och interaktionen produkt/förpackning/logistik arbetar i företagen.

Caseföretag: XX
Denna intervju: namn, position
Datum: xx

A.

1. Berätta om Din roll på XX och hur Du arbetar med förpackningar.
2. Vilka funktioner arbetar med förpackningar hos XX?
3. Hur arbetar avdelningen för XX med förpackningar?
4. Vad är Ert syfte med att arbeta med förpackningar?
5. Var i flödeskedjan börjar och slutar Ert ansvar för förpackningsrelaterade frågor?
6. Vilken roll har förpackningen för Er?

B.

1. Är förpackningsrelaterade frågor prioriterade?
    a. Om ja, hur? (finansiellt, tidsmässigt…)
    b. Om nej, varför?

2. Vilken avdelning/funktion beslutar om vilka förpackningssystem ni skall köpa in?

3. Vilka faktorer styr valet av förpackning?

4. Vilka krav ställer Ni på förpackningen?

5. Har Ni riktlinjer för att få rätt förpackning till en produkt?
    a. Vilka aspekter är med i dessa riktlinjer?

6. Hur ser processen ut mellan Er och leverantör för att välja förpackning och förpackningsmaterial?
    a. På vilket sätt är Er leverantör involverad i val av förpackning?
    b. På vilket sätt är Ni involverad i val av förpackning?

7. Hur ser processen ut mellan Er och slutkund för att välja förpackning och förpackningsmaterial?
    a. På vilket sätt är Ni involverad i val av förpackning?
    b. På vilket sätt är Er kund involverad i val av förpackning?

8. I vilka fall används returförpackningar?

9. I vilka fall används engångsförpackningar?

10. Vilka material används för engångs- respektive flergångsförpackningar?

11. Sker utvärdering av valet av förpackning?
    a. Hur sker detta?

12. Vilka typer av förpackningar används mest?
    a. Vilka undergrupper av förpackningstyper finns?

C.

1. Vilka parametrar beaktas vid inköp av förpackningssystem?

2. Vilka problem ställs Ni inför vid inköp av förpackningssystem?

3. Hur skiljer sig inköpsprocessen av att köpa in förpackningar till skillnad från att köpa in komponenter till Spare parts respektive Assembly?

D.

1. Hur ser Ert samarbete med XY ut?

2. Vilka förpackningssystem hanteras av XY?

3. Vilken kravspecifikation av förpackningen överlämnar Ni till XY?

4. Vilken information om produkten respektive dess förpackning stämmer Ni av med leverantörer?

E.

1. Hur kombineras produktsystem och distributionssystem?

2. Följer ni principer för hur dessa kombineras?

a. Om ja, hur ser dessa ut?

3. Hur inverkar valet av transportmedel på valet av förpackning till en viss produkt?

4. Vid känsliga produkter, hur förpackar Ni för att säkerställa att godset inte skadas
    a. Under transport?
    b. Under sammansättning?

5. Följer ni upp var i transportkedjan skador uppstår?
    a. Vilka skador uppstår?
    b. Kan Ni bedöma orsaken till skadan?
    c. Hur frekvent sker detta?

F

1. Vilka förpackningar används inom sammansättningsbyggnaden?
    a. Vilka faktorer har lett till att detta förpackningssystem används?
    b. Hur och varför har dessa faktorer identifierats som viktiga?

2. För vilka slags produkter/komponenter används flergångsförpackningar idag?

3. Vilka omständigheter kvalificerar för användning av flergångsförpackningssystem?

4. För vilka slags produkter/komponenter används engångsförpackningar idag?

5. Vilka omständigheter kvalificerar för användning av engångsförpackningssystem?

6. Vilka slags förpackningar används av Ert företag inom

a. Regionalt?
b. Globalt?

7. Sker ompaketering av produkter?
    a. Varför sker det?
    b. Vad ändras?

Appendix 4

Second case study

Interview guidelines

Packaging suppliers

Appendix 4: Interview guidelines – packaging suppliers

Packaging Practice – en nulägesbeskrivning
Hur förpackningsleverantörer arbetar med förpackningsutveckling

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Jag behöver en beskrivning av hur förpackningsleverantörer arbetar med förpackningsutveckling och val av förpackning samt hur interaktionen med det beställande företaget ser ut.

Caseföretag: XX
Denna intervju: namn, position
Datum: xx

A.

1. Berätta om Din roll på XX och hur Du arbetar med förpackningar.
2. Vilka olika förpackningsfunktioner finns i Er organisation?
3. Vad innebär de tjänster Ni tillhandahåller?
4. Var i flödeskedjan av komponenter och färdiga produkter används Era förpackningar och tjänster?
5. Var i flödeskedjan används Era produkter och tjänster?

B.

1. Hur ser processen ut mellan Er och det beställande företaget för att utveckla och välja förpackning och förpackningsmaterial?
    a. Hur ser Er roll ut?
    b. Hur ser det beställande företagets roll ut?
2. I vilket skede hos det beställande företaget involveras Ni?
3. I vilket skede skulle Ni önska att Ni involverades och varför?
4. Vilken slags information får Ni från de beställande företagen?
5. Vilken slags ytterligare information från de beställande företagen skulle hjälpa Er i Ert arbete?
6. Vilka krav ställer Ni på förpackningen?
7. Vilka krav ställer de beställande företagen på förpackningen?
8. Vilken kravspecifikation av förpackningen överlämnar de beställande företagen till Er?
9. Vilken information om produkten i förpackningen stämmer Ni av med det beställande företaget?

C.

1. Kan Du beskriva hur Ni kategoriserar Era förpackningar?
2. Har Ni standard respektive specialförpackningar? Om ja,
    a. Hur ser de beslutsunderlag ut som styr valet av standardförpackning?
    b. Hur ser de beslutsunderlag ut som styr valet av specialförpackning?
3. Hur har dessa beslutsunderlag tagits fram?
4. Hur ser beslutsunderlagen ut för att välja en viss förpackning?
5. Avspeglar sig förpackningsvalet i förpackningsansvaret med avseende på produktskador?
6. Vilka typer av förpackningar används mest?
    a. Hur relaterar dessa typer av förpackningar till varandra?

D.

6. Hur inverkar valet av transportmedel på valet av förpackning till en viss produkt?
7. Följer Ni principer för hur dessa kombineras?
    a. Om ja, hur ser dessa ut?