The process of creating a nation-wide pool system for transport packaging - from vision to decision

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The Process of Creating a Nation-Wide Pool System for Transport Packaging

– From Vision to Decision

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Thesis for the degree of Licentiate in Engineering

The Process of Creating a Nation-Wide Pool System for Transport Packaging
– From Vision to Decision

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Acknowledgements

It must have been in late 1994 or early 1995 that Professor Gunilla Jönson asked me if I was interested in writing a thesis on the process of introducing a pool system for returnable packaging within the Swedish food supply chain. I remember exactly where we were when she asked the question that started the long journey towards the completion of this thesis. We were leaving a meeting with the Waste Research Council in Stockholm, where both of us were members of the research committee, which provided financial support to research projects concerning resource management and material recycling.

Back home at work at the Perstorp Group in southern Sweden, there were mixed reactions to Gunilla's suggestion. Some roared with laughter at the proposition, as they could not imagine me becoming an industrial PhD candidate, others frowned and demonstrated their disapproval of this prospect. However, in October 1995 I was accepted as an industrial PhD candidate at Lund University. To keep me away from diving into the research activities, I was appointed project manager of a group-wide European transport procurement initiative, which took up all my time and commitment from 1996 to 1999. When I took up my new position as the environmental manager at Lund University in April 1999, Gunilla immediately approached me and asked if I was still interested in writing this thesis. I was, but I had no financial support to get started. It took two more years to find a research foundation interested in supporting this type of research. I am very grateful to Ångpanneföreningen's Resarch Foundation, which provided the basic funding. One year later, another research funding body, Handelns Utvecklingsråd, decided to support this project, which enabled me to continue my part-time duty as a PhD candidate until the end of 2004.

Thank you Gunilla, for your warm-hearted persistency, your never-ending optimism concerning the feasibility of this project and your encouraging comments during all these years.

Since 2003 Professor Hans Sarv, the logistics practitioner and researcher, has guided me into the fields of change management and systemic learning.

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Associate Professor David Grant at Heriot-Watt University in Edinburgh has spent some time on my texts - thanks for your time and for giving me your most valuable advice and useful comments.

The everyday support I have had must not be forgotten; thank you from the bottom of my heart, all dear friends at the Department of Packaging Logistics for all the creative discussions, explanations, support and enlightening during coffee and lunch breaks, seminars and conferences. I will miss you…

In the afternoon of September 11, 2001, my fellow PhD candidate Caroline and I attended a research conference held by the British LRN, Logistics Research Network, which took place in Edinburgh that year. This was my first contact with the academic world on the logistics research level. The PhD workshop held on September 12 was, of course, affected by the events in Manhattan the day before. But in spite of those shocking events, the participants in the PhD workshop got plenty of good advice on how to succeed with a PhD project. One of the lecturers, a middle-aged woman, had completed her PhD in an effort of combining part-time work and family life with her research project. She advised all senior PhD candidates to find time for a full-time effort, focusing only on the research project. I can confirm that her advice is appropriate and should be a compulsory recommendation to all industrial, middle-aged PhD candidates. For this reason I am most grateful to Dr Hans G. Forsberg at Ångpanneföreningen's Research Foundation, who provided the extra funding required to allow me to work fulltime with this thesis for some weeks during the spring of 2005.

It is a truly difficult task to complete a thesis and meet all other professional and social expectations at the same time. My additional advice to that given at the PhD workshop in 2001 is: do not change jobs when you are in the concluding stages of finalising your thesis. For this reason I am also very grateful to my new boss, Gösta Ahlberg at Skånetrafiken, who has given me his full support when I needed to take some time off to finish this project.

There are, of course, a long list of names of people who have been important for the initiation, implementation and completion of this research project. I cannot mention everyone, but a few are very special and

must be acknowledged for their support. First, I am indebted to my informants, the 14 people who so generously shared their views on how the development and decision process proceeded. Without your analyses, comments and wisdom it would not have been possible to write this thesis.

I am also indebted to Kaj Ringsberg, who was involved in this project even before it started in 1992, first as a consultant, networker and strategic advisor. When I left the project, we still kept in touch: Kaj joined me as a consultant and mentor in the transport purchasing project called EcoFreight at Perstorp. Finally, during recent years Kaj has been my associate supervisor, as he entered a new role as Adjunct Professor at the Division of Packaging Logistics in Lund. It has been a great pleasure, Kaj, to exchange ideas with you and share all the valuable experience that you have acquired within the fields of business, logistics and academic research.

Two other people to be mentioned are Sten Nordberg and Pelle Lundholm, nowadays happily retired from their management positions within the Perstorp Group. Both of you have been my best supporters and teachers. Sten and Pelle, I will never forget your commitment, enthusiasm and your sometimes controversial support to a non-engineer like me. Thanks Sten for believing in me and recommending me as a member of that waste research committee, where I met Gunilla. And Pelle, your visions concerning recycling of thermoplastics actually formed the strategic platform for the pilot test activities which laid the groundwork and provided the basis for the brave business decision made by the business area manager Wiking Henricsson to start the process of introducing a pool system in Sweden.

There is another person who must not be forgotten: Kent Gustavson, today at Schoeller Arca Systems, mentioned by several of my informants as the man who managed to keep the decision process alive over the years. He never gave up in his persistent support, especially of the second working group during 1996-1999. Kent, if every packaging sales manager had your qualities, all customers would be involved in stimulating and creative learning and change processes concerning material handling improvements and logistics development.

In terms of moral support and encouragement I must also mention a fellow PhD candidate in Bedford, England, David L.G. Smith and his supervisor Professor Leigh Sparks at Stirling University in Scotland. David and I started a discussion at the LRN conference dinner in Edinburgh 2001,

where I frankly suggested that we should write a book about fresh food retailing and packaging logistics. David and I managed to persuade our supervisors (which actually was much easier than we had anticipated), and now this vision will come true next spring when the book will be published. It has been a great inspiration, pleasure and honour to work with you, David and Leigh. Good luck David, I am looking forward to reading your thesis soon.

Christer, my beloved husband, you have left me so many Saturdays and Sundays during this process. I am so happy that you have always come back in the evenings, finding me either happy or frustrated depending on the results of the hours spent in front of my laptop. Without your patience with me this project would not have been accomplished. Now I am looking forward to getting back to our normal weekend routines – if we can remember what we used to do before all this started.

My dear daughters Anna-Karin and Ida, hopefully you will now better understand what this thesis project is about as you yourselves proceed in your academic studies. Hopefully I will have inspired you to follow suit within 15-20 years, when you will have gained enough work life experiences to be transformed into the scientific research framework. It is still my opinion that the most important research must be both empirically and theoretically based. The academy must interact even more closely with the surrounding society in order to develop new theories to help decision-makers find the proper paths to the sustainable society.

Månstorp, September 2005

Abstract

After several years of discussions, tests, investigations and additional tests, the suppliers and retailers within the Swedish business sector for food and commodities formed a jointly owned, non-profit company in 1997, which subsequently started its physical operations in 2000. This company, Svenska Retursystem AB (www.retursystem.se), is now responsible for introducing returnable transport packaging into the Swedish food supply chains. The product range includes a family of nestable and interstackable plastic trays and plastic pallets in two sizes. This pool system is unique, since it is the only open, business-wide and national pool system in operation in the world. Planning and implementing an open-loop, business-wide national pool system for transport packaging is a complex process. This research project focuses on the driving forces in the entire process, from vision to decision. During 1992-1999, a group of logistics specialists within the Swedish food supply chains took part in a development process that resulted in a great deal of learning. The process contained eight separate missions that are all described in this thesis. This development and decision process is an example of a process where there has been no clearly dominant or driving actor. Instead, suppliers and retailers have worked together in a process based on majority decisions, negotiation and consensus. The collection of data is based on semi-structured interviews with 14 informants. Documents from meetings complement these interviews and support the analyses. The theoretical platform for this research is based on change management in packaging development oriented towards the supply chain. The results obtained show the importance of establishing a common vision at an early stage, where a shared understanding forms a driving force for packaging development. Three "power tools", *information, resources* and *support* (Kanter, 1984), must be applied to avoid failure in change processes. One conclusion drawn in this research project is that an additional, fourth tool, *gaining acceptance,* is required in order to secure the participation of all supply chain actors in a packaging development process. Another conclusion is that all future development of packaging and logistics systems must be based on co-operation and an active dialogue among the actors along a supply chain. Supply chain transparency is an important driving force, enabling parties to see where costs can be cut and savings can be made. Study visits and pilot tests have been identified as the most efficient methods to acquire new knowledge about logistics development.

Keywords

Packaging logistics, multi-party packaging development, packaging pool, pool system, change management, supply chain learning, supply chain management

Sammanfattning

Syftet med denna licentiatavhandling är att beskriva och analysera en utvecklingsprocess från vision till beslut inom svensk dagligvaruhandel. Målet för denna utvecklingsprocess var att skapa ett nationellt, branschövergripande retursystem (poolsystem) för transportförpackningar (returlådor i olika storlekar) och lastpallar. Av avgränsningsorsaker behandlar denna avhandling enbart utvecklingsprocessen kring returlådorna. Avgränsningen i tid är åren 1992-1999, och omfattar de år som processen pågick från vision till beslut om inköp av lådor för att kunna starta det retursystem som idag drivs av Svenska Retursystem AB.
(www.retursystem.se/)

Forskningsresultaten bygger på de uppfattningar som 14 intervjupersoner bidragit med tillsammans med den skriftliga dokumentation som flera av intervjupersonerna generöst ställt till förfogande. Intervjupersonerna har alla varit helt eller delvis delaktiga i den utvecklings- och beslutsprocess som beskrivs i denna avhandling. De representerar de olika intressentgrupper som var aktiva i processen 1992-1999. Det måste också noteras att jag själv deltagit i de första två åren av processen och har därmed som forskare haft goda möjligheter att analysera och värdera det muntliga och skriftliga underlaget.

Bakgrunden till att denna process drogs igång kan beskrivas från flera utgångspunkter: en är den så kallade Brundtland-rapporten ”Vår gemensamma framtid”, publicerad 1987, som påtalade vikten av att skapa ett samhälle som förbrukar resurser utan att det äventyrar framtida generationers välstånd. I linje med denna rapport, och som följd av samhällsdebatten under 1980-talet, kom den tyska förpackningsförordningen, några år senare följd av den europeiska unionens förpackningsdirektiv. Parallellt utvecklades i början av 1990-talet den svenska förpackningsförordningen. Aktörerna inom svensk dagligvarusektor hade samtidigt med denna utveckling en pågående logistikutveckling som innebar att nya typer av lastpallar, bland annat en engångs halvpall i trä, snabbt introducerades på marknaden. Kvalitetsproblem med dessa träpallar var ett av skälen till dagligvarusektorns intresse för nya typer av retursystem. De svenska grönsaksodlarna var vid denna tid pådrivande för att förbättra sin konkurrenskraft inför det svenska inträdet i EU. Odlarna hade under

studieresor på kontinenten identifierat returlådor i poolsystem som ett intressant alternativ till engångslådor.

De faktorer som låg till grund vid starten av denna utvecklingsprocess var ekonomi, logistik, ergonomi och miljö. Ett första steg togs 1992-1994, då konsekvenserna inom dessa fyra områden blev utredda efter att några storskaliga systemtester hade genomförts sommaren och hösten 1993. Denna första del av utvecklingsprocessen genomfördes med bidrag från Nutek och Arbetsmiljöfonden.

Utvecklingsprocessen drevs i partssammansatta arbetsgrupper, den första arbetsgruppen verkade 1992-1994. Handeln och leverantörerna startade 1995 två nya arbetsgrupper, en för returlastpallar och en för returlådor. Arbetsgruppen för returlådor hade i uppdrag att driva utvecklingsprocessen fram till beslut om inköp av returlådor, vilket slutligen skedde 1999.

Analysen av intervjuerna och dokumentationen visar hur aktörerna försökt hitta samförståndslösningar och kompromisser baserade på förhandlingar och majoritetsbeslut. Jag har identifierat åtta uppdrag som de två arbetsgrupperna genomförde under åren 1992-1999:

1. Sälj in visionen om ett branschgemensamt retursystem för lastpallar och transportlådor till alla deltagarna i den första arbetsgruppen (1992).
2. Planera och genomför en storskalig systemtest (1992-1993).
3. Utforma ett administrativt upplägg för retursystemet (startades 1993, men senarelades till 1998, uppdrag 8).
4. Utforma en materialneutral funktionsstandard för halvpallar (800 x 600 mm), europeisk standard, (1993-1994).
5. Utveckla ett poolsystem för grönsaker på uppdrag av Jordbruksverket (1994).

Därefter stängdes den första arbetsgruppen och den andra arbetsgruppen tog vid i slutet av sommaren 1995 och genomförde de följande tre uppdragen:

6. Utveckla en kravspecifikation för en branschövergripande returlåda, följt av en upphandlingsprocess (1995-1998).
7. Genomför en utvärdering avseende miljöegenskaperna hos en returlåda i plast (1996-1997).

8. Utforma ett administrativt upplägg för retursystemet, skapa ett delägt bolag för retursystemet (1998-1999, fortsättning från uppdrag 3).

Forskningsarbetet har fokuserats på uppdrag 6, att beskriva och analysera hur arbetsgruppen successivt och iterativt tog fram en kravspecifikation för en branschövergripande returlåda och därefter genomförde upphandlingen av den.

De intervjuade konstaterar att det var en tidsödande utvecklingsprocess, många beskriver den som ”två steg framåt och ett steg tillbaka”. Analysen av intervjuerna och dokumentationen visar på svårigheterna och komplexiteten i att driva en utvecklingsprocess utmed en försörjningskedja. Alla aktörer hade egna intressen att bevaka, men skulle samtidigt lära sig att se den gemensamma nyttan i ett försörjningskedjeperspektiv. Stridande viljor kring viktiga detaljer i utformningen av returlådan tog lång tid att lösa med hjälp av nya tester, faktainsamling, enkäter osv. Ofta hamnade kraven från ’frukt och grönt’ i konflikt med de krav som ’kött och chark’ ansåg sig tvungna att ställa. Konflikterna beskrivna i denna avhandling handlar om val av optimala lådhöjder, handtagens utformning, färgen på returlådorna samt om det skulle vara en tät eller en ventilerad låda (ventilerad = perforerade sidor och botten).

Det måste poängteras att de frågor som tog upp mest tid och kraft (detaljutformningen av returlådorna) aldrig handlade om själva retursystemet. Tidigt i processen var alla aktörer eniga om utformningen av retursystemet; en öppen pool med transparent ekonomi, där alla, stora som små, aktörer kan vara medlemmar. Lådor och pallar skulle följas av en pant stor nog att förebygga stölder och förhindra otillåten användning av lådor och pallar. Behovet av tvättning av använda returlådor och returpallar i särskilda tvättanläggningar hade identifierats i samband med studiebesök utomlands. Aktörerna var också eniga om att retursystemet skulle ägas och drivas av aktörerna själva i ett gemensamt bolag. Någon tredjepartslösning, att till exempel ett större transportföretag skulle äga och driva retursystemet, var aldrig aktuellt.

Redan 1993 lade den första arbetsgruppen fast riktlinjerna för utformningen av returlådan. En viktig designaspekt är hur man minimerar utrymmesbehovet för tomma lådor i returtransporten. Tomma lådor måste

kunna komprimeras för att spara plats. Efter en genomgång av de tekniska lösningar som då fanns på marknaden (fällbara lådor, bygellådor och 180º-lådor) enades aktörerna om att 180º-lådan var den utformning som var bäst från hanterings-, kvalitets- och hygiensynpunkt. (180º-lådan staplar på ena hållet, och när den vrids 180º travar man den med cirka 50 % komprimering, det vill säga två lådor ryms då på samma höjd som en fylld, staplad låda. Komprimeringen kan även uttryckas som 1:2 i detta fall.)

Utvecklingen av kravspecifikationen 1995-1998 visar hur den partssammansatta arbetsgruppen gradvis lär sig att gå från tekniska detaljspecifikationer till att ge lådtillverkarna i uppdrag att möta specifika funktionskrav som ska uppfyllas i standardiserade testprocedurer.

Arbetet med att få fram en slutlig kravspecifikation var nästan klart våren 1997, då någon eller några aktörer inom dagligvaruhandeln hittade en helt ny typ av returlåda med avsevärt förbättrade egenskaper beträffande komprimeringen av tomma lådor. Det var en bygellåda, en konstruktionsprincip som dömts ut redan 1993 på grund av kvalitets-problem och svårigheter att rengöra sådana lådor. Lådan, som var den brittiska dagligvarukedjan Tescos andra generations returlåda, fick stort genomslag hos representanterna för den svenska dagligvaruhandeln, medan stora aktörer inom dagligvaruleverantörerna ansåg att detta var fel väg att gå. Komprimeringsegenskaperna, beskrivna som 1:4, att fyra tomma lådor tar upp samma plats som en fylld låda, bedömdes av handelns representanter ha avgörande ekonomisk betydelse för transport- och lagringsbehoven vid distribution samt hantering i butik.

Efter många månaders intensiva diskussioner kunde parterna slutligen enas om att sommaren 1998 gå ut med en offertförfrågan på en bygellåda av den typ som Tesco utvecklat. Våren 1999 tog styrelsen för det nybildade returbolaget Svenska Retursystem AB beslut om att köpa in returlådor av Tesco's lådleverantör.

Den vetenskapliga analysen av denna utvecklingsprocess utgår från teorier inom supply chain management och förpackningslogistik kombinerade med de teorier om förändringsarbete (change management) som Rosabeth Moss Kanter formulerade 1984. Definitionen av en försörjningskedja innehåller en beskrivning av att viktiga inslag är koordinering, integrering och samarbete mellan parter i försörjningskedjan. Teorierna inom förpackningslogistik pekar på vikten av att samtliga aktörer utmed en

försörjningskedja måste delta i utvecklingen av förpackningssystemen för att bästa möjliga effektivitet ska uppnås, både ekonomiskt och för den logistiska effektiviteten. Denna avhandling belyser hur förändringsarbete kan startas och drivas inom en försörjningskedja bestående av ett stort antal aktörer som måste samarbeta för att de önskade effekterna och resultaten ska erhållas.

Forskare inom supply chain management och logistik har ifrågasatt att mycket forskning hittills ägnats åt kvantitativa frågor, som svarar på *vad?*-frågor. Denna avhandling visar på vikten av att fortsatt forskning även måste kunna besvara mera kvalitativa *hur?*-; *varför?*-; *vem?*-; *var?*- och *när?*-frågor.

Att driva förändringsarbete inom förpackningslogistiken i en försörjningskedja är en komplex process som måste få ta tid. Samtidigt finns det exempel på liknande förändringsprocesser som kunnat drivas i ett högre tempo än den inom den svenska dagligvarusektorn. Två sådana exempel redovisas i denna avhandling, IKEA och Tesco. Skillnaden mellan dessa två, snabbare processer och den långsammare utvecklingsprocessen inom den svenska dagligvarusektorn är att både IKEA och Tesco utnyttjat sin roll som stor kund och därmed kunnat påskynda förpackningsutvecklingen. Men dessa två storkunder har inte gjort det på ett traditionellt diktatoriskt sätt. De har ansträngt sig för att skapa delaktighet, samsyn och samförstånd mellan aktörerna i de aktuella värdekedjorna. IKEA och Tesco har hjälpt sina leverantörer att förbättra effektiviteten och lönsamheten i den egna verksamheten. Båda exemplen visar på betydelsen att driva förändringsarbetet som en lärprocess, där alla inblandade lär sig mera om de totala förutsättningarna för att förbättra förpackningarna och logistiken. IKEAs och Tescos sätt att driva förändringsarbete har jag här kallat *participative dictatorship*, på svenska ungefär 'delaktig diktatur'.

I den svenska processen inom dagligvarusektorn fanns det ingen klart dominerande kund, i alla fall ingen som uttalat ville ta på sig den rollen. Därmed kunde processen inte drivas som hos Tesco eller hos IKEA. Att komma fram till majoritetsbaserade konsensubeslut tar mera tid. Enligt Rosabeth Moss Kanters teorier om förändringsarbete krävs det tre *'power tools',* på svenska *'maktverktyg'* som grundförutsättning för att kunna driva framgångsrikt förändringsarbete. Dessa tre verktyg är *information, resurser* och *support/stöd*. Den utvecklingsprocess som jag beskriver i denna avhandling försenades på grund av bristande information och kunskap, bristande resurser och otillräckligt stöd från aktörernas uppdragsgivare.

Trots dessa brister var visionen så stark och så många var så övertygade om genomförbarheten av ett branschövergripande retursystem så att viljan att nå målet övervann svårigheterna på vägen mot förverkligandet av visionen.

En slutsats blir därför att ett fjärde 'maktverktyg' behöver läggas till de tre som Rosabeth Moss Kanter introducerat. Det fjärde, *'gaining acceptance'* på svenska *'vinna acceptans'* krävs för att skapa en vilja att vara delaktig i visionen, att våga ge sig ut på oprövade vägar och vara övertygad om att det kommer att leda till förbättringar. Genom att ge alla inblandade möjlighet att delta i det lärande som en förpackningsutveckling innebär ökar förutsättningarna för att de fyra maktverktygen ska fungera som pådrivande faktorer i ett framgångsrikt förändringsarbete.

De tre maktverktygen information, resurser och support/stöd fungerade inte fullt ut i utvecklingsprocessen inom den svenska dagligvarusektorn, men tack vare det fjärde verktyget, att man lyckades vinna acceptans från tillräckligt många, överlevde processen trots alla svårigheter och man kunde gå från vision till beslut. Utan några få starka individer med förmågan att kommunicera visionen hade detta aldrig kunnat hända.

Table of Contents

1 INTRODUCTION AND BACKGROUND

This first chapter provides the background to this thesis, containing descriptions of the purpose, objectives and relevance of this project. The research questions will also be presented. Readers with a good knowledge of the situation in Sweden may skip the last part of this chapter, from 1.5.1, as those text sections provide basic market information concerning the Swedish food supply chain, which may benefit non-Swedish readers.

1.1 The purpose and relevance of this research

All actors involved throughout a supply chain[1] must be capable of collaborating in order to achieve an improvement of the logistics efficiency by identifying the root causes of a problem and solving it. In order to accomplish this, the actors must be provided with the proper knowledge, skill, information, support and power to plan and implement changes in e.g. product design, packaging design, distribution concepts, and procurement of transports.

This means that supply chain development and improvement must be based on a multi-party perspective in order to reap the full improvement potential. (Cooper and Ellram, 1990).

The overall objective for a supply chain is to create a cost-efficient as well as a quality-focused supply chain. Christopher (1994) describes how successful supply chains that have reached this objective have *"…achieved the twin peaks of excellence: They have gained both cost leadership and service leadership."*

The primary purpose of this research project is to provide an explanatory description of a multi-party collaboration from vision to decision within the

[1] For the definition of "supply chain", see Chapter Two, Frame of Reference

Swedish food supply chains that resulted in a nation-wide, open pool system for returnable transport trays[2].

The second purpose is to identify the factors affecting multi-party collaboration in the development process described in this thesis.

This research project has its main relevance in describing the multi-party cooperation process combined with the vision-driven entrepreneurial efforts, which eventually resulted in the realisation of the vision: a nation-wide, business-wide open pool system for transport packaging in the Swedish food supply chain.

The relevance of this research also lies in its qualitative approach. This approach enabled me to perform a deeper analysis of the attitudes towards change management in a multi-party process as it was described by the operative logisticians that were interviewed. In logistics research there is a need for applying different theories from other disciplines (Stock, 1997).

The academic contribution of this research project is to show how logisticians, often located in middle management positions, deal with change management and development challenges – including new packaging and distribution solutions – especially in situations where there are no large-scale references available to look at, learn from or draw conclusions from. This research describes how visionary entrepreneurs can become driving forces that are strong enough to overcome hesitation or reluctance due to lack of experience from other similar logistics solutions.

1.2 Boundaries and delimitations of research

This thesis provides an exploratory description of the development and decision process that took place during the years 1992-1999. It encompasses the years during which this multi-party process went from vision to decision. In 2000, the pool system was opened, and since then the returnable trays and pallets have been successively – and successfully – introduced into the Swedish food supply chain. However, the implementation stage is another story, worth exploring in some other

[2] For the definition of "pool system" and "returnable tray", see Attachment One, A Typology for Returnable Transport Packaging

context. (Nevertheless, the implementation stage must be considered a vital part of a change management process!)

During the development and decision process, the issue of being able to make comparisons between different packaging systems was highlighted several times. This issue is not dealt with in this thesis, nor are the attitudes of the packaging industry toward the upcoming change.

It can be concluded that this thesis focuses on the qualitative aspects of the development and decision process, not on the quantitative aspects concerning e.g. logistics efficiency evaluations, pool system total cost analysis or life-cycle assessments. One of the reasons for the exclusion of quantitative aspects is that they were not given top priority attention in the process to be described in this thesis.

1.3 Research questions

The overall research question is:

”How are strategies for change management and decision-making established within multi-party based packaging logistics development?”

In addition to this, five underlying questions have been formulated:

- How are the processes for product development and for the formulation of a specification of requirements driven in this type of multi-party cooperation?
- How are demands concerning system economy, technical aspects, ergonomics and environmental requirements dealt with in this type of development process? What parameters dominated the discussion and decision-making?
- How are shared views and a willingness to cooperate created and established within a group of actors who are normally competitors or dependent on each other in supplier-customer relationships?
- Why do certain actors step on the accelerator while others push the brake when confronted with demands for new systems? How can a development pace be established that is acceptable to all participants, without losing speed?
- What role do individual efforts play in terms of an entrepreneurial approach in driving the development process?

1.4 Research objectives

The objective of this research is to make a contribution to the research field of packaging logistics, as this single case study provides a description and an analysis of a large-scale, multi-party development and decision process within a food supply chain on a business sector wide, national level.

1.5 Background to research project

An increased understanding of the non-sustainable systems for waste handling was a driving force in the initial phases of this process. This understanding was generated by a number of international events that took place in the 1980s.

In 1987, the World Commission on Environment and Development (WCED, 1997), a body within the United Nations headed by the former Norwegian Prime Minister Gro Harlem Brundtland, published its report "Our Common Future". The conclusions in the report were widely spread in society, as the report formed an important milestone in the process of establishing an understanding of the global problems caused by the overconsumption of natural resources in parts of the world, while a large share of the global population has no access to this prosperity and good life. The report provides a definition of sustainable development, pointing at the importance of applying a generation perspective in order to guarantee our grandchildren the same standard of living as we are enjoying, and at the fact that our present activities must not endanger the prosperity of future generations.

This report, often called the "Brundtland report" (WCED, 1997) formed a starting point for a number of efforts throughout the world with the aim to improve global quality of life without endangering the fundamentals for long-term survival. The next important step in this process was taken at the environmental conference held in Rio de Janeiro in 1992, where the Agenda 21 document was agreed upon. This document focuses on three basic aspects of sustainable development, as ecology, social issues and the economy must be in balance with each other to facilitate the efforts of creating a sustainable society.

In the beginning of the 1990s, the European and national legislation on recycling schemes for packaging were announced (Packaging and Packaging Waste Directive, 94/62/EG, 1994 OT L 365; Swedish national ordinance:

SFS 1997:185, Ordinance on Producers' Liability for Packaging). It must be emphasized that the field of packaging was the first to be put in focus on the legislative level formed by the European Union. (Further on, similar legislation has been introduced for cars and electrical devices, for example.) This upcoming legislation caused much concern, both in the packaging industry and at all companies using any kind of packaging; the closer to the consumer, the more intensive was the energy spent on design efforts in order to reduce material use and/or facilitate the best possible recovery system for used packaging.

One typical example of this growing environmental concern can be found in the autumn of 1992, when a high-level Swedish politician, Lennart Daléus, expressed his fear for the environmental effects of chlorine in PVC at a recycling conference, suggesting a general ban on that type of plastic. At the same time he launched the concept of "reusable and returnable packaging" in order to reduce the environmental load. (Source: Sydsvenska Dagbladet, September 24, 1992)

At this stage, there were no written specifications of technical and functional requirements on transport packaging within the Swedish food supply chains. There was some concern about loading efficiency, hygiene, workplace safety and ergonomically designed packaging. (Source: interviews in this research project, 2002.)

One business-internal factor that is brought up by the informants in this thesis as a background to this process is the problem of one-way wooden pallets, half-size (800x600 mm). The increasing use of these low-price, low-quality pallets formed a trigger for the business sector to look for a better solution.

1.5.1 Figures on food consumption in Sweden

Before getting on, let us have a look at the food and grocery supply chain in Sweden. The following presentation may provide background information of particular interest to those readers who are not familiar with the business conditions and the demographic and geographical situation in Sweden.

In 2002, the total turnover for the Swedish food and commodity sector was SEK 157,650 m (approx. EUR 17,520 m) according to market statistics from the consultancy AC Nielsen AB (2003).

The Swedish Environmental Protection Agency has published a number of reports on the Swedish food supply chain. One of the reports provides interesting information concerning statistics on food consumption during the 1990s. (Carlsson-Kanyama and Engström, 2003). This report states that each Swedish citizen consumed about 800 kg of food and drinks in 2000. This is an increase by almost 100 kg compared to the consumption statistics for 1970. An estimation shows that almost 40 per cent of the food and drink consumed is imported. About 80 per cent of the imported food comes from other European countries. As in many other industrialised western countries, consumers tend to cook less at home and eat more ready-cooked meals, including an increasing volume of what is defined as "junk food".

The per capita consumption in 1990 and 2000 is presented in Table 1, where the distribution over the different product groups and the patterns of consumption changes between 1990 and 2000 can be observed:

Product group	*1990*	*2000*
Bread and cereals	83.6	93.9
Meat and processed meat	53.1	71.1
Fish, shellfish and molluscs	15.9	9.1*
Milk and fermented milk	154.7	138.6
Cream, cheese and eggs	36.5	37.1
Fats	19.0	15.8
Vegetables	54.9	64.6
Fruits and berries	90.4	95.3
Potatoes and potato products	67.1	55.9
Sugar, treacle, honey	15.1	11.0
Coffee, tea, cocoa, spices, salt	13.7	13.7
Sweets, chocolates, ice-cream	30.4	36.0
Soft drinks	49.8	82.2
Mineral water	9.7	8.4

Beer	41.2	31.7
Wine and spirits	35.6	44.4
TOTAL	**770.7**	**809.2**

Table 1.1: Food and drink consumption in Sweden, kg per capita.

(Source: Kanyama-Carlsson and Engström, 2003, based on statistics from the Swedish Board of Agriculture on direct consumption, defined as food deliveries to private households and large food preparing units.)

**the figure for 2000 concerning fish, shellfish and molluscs is not fully reliable, since the data collection for fresh fish has been cancelled as from 2000 due to severe uncertainty concerning the quality of the data collected.*

1.5.2 The suppliers: the agricultural sector and the food industry

The Federation of Swedish Farmers, LRF, is an interest and business organisation for all those who own or work farm and forest land, and for their jointly owned companies in the Swedish agricultural co-operative movement (www.lrf.se).

With about 150,000 members, LRF's mission is to create the conditions required for sustainable and competitive companies and to develop favourable conditions for life and enterprise in rural areas.

Operations are conducted in corporate form. LRF owns or part-owns a number of food processing subsidiaries with a total turnover of around SEK 70 billion.

LRF's food companies base their production on different types of raw materials delivered by LRF members, in terms of crops and livestock. The Swedish dairy industry is totally dominated by LRF's dairy companies, where Arla Foods is the largest and most well-known product brand. Meat processing is another area where LRF's companies are dominating as suppliers to the Swedish food retailers. Cereals and bread production, eggs, poultry, rape-seed oil and starch are other areas where LRF companies are well established suppliers with strong brands.

Most of the food producers owned or part-owned by LRF are also members of DLF, Dagligvaruleverantörers Förbund (Grocery Manufacturers of Sweden, www.dlf.se). DLF is a non-profit trade organisation for the brand manufacturers in the Swedish food retail and food service markets. It has a dominant position, and is well respected for its competence and lobbying capacity towards retailers, politicians and government authorities. However, DLF is not as well known as LRF to the Swedish public.

DLF has 200 members and is a member of AIM, the European Brands Association.

1.5.3 The level of market concentration in grocery retailing

Grocery retailing in Sweden is highly concentrated with just three retailers, ICA, COOP and Axfood, possessing more than 70 per cent of the total market share between them. (AC Nielsen AB, 2003). Consequently, these three retailers dominate the market, and by implication we would expect them to dictate the key decisions that have an impact on their business. Their ability to do so is, however, influenced by their own perception of their role in the market place and by the importance of the content of the decision itself.

The biggest grocery retailer is ICA, now half-owned by Dutch Royal Ahold. The other owners are a large group of ICA retailers who still keep the remaining 50 % of the company. ICA holds a market share of 35.7 per cent, making it the dominant retailer in Sweden. Next is COOP with 18.8 per cent, closely followed by Axfood, a privately owned, public quoted company with 18.3 per cent. There is one other retailer, Bergendahls, which is family-owned and growing fast, with a mere 1.7 per cent share. (AC Nielsen, 2003). During 2004, low-price chains such as German Lidl and Danish Netto have also entered the Swedish grocery retailing market.

COOP is part of a merger in 2001 between the Scandinavian cooperative retailers in Sweden, Norway and Denmark, but not Finland. This made the enlarged company the largest grocery retailer in the Scandinavian region.

1.5.4 The geography of Sweden

Of a total Swedish population of nine million people, around seven million live in built-up areas, two million live in rural areas in proximity (max. 45 minutes' car drive) to built-up areas and 200,000 live in sparsely populated

areas. The largest sparsely populated areas are mainly to be found in the inland regions of northern Sweden. (Swedish National Rural Development Agency, website www.glesbygdsverket.se , July 25, 2005)

The south of Sweden contains eight million of the total population of nine million. They are concentrated in the urban and surrounding areas of three cities: Stockholm, Gothenburg and Malmö.

The north of Sweden, as a consequence, is sparsely populated. This issue has been accentuated over the last few decades by the younger generations who have chosen to migrate from the north to the south in search of work and better living conditions.

It is much easier – and costs less – to serve the consumers in the south with daily deliveries of fresh food and groceries. In the north, although it is more expensive to provide frequent deliveries to the retail outlets, this is justified by the social obligation of serving the scattered population. This obligation is reinforced by government policy (Swedish National Rural Development Agency, 2005), which has the task of fulfilling the governmental policy, saying that all parts of the country must have well functioning and sustainable local labour market regions with a good service level. (Source: Government Policy; Area Regional Development Policy, 2005, www.regeringen.se)

The government policy includes activities to counteract the migration from north to south by creating public sector jobs and investing in higher education in the north, especially with the universities of Umeå and Luleå.

This geographical dilemma in Sweden is sometimes presented as a justification for not making the innovations and changes that are needed to provide more cost-efficient distribution in the south of the country. Consequently it is important to separate out the criteria of pure logistics efficiency from the additional social benefit objectives when deciding on supply chain strategies for Sweden.

It must be mentioned that during the time period of this research project, the dominant retailer ICA was investing considerably in new logistics set-ups in order to improve distribution efficiency and cut costs. One of these logistics projects, consolidation hubs on regional levels, was a development process that influenced the development process covered in this project.

1.5.5 The cultural tradition of co-operation

In Sweden, it is a cultural tradition that everyone, including business competitors, is willing to cooperate with each other whenever there is a topic that involves the need to agree on a common standard of design or operation.

Since the 1960s, the grocery retailers have made concerted efforts to rationalise their distribution and handling methods. Their logistics operators, although they remain competitors, are in the habit of staying in contact with each other on an informal basis. They resolve many of their issues by coordinating their ideas and resources. For example, during the 1970s and the 1980s, the grocery retail sector set up a variety of working groups to decide on policy on such matters as modular sizes of pallets, standard sizes for roll containers, standards for shelf dimensions as well as plastic beer crate specifications. (Source: Interviews in this research project.)

2 FRAME OF REFERENCE

In this chapter, the definitions, theories and models concerning the research fields included in this thesis are described. The purpose of a Frame of Reference is to show that the researcher has a good general knowledge of the theoretical framework within the research fields of this thesis.

Finally an attempt is made to identify what knowledge is missing, in order to fulfil the research ethics requiring that researchers must consider both what they know and what they do not know.

2.1 Fields of research

- Supply chain management and logistics
- Packaging logistics and pool systems for transport packaging
- Supply chain management within food retailing
- Product development
- Change management

Five research fields form the platform for this thesis. Supply chain management and logistics is the basic discipline of study, in which packaging logistics including pool systems for transport packaging in the food sector is the business focus of study. The two main theoretical areas of study are product development and change management.

2.2 Supply chain management and logistics

2.2.1 Supply chain management

Among several definitions of 'supply chain management', the following given by the Council of Supply Chain Management Professionals, CSCMP, www.cscmp.org (formerly known as the Council of Logistics Management, CLM) has been selected, as it describes the importance of collaboration and communication between the firms involved in a supply chain (my underlining):

"*Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies."*

The parts of the definition that have been underlined are important aspects as driving forces in the case study described in this thesis. CSCMP has also provided a definition of the boundaries and relationships of supply chain management, where it is stated that:

"Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. (……), and it drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology."

At this point, it must be noted that there has been some discussion among logistics researchers concerning the proper interpretation of 'supply chain management'. Cooper and Ellram (1990) defined supply 'chain management' as an "integrative philosophy to manage the total flow of a distribution channel from the supplier to the ultimate user." This definition has been questioned by Christopher (1998), who argues that, instead of managing flows, supply chain management must be considered a way to manage a number of networks. He argues that normally more than one supplier and more than one customer and end-consumer are involved in a supply chain. Furthermore, Christopher argues that the supply chain should rather be called a 'demand chain' since it must be considered to be market-driven.

Behind the discussion of how to define the term 'supply chain management' lies the well-established theory formed by Porter (1985) on how to create competitive advantages by adding value throughout all the steps, from raw material to finished consumer product and/or service.

2.2.2 Logistics

Logistics is a large field of activity, having been defined in several stages over the years, as increasing empirical knowledge has contributed to the theory-building.

It is important to point out that logistics and the concept of 'supply chain management' are not the same thing. In 2002, the Council of Logistics Management, CLM, now the Council of Supply Chain Management Professionals, CSCMP, formulated a revised definition of logistics, where the relation to 'supply chain management' is sorted out (my underlining shows CSCMP's position):

"Logistics management is <u>that part of the supply chain process</u> 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. (……)".

Larson and Halldórsson (2004) point at four perspectives on the relations between logistics and supply chain management:

- the traditionalist perspective, where supply chain management is a field within logistics
- the re-labelling perspective, where 'supply chain management' is the new name for 'logistics'
- the unionist perspective, where supply chain management is the large field, including a smaller field of logistics
- the intersectionist perspective, where supply chain management and logistics are equally large fields of research, although they overlap each other somewhat.

From my point of view, with respect to the perspective adopted in this thesis, the *unionist perspective* seems to be the most appropriate here, since supply chain management also involves other parts than purely logistics in order to create a business system that satisfies the customer's demands and expectations. This position is also in line with the CSCMP definition of 'logistics' and its relation to the supply chain process.

2.3 Packaging logistics and pool systems for transport packaging

Packaging logistics is a novel research field with a limited number of researchers in Europe and North America (e. g. Pfohl, 1990; Twede, 1992; Johnsson, 1998; Jönson, 2000). In 2004, Mazen Saghir presented his doctoral dissertation, *"A platform for Packaging Logistics Development – a systems approach"*, where he concludes that this is an area that is in need of "substantial theoretical building". Among logistics researchers the dominating assumption is still that packaging is a part of logistics, or even a part of warehousing activities (as in a UK handbook on logistics by Waters, 2003). Saghir advocates more multi-disciplinary approaches to show the impact of packaging on many more aspects throughout the supply chain than just logistics. He argues that a better understanding of how packaging influences marketing, production, sustainable development and environmental issues etc. must be established in order to reap the efficiency and effectiveness potentials that can be obtained when applying a systems approach to packaging logistics.

2.3.1 Packaging and logistics

In his licentiate thesis, Saghir (2002) concludes that it is important to start to define *'packaging'* and *'logistics'* as two separate entities, followed by a combined definition of the two aspects. One definition of 'packaging' is suggested by Saghir, as he elaborates on two packaging definitions, the first one described in three statements by Paine and Paine (1983):

- *"Packaging is a coordinated system of preparing goods for transport, distribution, storage, retailing and end-use.*
- *Packaging is a means of ensuring safe delivery to the ultimate consumer in sound condition at minimum cost.*
- *Packaging is a techno-economic function aimed at minimising costs of delivery while maximising sales (and hence profits)."*
-

The second definition of 'packaging' is provided by Bjärnemo, Johnsson and Jönson (2000):

"Packaging is a coordinated system of preparing goods for safe, efficient and effective handling, transport, distribution, storage, retailing, consumption and

recovery, reuse or disposal combined with maximising consumer value, sales and hence profit."

It can be noted that between the first definition from 1983 and the second, formulated in 2000, the issue of how to deal with the increasing volumes of packaging waste has been introduced. This also shows the change in perspective, from a linear way of thinking *("cradle to grave"*) in the early 1980s to a cyclic perspective, where the total life-cycle of the packaging material is considered. For this reason end-use beyond the end-consumer is included in the second definition written in 2000. This is a result of the European Directive on Packaging and Packaging Waste (1994), preceded or followed by national legislation, e. g. the Packaging Covenant in Holland (1991) and the Swedish directive on producer's responsibility for packaging (1997).

The words *"recovery, reuse or disposal"* that are included in the second definition point at this new perspective. It also opens for different types of packaging solutions. The producer has to plan for which type of packaging is the best solution there and then, depending on legislation, geographical conditions, customer and end-consumer convenience and total cost calculations.

In his licentiate thesis Saghir (2002) concludes that: "Logistics plan, implement and control, while Packaging contains, protects and preserves, promotes, sells, informs and is a source of profit." Saghir's definition of packaging logistics shows the close interaction between the two fields:

"The process of planning, implementing and controlling the coordinated packaging system of preparing goods for safe, efficient and effective handling, transport, distribution, storage, retailing, consumption and recovery, reuse or disposal and related information combined with maximizing consumer value, sales and hence profit."

2.3.2 Pool systems for returnable transport packaging

Pool systems for returnable transport packaging are a sub-area within packaging logistics. Saghir's (2002, 2004) conclusion that there is only a limited amount of theory development in progress within packaging logistics can be applied to this research field as well. (A typology for returnable transport packaging is provided in Attachment One.)

A literature review shows that not so many studies have been made in the fields of returnable transport packaging, packaging pools, the development process of such pools and how they are managed. Diana Twede has published a number of papers arguing for the advantages of returnable packaging from logistics and financial points of view (1992, 1999a, 1999b; co-author in Mollenkopf et al., 2005). Kroon and Vrijens (1995) point at the environmental implications and present a quantitative model for the evaluation of pool systems.

Kroon and Vrijens (1995) refer to Lützebauer (1993), who describes three types of pool systems. The first type of pool system is a transfer system where the sender owns his own need of returnable transport packaging and exchange one-by-one with its suppliers and customers. The second type of pool system is a depot system where an agency owns the packaging. The agency has two ways of operating: either a book system where the senders continuously provide the agency with accurate data on the location of the packaging, or a deposit system where a deposit follows the packaging all the way until the agency pays back the deposit when empty packaging is returned. The third option is a pool system without any return logistics, where the sender rents the packaging from an agency and takes full responsibility for all administration, handling, cleaning, maintenance etc. until surplus or worn-out packaging is sent back to the agency by the sender.

Stahre (1996) provides a comprehensive description and analysis of the operational logistics prerequisites for different pool systems and gives explanations of the arguments for certain business sectors to choose returnable transport packaging. Koehurst et al. (1999) describe the process of developing a pool system but do not include a business-wide, open-loop packaging pool. After a multi-case study, Kärkkäinen et al. (2004) conclude that there is a need for more research concerning the updating of management theories on operational packaging pool systems.

The results of this thesis will hopefully help other researchers to make new theoretical contributions concerning multi-party managed pool systems for transport packaging.

2.4 Supply chain management and logistics within food retailing

'Retailing' is traditionally defined as the sale of articles, either individually or in small numbers, directly to the consumer (Sparks, 1998). This may sound easy when expressed in this way. However, it encompasses a complex set of processes, relationships and professional skill that are either experience-based or based on academic knowledge.

It can be concluded that during the recent three decades, tremendous changes within food retailing have resulted in a number of world-leading supply chains, providing large numbers of consumers with a food supply of an abundance, variety and quality unsurpassed in history (Sparks, 1998).

This section will briefly describe the present major trends and theories in food retailing. The basis for the facts and theories presented here is collected from research performed in the United Kingdom. The development within food retailing is in the forefront there, forming the dominating benchmark for most other European food supply chains.

The distribution of food includes a number of sub-groups, which require special handling. Fresh, frozen, perishable and non-perishable, processed and unprocessed food are common classifications (Stock, 2004). In certain cases, different food groups must be kept separated during distribution in order to meet quality and safety regulations. Temperature controlled distribution systems are becoming increasingly important in terms of meeting consumer demands on food safety as well as providing retailers with fresh products with longer shelf-life (Smith and Sparks, 2004).

Nowadays the points of sales are not only the traditional grocery stores or supermarkets. An increasing number of other types of food outlets can be described: vending machines, farmers' markets, the internet, mail order, gasoline service stations, sporting events, cinemas etc. (Stock, 2004).

2.4.1 Urbanisation and demographics influencing the food supply chain management

During the three recent decades, there has been a clear trend towards large-scale retailing, resulting in the development of very large stores located outside of the city centres, easily accessible by providing free parking for the consumers' cars. This trend has transformed our perception of food and grocery retailing to a considerable degree. (Sparks, 2000).

One of the key themes that underlies the discussion is that if there has been a transformation at the retail shop end of the chain, then there has to be a transformation in supply systems as well (Sparks, 1998).

In addition, the demographical changes in the western industrialised world also have an impact on the development of the food supply chain management. Stock (2004) describes the changes within socio-economic patterns, such as an increasing number of single parent households, multiple income families with less time for home-cooking, the eating-away-from-home habits etc. As for the socio-economic situation in Sweden, it can be added that the increasing number of elderly still living at home will add to the complexity o providing the proper food supply chain to satisfy consumer needs.

2.4.2 Common forms of business organisations within food retailing

Smith and Sparks (2006) identify the following four most common forms of business organisation for food retailing:

1. Independent traders, e.g. local village shops
2. Corporate or multiple retailers, e.g. ICA, Ahold, Tesco
3. Co-operative chains, e.g. Coop Norden
4. Contractual or franchise chains, e.g. Spar

Corporate retailers have become the dominant commercial form in many countries. Their power is due to the cost and efficiency advantages of operating larger businesses under central control. The role and function of store management in a chain organisation have consequently become more

crucial over time, even though the boundaries of central versus local control remain flexible and variable amongst companies.

2.4.3 Efficient logistics creating competitive advantage

Smith and Sparks (2004) conclude that *"elements of logistics are remarkably expensive, if not controlled effectively. Holding stock or inventory in warehouses just in case it is needed is a highly costly activity. The stock itself is expensive and might not sell or could become obsolete, or in the case of food,"go off". Warehouses generally are expensive to build and maintain as well as operate. Vehicles to transport goods between warehouses and stores are major costs, both in terms of capital and running costs, with drivers' wages and ever higher fuel costs. There is thus an imperative to making sure that logistics is carried out effectively and efficiently."*

For many retailers in the UK, being in retailing is sufficient, and logistics systems are often out-sourced to providers of logistics services. In many cases, their specialist handling skills are essential to the food supply systems. If operating properly, a good logistics system can both reduce costs and improve service, providing a competitive advantage for the retailer.

Today, retailers are, or are gradually becoming, the active controllers of product supply in reaction to known customer demands. They control, organise and manage the supply chain from production to consumption. This is the essence of the retail logistics transformation that has taken place. It can be concluded that in the UK, retailers are the *channel captains* (see section 2.6.3 for a definition) and set the pace in logistics.

McKinnon (1996) has reviewed and summarised the key components of this logistics transformation. He identified six trends, all of which are closely related and mutually reinforcing:

1. *Increased retailer control over secondary distribution (i.e. warehouse to shop) by channelling an increasing proportion of their supplies through distribution centres (DCs). British retailers exert much tighter control over the supply chain than their counterparts in most other countries. Their logistical operations are heavily dependent on information technology (IT), particularly the large integrated stock replenishment systems that control the movement and storage of an enormous number of separate products.*

2. *Reduced inventory and generally improved efficiency through the development of 'composite distribution' (the distribution of mixed temperature items through the same distribution centre and on the same vehicle) and centralisation in specialist warehouses of slower moving stock.*
3. *Adoption of 'Quick Response' (QR) type approaches with the aim of cutting inventory levels and improving speed of product flow. This has involved reducing order lead-time and moving to a more frequent delivery of smaller consignments both internally (between DC and shop) and on external links with suppliers. QR was made possible by the development of EDI (Electronic Data Interchange) and EPOS (Electronic Point of Sale), the latter driving the 'Sales Based Ordering' (SBO) systems that most of the larger retailers have installed. Sharing such data with key suppliers further integrates production with the supply function. Major British retailers have been faster to adopt these technologies than their counterparts in other European countries.*
4. *Rationalisation of primary distribution (i.e. factory to warehouse). Partly as a result of QR pressures and partly as a result of intensifying competition, retailers have extended their control upstream of the DC (i.e. from the DC to the manufacturer). In an effort to improve the utilisation of their logistical assets, many have integrated their secondary and primary distribution operations and run them as a single 'network system'. This reduces waste and improves efficiency.*
5. *Introduction of Supply Chain Management (SCM) and Efficient Consumer Response (ECR). Having improved the efficiency of their logistics operations, many retailers have closely collaborated with suppliers to maximise the efficiency of the retail supply chain as a whole. SCM and ECR (see later) provide a management framework within which retailer and suppliers can more effectively co-ordinate their activities.*
6. *Increased return flow of packaged material and handling equipment for recycling/re-use. Retailers have become much more heavily involved in this 'reverse logistics' operation. This trend has been reinforced by the introduction of the EU packaging directive.*

2.5 Product development theories

When you study the literature on product development from the engineering perspective, you find that most product development theories are formulated from a single-company, mainly a manufacturer's, perspective. What is defined as "concurrent engineering" (Ulrich and Eppinger, 2000), for example, aims at reducing the production time and cost before the product reaches the end-user.

The single-company perspective includes cross-functional aspects to describe how the process is initiated in the marketing and/or the R & D departments and ends up in the manufacturing department, and then the new products are dispatched to their customers.

In the three licentiate theses referred to below, observations and conclusions adhere to Ulrich and Eppinger's (2000) perspectives.

In her licentiate thesis, Bramklev (2004) describes a number of theories concerning product development and how packaging development should be further integrated into the product development process. She refers to Ulrich and Eppinger (2000), who describe a six-step model for a generic product development procedure. The six steps are *planning, concept development, system-level design, detail design, testing and refinement* and *production ramp-up*.

Klevås (2005) provides an in-house perspective on integrated packaging, logistics and product development based on experiences from a case study at IKEA. She concludes that *"A logistically-friendly packaged product enhances supply chain performance, and is an extremely important incentive for cost reductions."* The importance of the integration of packaging development into product development is pointed out: *"When there is little insight into supply chain demands, and packaging knowledge is poor, logistically-friendly products are unlikely to be developed."*

In his extensive literature study, Adamsson (2005) concludes that little research has been performed on cross-disciplinary product development processes. His research focuses on product development within mechatronics, a growing niche in the automotive industry involving mechanical, electrical and software engineers. The issue of creating well-functioning, multi-disciplinary, heterogeneous development teams is

focused; this is a field where he concludes that theory building is still sparse. Adamsson's research focus and conclusions can be applied here as theory concerning product development based on multi-party customer requirements. He points at the need for integration on three levels, top, team and individual, and finds that most practical integration takes place on the team and individual levels. The need for coordination activities, support from management, open communication and competence building suggested by him is something that can be applied in the analysis of the single-case study described in this thesis.

In Ulrich and Eppinger (2000) there is a definition of the 'product planning process' that applies to my research project: *"The product planning process takes place before a product development project is formally approved, before substantial resources are applied, and before the larger development team is formed."*

2.5.1 The project management aspects within product development

In the research project described in this thesis, a group of prospective customers along a supply chain had to agree on a specification of requirements based on consensus or majority-based decisions. In my literature studies, I had to look for research concerning product development theories based on multi-party customer needs to be met along a supply chain, involving a broad range of products with properties that are often counteractive in the formulation of a specification of the functional requirements for multi-product transport packaging.

Ulrich and Eppinger (2000) provide the following definitions of the purpose of project management in product development: *"Project management is the activity of planning and coordinating resources and tasks to achieve these goals."* Further on, they state that *"Project management activities occur during* project planning *and* project execution*."*

Project management during the project-planning phase deals with scheduling project tasks and deciding on resources for the project in its execution phase. Project schedules are a merger of tasks and timeline, combined with project milestones.

Project management also includes the responsibility for team staffing and organisation of the project team. Here Ulrich and Eppinger (2000) refer to Smith and Reinertsen (1991), as they have formulated seven criteria that determine the speed of the fulfilment of the project tasks:

1. There are 10 or fewer members of the team.
2. Members volunteer to serve on the team.
3. Members serve on the team from the time of concept development until product launch.
4. Members are assigned to the team full-time.
5. Members report directly to the team leader.
6. The key functions, including at least marketing, design, and manufacturing, are on the team.
7. Members are located within conversational distance of each other.

These seven criteria may be applicable to my research project, but it must be noted that these criteria are formed as guidance in the planning of single-company, cross-functional projects. It is probably more complicated to apply these criteria in project management tasks involving many firms along a supply chain.

Ulrich and Eppinger (2000) have identified coordination mechanisms as key parameters to be taken into careful consideration when managing a product development project. To accomplish the best possible results, the project management must make sure that team members can communicate informally with each other, that meetings are set and planned in such a way that problems can be identified and dealt with at an early stage, that the project team is provided with frequent status updates, that incentives can inspire team members to make a full effort and that project documentation is well planned and available to everybody involved.

2.5.2 Product and system development from an intra-organisational perspective

In a supply chain environment, it is not possible to fully apply the models that Ulrich and Eppinger (2000) recommend. Instead, you have to look at theories applied within industrial network theory and innovation. Hobday, Rush and Tidd (2000) conclude that present theories of system and product development focus on mass production. They claim that other theories

must be formulated for studying the product development processes of complex systems. In the context of this thesis, it must be noted that the proposed pool system can be identified as a complex system, while the packaging (trays and pallets) can be defined as mass production. However, the definition of the design features of the trays was a multi-party, intra-organisational process with closer similarities to the definitions made by Hobday, Rush and Tidd (2000) than to those made by Ulrich and Eppinger (2000).

Håkansson and Johansson (2001) point at the importance of knowledge and learning as well as firm cooperation and business relationships. Their studies show that business relationships constitute a firm's business base. Long-lasting relationships include joint development efforts in order to reduce total costs in production or in process development. They conclude that an initially weak interdependence between firms can develop into a mutual dependence that allows the partners involved in the relationship to coordinate in order to improve their mutual business. However, Håkansson and Johansson also conclude that such relationship building takes time and requires managerial support and effort to eventually result in strong strategic implications. (Their conclusions are in line with Kanter 1984, cf. 2. 6.2)

In their research on innovation in complex products and systems, Hobday, Rush and Tidd (2000) claim that *"…innovative non-functional organisational structures are required to coordinate production, particularly in the case of uncertain and changing user requirements."* They also point at the value of the knowledge and learning aspects in the production of complex products and/or systems. They point at the need for soft, intangible skills, such as leadership, communication and team building, in order to achieve a good performance (cf. Kanter, 1984, 2.6.2).

The type of complex products and systems development processes that Hobday, Rush and Tidd (2000) have studied displays similarities with the development and decision process described in this thesis. Hobday, Rush and Tidd (2000) describe how *"Users frequently change their requirements during production, leading to unclear goals, uncertainty in production and unpredictable, unquantifiable risks. Managers and engineers often have to proceed from one production stage to the next with incomplete information, relying on inputs from other suppliers who may be competitors in other multi-firm projects. Project management often involves negotiating between the*

competing interests, goals and cultures of the various organisations involved in the production."

2.5.3 Strategies for re-developing packaging systems

One case study (Jönson et al. 2005, Appended paper no Three) describes how a global retailer re-develops the packaging concept and the packaging logistics for a high-volume product. That is a development process that involves the retailer, the packaging supplier, the supplier of packaging machines, the manufacturer of the product in focus for a re-designed packaging logistics concept as well as the raw material suppliers to the manufacturer.

First, the old packaging concept was analysed in order to identify the weak points that needed re-developing. Subsequently, a new concept was designed, tested, adjusted and tested again at the pilot scale through the supply chain. After the evaluation of the pilot test and further adjustments, the new packaging logistics concept was successively introduced.

The close interaction between pilot tests, data collection and the formulation of specifications of requirements is one of the cornerstones of the case study presented in this thesis. System-level pilot tests and test packing of transport packaging and pallets provided valuable input, sometimes showing results contradictory to the preconceived positions and opinions of the members of the working group .

2.5.4 The Theory of Dominant Designers

Koehurst et al. (1999) describe how a large food retailer in Holland, Albert Heijn, together with a packaging developing and manufacturing company, Wavin, took the lead in the development process resulting in a new transport tray for fresh food to be used in Albert Heijn's supply chains. Koehurst et al. define these two actors as 'dominant designers'. By means of their commercial and technical competences combined with the dominant market position of Albert Heijn, they could force the other parties into accepting the packaging design solutions preferred by the two leading actors.

Smith and Sparks (2004) describes an almost similar case, where a large retailer, Tesco in the UK, forces the re-design process of a returnable transport tray. But in this case, the packaging supplier also has to accept

being pushed to meet the challenging requirements formulated by the dominant designer. (See Chapter Five, 5.3.1)

There is a clear connection between dominant designers and *channel captains*, who are described in the following section concerning change management theories (see 2.6.3).

In Utterback (1994) the dominant designer theory is described from the perspective of the innovation research discipline (e. g. Thomas Alva Edison and the light bulb). However, this approach is not fully applicable to the scope of my research project, since it is not based on a supply chain management and collaboration perspective.

2.6 Change management theories adapted to packaging logistics and supply chain management

Decision-making within a food supply chain is a complex process, where there are often several options to consider and many issues to negotiate. Change occurs, not only for a single company but also for other supply chain actors. Due to this difference between company and supply chain perspectives, the theories proposed by Kanter (1984) have been selected as the main theoretical platform for this thesis.

Change management based on theories concerning learning and systemic thinking are also considered here. Senge (1990) and Sarv (1997, 2003) provide theoretical platforms that are applied in this thesis.

2.6.1 Change management theories on company level

After analysing a large number of case studies, Kanter (1984) explains the drivers and barriers for change and also points to the significant basic aspects of how to plan and implement change processes. Kanter concludes that there are two types of organisational attitudes or company cultures that form the prerequisites for change processes, i.e. the *integrative* attitude and the *segmentalist* attitude. This is clearly adaptable to both a company and a supply chain perspective.

Kanter describes the *integrative company* as a company where employees have access to many types of useful information, collected from both internal and external sources. There is open communication and collaboration between departments, where decentralised decision-making

results in team-building, entrepreneurial spirit, less control and more focus on visions for the future. Problems are treated in a holistic perspective, where attention is paid to consequence analyses of different problem-solving actions. Top management encourages innovation and gives support to many change processes. Integrative companies are more proactive than segmentalist companies. An integrative organisation shows an openness towards the surrounding society, thereby being able to catch early signals of change in the market. Employees are expected to report early signs of change in the market to the management.

The segmentalist company is more hierarchical, conservative and traditional. Decisions are made only by a few managers on high levels. A fear of change seems to be prevalent, as problems are dealt with in a manner where focusing on details is more important than trying to get the full picture. "Walls" between departments restrict communication and cross-functional team-working. Innovation is, as Kanter describes it *"something given to the R&D department to take care of so no one else has to worry about it."* Control systems allow the management to keep a detailed check of the company's past and present operations, but this information is not shared with the workforce. Segmentalist companies with a stable market share, well-running operations and a high profitability are the most unlikely to support new ideas. Employees who try to point at emerging threats are considered as disloyal. Kanter concludes that this type of segmentalist company is the most vulnerable in terms of being able to manage a rapidly emerging major change in their market.

It is suggested by Kanter that change processes are more likely to be successful in integrative organisations than in segmentalist ones. But when a supply chain perspective is applied, the picture gets more complicated. How can change processes be managed when a supply chain consists of several actors who represent both types of organisations? This will be further discussed in Chapter Six (see 6.2.2).

2.6.2 Basic requirements for successful change processes

Kanter points out three basic requirements for successful change management. First, the availability of information; secondly, enough resources provided for the change project; and thirdly, support from top management, not only in terms of economic resources but also in terms of commitment to the vision and objectives of the change project. This can be

readily understood in the context of an individual business but is more difficult to envisage along a supply chain.

In a forthcoming book (Gustafsson, Jönson, Smith and Sparks, 2006) it is concluded that change processes introduced in a supply chain are more difficult to perform successfully due to the variety of organisations that are involved. A fourth basic requirement is therefore suggested: before succeeding in achieving support, much effort must be spent on *gaining acceptance* along the supply chain for the new visions and ideas (from both top management *and* the grass-roots levels in the companies involved).

2.6.3 The supply chain power issue – who is the channel captain?

Ideas about acceptance are inevitably bound up in questions of power. Who has the power in the supply chain? Is it one single dominant company, or an alliance of companies within the supply chain? This aspect is important and will be analysed more in-depth further on in this thesis. However, in this chapter some theoretical discussions will hopefully guide the reader through the case presentation.

Traditionally, manufacturers have been the drivers and power centres in terms of the packaging and logistics decision-making in a food supply chain. However, retailers have successively taken over that power position by using their access to primary consumer information concerning demand, both in terms of quantity and quality (Burt and Sparks, 2003).

Cox (2004a) and Cox et al. (2004b) contribute theories concerning power regimes and the management of relationships between buyers and suppliers in supply chains. Cox concludes that *"…supplier development and supply chain management tend to work best in circumstances when buyers have dominance over suppliers or, at the very least; there is an interdependence in the power relationships between them."* (2004a, p. 350).

From a European perspective, the large retailers have become *channel captains*. 'Channel captaincy' can be defined as the *"…member of a marketing channel assuming a leadership role in organising the system in order to lessen conflict, achieve economies of scale and maximise business impact"* (Marketing Glossary, 2003). Channel captaincy includes logistics skill, packaging skill, handling skill, efficiency focus, environmental/sustainability

awareness etc. In Sweden, retailers are in the process of taking over power from the manufacturers and suppliers, whereas in the UK in particular, the process is already well advanced (Sparks, 1998).

Power has often been utilised in a way that can be described as pure dictatorship. "Like it or leave it" has been the message from the company that is in the position to decide on logistics and packaging in a supply chain. This ancient way of doing business has been effective for thousands of years, and in many cases it is still effective. The problem is that this produces a supply chain that is organised for the benefit of just one business. Other parallel chains may be organised differently, resulting in overall inefficiency for manufacturers and ultimately for all. It is also the case that such systems tend to increase inventory and other 'buffer' techniques to make the service levels work. This, in turn, adds cost and/or requires additional efforts. (Sparks et al., 2005, Appended paper Two)

The emerging awareness of how to build a sustainable supply chain, where any potential for improvement must be explored, is showing the way to other types of power use. The growing importance of active participation *throughout* a supply chain is pushing this development. Large retailers, such as Tesco or IKEA, have learnt the lesson. Instead of just giving orders like "do as we say and keep quiet", these large retailers invite their manufacturers and suppliers to establish a dialogue concerning improvements in their supply chain. They are adopting a "learn to like this" attitude towards their suppliers. This is a new type of *"participative dictatorship"*, where involvement and access to information and new knowledge are basic parameters. Power is still being applied, but in a way that works for the good of the sector rather than just the individual company/supply chain. (Appended papers Two and Three).

This new type of change management based on participative dictatorship includes learning processes to a large extent. Instead of forcing new methods, new packaging systems or distribution concepts upon the suppliers, these retailers want to emphasise the opportunities that arise with the new aspects. They want to point at innovations that, in turn, may even lead to improvement up-stream, resulting in better business for the manufacturers as well as the suppliers. The potential of starting coordinated learning processes, e. g. systemic learning, is identified (Sarv, 2003; Senge, 1990). The overall objective is to create win-win situations through increased collaboration, where both supplier and customer will gain from

the new way of working. The associative or collaborative method of working is not new (Dawson and Shaw, 1990) but the method and scope of application into the packaging logistics field marks an extension of the approach.

2.6.4 Enablers, drivers, barriers and obstacles

The discussion above has so far contrasted integrative and segmentalist companies and suggested that such tendencies affect the propensity and ability to change. This operates at both the company and the supply chain level, though the main interest is naturally in the problems brought on by segmentalist companies trying to operate an integrative supply chain. In either case, however, there are some hidden barriers and enablers to change.

Somewhere behind the scenes, there are lots of skilled people on many levels in the hierarchies who have insight, experience, knowledge and understanding of the need for change in products, packaging, logistics, organisation etc. They form an essential starting point in the first efforts in the process of gaining acceptance. In some situations, these *enablers* have actually already initiated the change process by starting a discussion or pointing at possible ways to solve a problem. They form the prehistory of a change process. Many of the enablers could very well be drivers of change themselves, but for some reason they have decided to position themselves as the silent majority – in spite of the fact that some of them accomplish results that definitely reveal the need to persuade them to embrace widespread change (Kanter, 1984).

The *drivers* of change are entrepreneurs who have the ability to look around the obstacles, understand the full picture and are able to grasp "the whole" without losing detail. The drivers are good communicators as well as good listeners, and they have the ability to share their early vision with others. They are good at establishing relations with the enablers for change, making use of their experience, knowledge and good advice. The drivers are also good at identifying and handling tension, and they know how to fight against the barriers for change (Kanter, 1984).

Obviously there is a wide range of *barriers* and *obstacles*, more than enough to chill the most enthusiastic drivers, enablers and entrepreneurial spirit. Opposition and resistance can be active or passive. There are also two different time frames for opposition. Early opposition can be seen as scepticism as well as reluctance to commit time and resources. People who

put up an early opposition may say that they have other obligations that are more important, or they conclude that "we tried to do that five (or ten or fifteen) years ago, and it did not work". Later opposition can emerge quickly, surprising the drivers of change. Some people start to challenge specific details of the plan that is unfolding. At a late stage, they suddenly realise that the change will affect them personally or their close environment negatively.

Active opposition may be easier to handle. It is often possible to discuss with people who tell you that they are against the action proposed. Verbal argumentation is easier to handle than silent opposition. When passive opposition and resistance are dealt with, certain common types can be identified. Some people are critical of specific details of the plan – many of them lack the ability to grasp the full picture. Not responding to requests is another typical form of passive opposition mentioned by Kanter. Not being available is another way of protesting. Others show their unavailability by preferring to work with other projects. The common types of passive opposition mentioned above can be identified where office work takes place. These types of opposition may occur on the grass-roots level, but here another type of passive opposition is likely to occur. In warehouses and distribution centres the problem of passivity or 'foot-dragging' is more common – even if 'foot-dragging' may occur in offices as well.

One important aspect of 'foot-dragging' must be highlighted. Kanter describes how passivity of any kind is more efficient in many ways than open, verbal opposition. It is the only "weapon" that the most powerless people can use. Furthermore, it is a comfortable weapon, since the opponents using it do not have to put themselves in tricky situations where they have to say no and provide well-formulated arguments for it. Finally, the foot-dragging is a way to buy time, to postpone something that might disturb the normal every-day working routines.

When an impending change is about to happen in real life, many critics that have kept quiet during the planning processes become actively resistant. One possible reason for this is that latent discontent with other issues may become mobilised, as the change process can also work as a catalyst and reveal other hidden problems.

When a driver of change encounters all, or some, of the active and passive resistance, there are some ways to deal with it by disarming the opponents.

At first, the method of waiting it out can be applied, i.e. showing patience with the opponents and trying to win them over with fact-based argumentation. Appealing to larger principles may be one way of argumentation. In some cases it may be enough to say that "this has been decided by top management". Inviting the opponent in and offering interesting tasks to be fulfilled is another way of dealing with individual opponents. It is better to have certain people with you than against you, but in such cases it is important that the process is transparent, open and aligns people, processes and technology (West and Sparks, 2004).

The aspects of resistance to change have been described in a paper by Weymann (2001), in which the reasons why change programs fail are discussed. Weymann points at the "psychological contract" between employer and employee/worker, where "a fair day's work for a fair day's pay" forms the basis for employee and worker satisfaction. What has produced positive outcomes for the workers for a long time can be very difficult to change if the proposed change is not accepted. Weymann concludes that *"change is a process driven by human beings who, by their very nature, are programmed to attend to their own needs first. When those needs are threatened by proposed change, the natural response is to resist."*

2.6.5 Changing logistics systems - creating change processes by learning and new thinking

The development and decision processes that are described and analysed in this research project can be explained by using reflexion (mirroring) on different perspectives. Reflexion on logistics innovation systems, including dynamic and systemic learning, is a theory elaborated by the researcher and practitioner Hans Sarv during the 1990s.

In Sarv's books and papers, he presents the different forces that drive the innovation within logistics systems. In one of his papers, he concludes that *"most organisations are full of ambitions, but often pursuing a double life, between intention and practice".* This double life can be explained by two, often parallel, reasons for not being successful in implementing change:

- The managers' intentions or ambition levels are not sufficiently defined or clearly communicated to become implemented and realised.

- The practise itself (the management and/or the operative levels) has problems accepting or adjusting to new ideas and knowledge.

Sarv describes his interpretation of the third generation of change knowledge.
(The first generation started in the US during the 1960s, and can be described as a linear way of thinking and planning change, where much of the change was based on a top-down perception, management-by-command (Simon, 1958 and1976), while the second generation identified "change masters" (entrepreneurs) using communication or even lobbying and networking (Kanter, 1984). The second generation left the linear context by identifying the changing processes as being circular. The third generation is based on what is called systemic learning (Senge, 1990).

Sarv has presented his model of what parameters must be in place before a change process can be successfully performed (Sarv, 1997). The "V man" (based on five Swedish words all starting with a V) points out five aspects that must be in place:

- The actors must see the present **prevailing reality** (1)
- and see the **vision** (2), the objectives to be accomplished
- and understand **what** (3) actions needed to be taken
- on the **road** (4) to reaching the vision. Not until then, when these first four parameters are fulfilled, can the actor be expected to be
- **willing** (5) to join in and contribute his/her competence and energy in the change process.

(In Swedish: 1. Verkligheten 2. Visionen 3. Vad 4. Vägen 5. Viljan.)

This dynamic of creating a willingness on the part of the actors to start, join and be an active part in a change process is described by Sarv as a "space of opportunity".

The first challenge is to give the actors in a change process a shake-up to get them out of their safe and ingrained everyday life, to make them see other parts of reality. The second stage is to make all the actors aware of the fact that there are potentials in alternatives to the prevailing reality. The third stage in this dynamic learning process is the start of the changing process, when everybody has seen the light and is convinced that the step into something new will be the best step that they have ever taken.

To create this space of opportunity, Sarv recommends using three dimensions:

1. **The story-telling dimension** involves using a concrete course of events taken from a customer-related situation in a production system, told by one of the actors involved in the course of events. This is followed by a Question & Answer session, where other actors involved are allowed to ask, comment on and explain the actual course of events. This stage helps the actors to start moving away from the safe and cosy present situation, and helps them to realise their impact on the supply chain.
2. **The alternative visions dimension** will help the actors to understand what changes can be the solution in order to create a better logistics system. This second stage helps actors to move on to the third stage, where they "see the light" and are convinced of their capacity to create change.
3. **The action dimension** starts the movement and change, leading on to a new level of the safe corner, where change has been institutionalised.

This is a circular movement, and in its most perfect setting the change process is triggered by the organisations' ambition to be world-class or cutting-edge in terms of having an efficient logistics system based on constant learning, including respect for all actors and their capacity to see, understand, learn and implement new knowledge in a never-ending improvement process.

The theory very briefly described above is based on Sarv's many years of experience of performing two parallel tasks, as a logistics consultant and as an academic researcher. He concludes that it is extremely difficult to create change and learning processes by using logistics theory exclusively. The learning process must be based on practical, concrete cases, which are analysed and used as triggers for creating learning and change.

Håkansson and Johansson (2001) point at three stages of learning in business network relationships, which support Sarv’s theory concerning dynamic and systemic learning and which also support the multi-party, intra-organisational processes that are described in the single-case study in this thesis.

2.6.6 Change management selected as the principal theoretical platform

At this stage, after having presented the five theoretical frameworks that have been used in the analysis of this research, it may be appropriate to point out which of the theories has been most useful.

For this thesis, Christopher's discussion (1998) of supply chain networks seems appropriate, in combination with CSCMP's position on the importance of coordination and collaboration between channel parties in a supply chain. The case study described in this thesis is based on the need to improve coordination and collaboration in demand-driven networks formed by suppliers, wholesalers and retailers. The idea of creating competitive advantage by introducing a new system for transport packaging is also included in this thesis.

This process is concerned with implementing radical change in a well-established distribution system, including both hardware and software. The analysis, discussion and conclusions concerning the decision process can be applicable to many other types of system changes within a supply chain. For this reason, the theories concerning change management have been selected as the principal theoretical platform.

2.7 Lack of knowledge

When attending the PhD course in scientific theory and ethics, we were repeatedly urged to remember to include a discussion of what knowledge is missing in our theses. The risk of not being aware of the consequences of the unknown (Sahlin, 1992 and 2003) must be considered. In this type of research, risks due to lack of knowledge may not result in hazards concerning life and death, as in medical and biotechnological research. Nevertheless it can be of interest to provide a short discussion of this issue. This is one such attempt, pointing at my lack of knowledge about behavioural sciences.

Multi-party decision processes include many mechanisms based on human behaviour and power issues in organisations. Although I have not been able to fully grasp these aspects, they have been slightly touched upon in the description and analysis of the "U-turn" (see Chapters Four and Five) and of how some of the informants refer to "hidden" meetings in the wings. With a deeper knowledge of sociology, psychology and other social sciences

it would maybe have been possible to achieve a deeper understanding of the effects and potentials of multi-party collaboration dynamics.

The learning process obviously requires much more analysis than my shallow knowledge has enabled me to perform.

Concerning the logistics aspects, there obviously was, and still is, a lack of knowledge about the expected system performance of a full scale, operational business-wide, national system for returnable transport packaging. (Kärkkäinen et al., 2004; Mollenkopf et al., 2005). This thesis is hopefully one of many contributions to knowledge creation in this field.

3 METHODOLOGY

The research method approach is presented here, including a brief discussion on research paradigms and theory building, which may enable the academic reader to evaluate the scientific value of this thesis. The chapter begins with a discussion of the selection of research approach. The methods selected for the accomplishment of data collection and analysis are presented. Finally, there is a discussion of the experiences from the data collection.

3.1 Paradigms and research approaches

Gammelgaard (2004) and Nilsson (2003 and 2005) point at the need to broaden the paradigmatic perspective and use complementary research approaches to facilitate new theory building.

Before continuing, a definition of the paradigm concept will be provided. In his book "The Structure of Scientific Revolutions" published in 1970, Thomas Kuhn, initiated the discussion of the paradigm concept. However, the definition I have selected here is proposed by Michael Quinn Patton in 1978, in his book "Utilization-Focused Evaluation":

"a world view, a general perspective, a way of breaking down the complexity of the real world. As such, paradigms are deeply embedded in the socialization of adherents and practitioners: paradigms tell them what is important, legitimate, and reasonable. Paradigms are also normative, telling the practitioner what to do without the necessity of long existential or epistemological consideration."

When studying the philosophy of science it is easy to get confused. For me, the hermeneutic and phenomenological approach seems more attractive than the positivist or realist standpoints, as it is discussed by Rosengren and Arvidson (1992). The hermeneutic approach strives for collecting data to be able to interpret, to increase understanding. In the book "Qualitative Methods in Organizational Research" (eds Cassell and Symon, 1994) Forster explains how a hermeneutic process consisting of seven iterative steps can be applied. The overall aim is to clarify what is considered unclear in an organization.

The meta-level research paradigm of this thesis is not positivist, since I cannot accept the standpoint that it would be possible to achieve objective truths where the effects of human activity are depreciated. Nilsson's (2005) discussion based on the assumption that all types of human activity have a considerable influence on both effectiveness (doing the right things) and efficiency (doing things right) in supply chain management and logistics is truly applicable when selecting the research methods in this thesis. The aspects concerning power, creativity, communication, cooperation, conflicts, interdependencies etc. must be included in the research approach, since these aspects provide valuable bases for exploratory analyses that may increase our understanding of the research field in question.

Gammelgaard (2004) and many other logistics researchers refer to Arbnor and Bjerke (1994 or 1997), as they describe three research approaches for the analysis of business research. These three approaches are fully applicable to supply chain management and packaging logistics research. Among the three approaches, *analytic*, *system* and *actor*, the system approach is the prevailing method of analysis within supply chain management and logistics research. This thesis is based on the system research approach, where I apply a hermeneutic perspective, as described in Arbnor and Bjerke (1994). The hermeneutic perspective is applied by the researcher to create an understanding of the system by receiving answers from informants that include their own reflexions and subjective interpretations of the reality they are working in. Their interpretations would result in statements concerning the meaningfulness of their participation in a system. Furthermore, Arbnor and Bjerke suggest that the researcher is striving to create an objective description of a reality based on several subjective descriptions. Finally, they conclude that researchers who apply a system approach with the hermeneutic perspective do not separate their own interpretations from the ones provided by the informants.

Both Gammelgaard (1997, 2004) and Nilsson (2005) point at the complex nature of supply chain management and logistics. Theories from both technical and social sciences must be applied in interaction, which calls for a multi-method research approach. Many logistics researchers conclude that there is a need for both quantitative and qualitative research methods, (among others Eisenhardt, 1989; Ellram, 1996; Stock, 1997; Arlbjørn and Halldórsson, 2002; and Nilsson, 2005).

In Table 3.1, the attributes of the qualitative and quantitative paradigms are presented. This forms an explanation of my decision to apply a qualitative method as a basis for the research in this thesis. As the research questions (presented in Chapter One, 1.3) are based mainly on "how"-questions, striving for description and explanation, the most suitable research method according to Yin (2003) is to apply the qualitative paradigm.

Qualitative Paradigm	*Quantitative Paradigm*
Advocates the use of qualitative methods	Advocates the use of quantitative methods
Phenomenologism and verstehen: "concerned with *understanding* human behaviour from the actor's own frame of reference"*	Logical-positivism; "seeks the *facts* or *causes* of social phenomena with little regard for the subjective states of individuals."*
Naturalistic and uncontrolled observation.	Obtrusive and controlled measurement.
Subjective	Objective
Close to the data; the "insider"* perspective	Removed from the data; the "outsider"* perspective
Grounded, discovery-oriented, exploratory, expansionist, descriptive, and inductive	Ungrounded, verification-oriented, confirmatory, reductionist, inferential, and hypothetico-deductive
Process-oriented	Outcome-oriented
Valid; "real"*, "rich"*and "deep"* data	Reliable; "hard"* and replicable data
Ungeneralizable; single case studies	Generalizable; multiple case studies
Holistic	Particularistic
Assumes a dynamic reality	Assumes a stable reality

Table 3.1 Attributes of the Qualitative and Quantitative Paradigms
Source: Reichardt and Cook (1979), p. 10.

** The quotes are from Bogdan and Taylor, Introduction to Qualitative Research Methods, New York, John Wiley, 1975.*

3.2 Theory-building in logistics and supply chain management

Whetten (1989) concludes that a theoretical contribution must include four elements, referring to Dubin (1978). The first two elements are *descriptive*, answering the questions *what?* and *how?* Comprehensiveness when elaborating on the *what?* question is pointed out as an important aspect, as all relevant factors must be included. Whetten advises against too much parsimony, deleting factors that add only little value to the theory or model, since it is easier to delete factors in the subsequent analysis and discussion of a model or a theory than it is to add new factors to an established theory or model. The *how?* question describes the causality between the factors that are part of the explanation. The third element is the *why?* question, which *explains* and constitutes the theory's assumptions. At this stage, logic reasoning may replace data during the process of theory development. Finally, the fourth element is based on the three questions *who?, where?* and *when?*. At this stage it is important to look at the limitations of the propositions generated for a theoretical model. Whetten explains that a proper model must be so universal that it can be applied in cultural, geographical and time settings other than the ones close to the researcher.

It can be concluded that most of the logistics and supply chain management research so far is based on a positivist paradigm, where hypotheses must be formulated and subsequently tested, based on the theory of knowledge building proposed by Popper (1983). Popper claims that theories must be tested empirically, and then falsified and rejected or accepted, followed by new knowledge that is continuously added and new theories that are once again tested, rejected after falsification, and new knowledge that forms new hypotheses to be falsified etc.

The positivist paradigm is based on objective and observable phenomena, i.e. on the collection of quantitative data which have been elicited by different measuring methods, resulting in theory models where a reductive, simplified approach form the tools for prediction and forecasting as well as for simulation. Several researchers, among others Mentzer and Kahn (1995) and Mentzer and Flint (1997) argue that logistics research must be more rigorous in terms of theory formulation, testing and application.

However, Arlbjørn and Halldórsson (2002) point at the need to apply different scientific paradigms in order to build theories in fields that are not

suitable to research with a positivist standpoint. They point at the systems approach, referring to Persson (1982) and Gammelgaard (1997). Other researchers, e.g. Mears-Young and Jackson (1997), Svensson (2003) and Nilsson (2003 and 2005) also point at the possibility of improving logistics research by applying other paradigms. Nilsson argues for a perspective based on a complexity paradigm, where the researcher must accept the wide range of aspects that influence the system properties in a supply chain. While accepting the complexity by applying a holistic approach, all the non-predicted events that normally occur in an every-day reality can be included in the research activity. Thus, researchers can formulate theories that would help practitioners improve their planning for the uncertainty and unforeseeable aspects in supply chain management and logistics.

Stock (1997) proposes that logistics research would profit from borrowing theories from a large number of other research fields.

This thesis is based on theories borrowed from other research fields; for example, theories on change management form the basis for the analyses of the development and decision process – from vision to decision – that will be described here.

Concerning the paradigm discussion above, it is quite obvious that this thesis is not based on a positivist, reductionist paradigm. Instead, it can be described as partly based on the heuristic paradigm, where learning processes increase our understanding and thus – hopefully – improve system properties and output in a supply chain (Nilsson 2003).

Arlbjørn and Halldórsson (2002) make an extensive contribution with their views on theory building within both logistics and supply chain management. They point at the existing confusion between what is called logistics research and what is defined as supply chain management research. They also point at the multitude of definitions, perspectives and the multi-disciplinary nature of logistics and supply chain management.

When developing new theories, it is interesting to see in which context theories can be placed. Arlbjörn and Halldórsson (2002) point at three such context levels:

- *The meta level*, where philosophy of science discussions take place, concerning ontological and/or epistemological debates

- *The discipline level*, where a considerable amount of the theory, model and empirically based knowledge development within logistics and supply chain management takes place, often based on existing theories in other research fields (e.g. transaction cost theory, resource based theory, contingency theory etc.). The data generation is based on both quantitative and qualitative methods, modelling and mathematical formulas.
- *The practice level*, which forms the basis for the input of data concerning flow of material and information within a company and/or the supply chain.

One strong aspect of this research field is the close contacts between researchers and practitioners. However, these close relations to industrial applications have also been identified as an obstacle to deeper theory building within this field. The reason for this is that the close relationships with industry keep the researchers active on the discipline research level, where forecast modelling, simulation models, best practice analyses etc. are provided (Arlbjørn and Halldórsson, 2002). But the meta level, where the ontological and epistemological debates take place, seems to be absent from many research agendas within supply chain management and logistics research (Halldórsson 2004; Nilsson 2003).

There is a discussion of the differences between "traditional logistics" and "non-traditional logistics" described by Mearsh-Young and Jackson (1997). They claim that traditional logistics is an operational function, with a system orientation focusing on optimising system performance, while the non-traditionalists point at the strategic aspects of logistics, i.e. that logistics is an important part of a company's corporate strategy, to be integrated with the other strategic aspects. Building relationships, both internally and externally, is pointed out as an important factor in order to enhance the efficiency of the logistics systems.

This thesis is part of the non-traditional logistics research field, since one of its purposes is to examine the strategic aspects of how a new packaging system influences business within companies involved in a food supply chain.

Svensson (2003, p.303) concludes that "…*most theory generation within the field of SCM is limited to either a specific field or a narrow context of the supply chain from the point-of-origin to the point-of-final-consumption, i. e. an atomistic theory generation. There is a lack of holistic theory generation.*"

An effort to apply a more holistic approach is one of the cornerstones in this thesis. It is interesting to note that I have been told both by colleagues and at international PhD workshops that the scope of this thesis is too wide. I have been advised to narrow it down, while my own problem has been to promote the need for telling the whole story, based on as many perspectives as possible, in order to create the best possible understanding of the development and decision process to be described.

3.3 Reasons for a single case study

The reasons for applying the *case study* as a research method should be quite obvious here. The main objective of this thesis is to explore, describe and analyse a specific decision process as it is interpreted by fourteen of the participants involved in this multi-party development and decision process. This type of research is non-experimental and descriptive, and it fulfils the definitions of a case study provided by Yin (2003) and Merriam (1994). The research is based on such questions as *why?, how?* and *in what manner?.* To my knowledge there is no similar business-wide, nation-wide process within the field of packaging logistics to compare with, which means that this is a single case study.

During the 1990s there was a discussion among scholars in logistics research concerning the scientific value of using case studies as a source for new theories and models (Mentzer and Kahn 1995; Arlbjørn and Halldórsson 2002). Ellram (1996) points at the advantages of using case studies as a basis for the formulation of new theories in logistics. She concludes that *"Case studies are excellent for theory building, for providing detailed explanations of "best practices", and providing more understanding of data gathered."*

According to Eisenhardt (1989), the *case study* is a research strategy focusing on understanding the dynamics present within a single setting. Both Yin (2003) and Eisenhardt (1989) observe that the case study is a strategy that typically combines data collection methods such as archives, interviews, questionnaires, and observations. The evidence may be qualitative,

quantitative or both. It may be used for many purposes, but one of them is the building of theory (Eisenhardt, 1989).

This is a *qualitative* single case study, as it focuses on aspects concerning insight, discovery and interpretation (Merriam 1994). Merriam points at four basic properties that are differential for qualitative case studies: *particularistic*, *descriptive*, *heuristic* and *inductive*. "Particularistic" means that a study observes one certain situation, event, process or person.

A case study is, by nature, descriptive, and it must aim at covering all that has taken place in the process to be studied. This results in a "thick" or "rich" description of the events that have been studied. This "thickness" is a basic requirement in order to be able to interpret and analyse the case.

The heuristic side of a case study is that it provides an analysis of the events that have been studied, which may improve our understanding of the process in question. It may even provide new insights that will either broaden the reader's experience or confirm certain issues that the reader has already been reflecting on. (Merriam, 1994).

Finally, when a case study is described as being "inductive", Merriam points at the nature of this type of research: it is not based on preconceived models or theories, it is not the traditional hypothesis-trial-falsification-corroboration-new hypothesis that Popper (1983) and other science theory philosophers who apply a positivistic perspective, advocate. When research is described as inductive, hypotheses, models and theories are built during and after the research process, as a result of new insights, facts and understanding derived from the research. The inductive research approach is more "soft" as opposed to the "hard" deductive hypothesis-falsification, positivist attitude described by Arlbjørn and Halldórsson (2002).

3.4 Researcher's Role and Background

Already during my years as a student at the College of Journalism in Gothenburg, Sweden from 1975 to 1977, my research interest was attracted to environmental, health and food related topics. After ten years as industrial editor and press officer at a large company within the field of defence electronics, I moved to southern Sweden to work at the corporate communications department of Perstorp AB, an international chemicals and plastics manufacturer. At that time, in 1987, environmental issues were high

up on the corporate management's agenda. The leaders of the company decided to apply a proactive approach to the environmental issues, to identify the business opportunities in taking in early signals concerning new demands placed on the company's products. One slogan was: "A clean environment is a pure profit". To work as a communicator at that time was a fascinating challenge, providing plenty of knowledge and new insights into how to create new business based on increasing environmental awareness, both internally in the company and in the surrounding society.

In 1991, I was employed as 'Environment and Communications Manager' at the business area Perstorp Plastic Systems, PPS, (now Schoeller Arca Systems, www.schoellerarca.com). To a large extent, this duty included project management tasks concerning new business development, where environmental aspects could be triggers that enhanced the possibilities of the realisation of commercial projects. Three such business opportunities were investigated:

- The material recycling of old thermoplastics packaging (crates, trays etc): is it viable from economic, technical/processing and environmental perspectives?
- The introduction of source separation of industrial and trade waste fractions. Development of new logistics solutions, in-house training concepts, new products etc
- Returnable packaging based on thermoplastics within the food supply chain

This thesis is a spin-off from the third project, as it explores and describes how it developed over the next few years. The vision of a system of returnable packaging emerged from the plastics recycling project, where one of the conclusions was that thermoplastics should be re-used and not recycled too much in order to attain maximum sustainability. Another lesson learned was that recycled thermoplastics are a good raw material to use in the production of plastic pallets.

During the winter of 1991-92, the planning started in order to find out if there was any interest in creating a system for returnable pallets and trays within the Swedish food supply chain. To begin with, a logistics consultancy was asked to make a calculation of the estimated total costs for different types of pallet pool systems. Three different systems were

identified; one-way pallets, company-owned returnable pallets and business-wide returnable pallets. The cost differences presented were easy to see and understand, and encouraged the management of Perstorp Plastic Systems to increase its efforts to start a business development project. (See Chapter Four, The Case Description)

This cost benefit case was the major justification for the company to start the marketing efforts of introducing an open pool system for reusable plastic pallets and transport trays in 1992.

Valuable support, both financially and morally, was given by Pernovo, the mother company's internal business development company, which granted funding from the Perstorp Group CEO's Development Fund to cover the costs for dummy models, tests and consultant fees. A total of SEK 1,055 m was granted. I was appointed project manager of this first phase of the process: the first objective was to create a working committee with participants from different parts of the dominating actors along the food supply chain.

My role in the first working group was to promote the build-up of a common understanding of this new concept, i.e. how a national, business-wide system for returnable transport packaging could be developed and put in commercial operation. The very first task, however, was to find out how to finance the future steps of the project. This part of the project is described in the case study description, Chapter Four.

Until the end of 1994, I was a member of the first working group. After that, I was able to follow the process closely for another three or four years until other assignments claimed my time. In 1999, I left the Perstorp Group but kept in touch with former colleagues at Schoeller Arca Systems to gain information about the ongoing business activities resulting in the start of a commercial operation in 2000.

3.5 Research Method

This single case study has been performed through personal interviews guided by a questionnaire with open questions. Written documents from meetings support the interpretation of the process described in the interviews.

3.5.1 The informants

A list of key persons was set up, including people involved in the different steps of this case study. A total of fourteen informants were selected, who represent actors throughout the supply chain as well as different phases in the development and decision processes. Of the fourteen informants, seven were members of the first working group. Of these seven, two are active today in the ongoing, operational stage, although in the years in between both of them were out of the process for some years.

Within the group of fourteen, four were members of the second working group 1996-1998, but not members of the first working group 1992-94.

The informants can be described as follows:

- From growers: 2
- From manufacturers/wholesalers: 7
- From retailers: 4
- From packaging suppliers: 2 (one cardboard packaging and one plastic packaging)

(One of the informants represents both growers and wholesalers.)

During the first part of the interviews, the backgrounds of the informants were carefully described: age, numbers of years employed within the food supply chain, educational background, logistics education etc.

The backgrounds of the informants can be described as follows:

- 13 men, 1 woman
- Seven have academic degrees
- Seven have high-school or lower education
- Ages range from 36 to73 years
- Eleven of them are over 50 years old
- The younger informants are the ones with academic degrees; only four of the informants who are over 50 years old have academic degrees
- The most common basic education is engineering, mainly mechanical engineering. Two informants have degrees in chemical engineering

Concerning their knowledge of and competence in logistics, a short remark must be made here. A majority of the fourteen informants state that they are self-taught in logistics and distribution skills; they have not attended any university level courses in logistics or packaging logistics. They have acquired their knowledge of logistics by reading journals and books, exchanging experiences with colleagues, competitors and logistics consultants, visiting trade fairs and attending logistics conferences etc. In some cases new knowledge has been acquired by performing benchmarking, on domestic or international levels.

3.5.2 Planning and performing the interviews

The interviews were booked by telephone in November 2001. All the informants selected were happy to participate. Most of the interviews were scheduled to be performed in January and February 2002, with all interviews completed in May 2002. An additional interview was made in November 2002 in order to attempt to dig a bit deeper into a description of the decision process. (A separate questionnaire was designed for that interview.)

Patton (1987), Lantz (1993) and Merriam (1994) all point at the importance of creating an informal and personal interview situation. Nine of the fourteen informants knew me more or less well from the early stages of the process in 1992-94. The other five informants were new contacts. It must be noted that all interviews were performed in a friendly, informal atmosphere. However the interviews with my old contacts were even more friendly and informal. Most of them (seven) had not been in touch with me since 1994.

All the interviews were recorded on a digital mp3 recorder. All of them except one were successfully recorded. The one that failed was performed and documented by detailed hand-written notes, which were typed out immediately after the interview. This failure shows how important it is to test that the recording equipment is working before performing the interview. In this case, the test showed that the recording did not work properly, and we decided to perform the interview without recording it.

Each interview lasted 2-3 hours.

The interviews were planned to be semi-structured, which follows the qualitative interview method widely described in the literature (Patton, 1987; Rosengren and Arvidson, 1992; Lantz, 1993; Merriam, 1994). A semi-structured interview is based on a questionnaire to make sure that all informants are asked the same questions. However questions are formulated in such a way – as open questions – that the informants are encouraged to describe their own interpretation of the events in the process to be described and analysed. The informants provide their own reflections, analyses and conclusions, which form the basis for the analysis of the case, to be matched with the researcher's own analysis and conclusions (Merriam, 1994).

A careful preparation of the questionnaire forms the cornerstone of the outcome of the interviews. A badly planned questionnaire can ruin the best research ambitions (Patton, Lantz and Merriam). One of the most important factors to consider is that once the interview sessions have started, the questionnaire cannot be changed. This is the reason why questionnaires must be pre-tested before the real interviews take place. The pre-test normally serves to indicate which questions need to be reformulated. The questions must be open and neutral, allowing the informant to answer in his or her own way, without being guided or influenced by the researcher (Rosengren and Arvidson 1992, Merriam 1994). Questions that may result in a short "yes" or "no" answer should be avoided.

I decided to design a questionnaire consisting of five sections, A-E, starting with personal data concerning age, sex, number of years employed, educational background, logistics education etc. In sections B and C, the questions were formulated in such a way that the informants were encouraged to give their own, personal comments on how they perceived the development and decision processes from their respective actor perspectives. The formulation of the questions resulted in answers that form the basis for an analysis of the informants' views of the development and decision process described in this case study. (See Chapter Five; 5.1.1 and 5.1.2)

Furthermore, the questionnaire includes section D, where the business intelligence capacity and activity levels are explored. Finally, Section E is a section where the informants are asked to describe how they themselves or their companies were acting to obtain support for a new packaging system in their daily operations.

A translation of the questionnaire is attached to this thesis in Appendix 1.

3.5.3 Additional, complementary sources

Complementary information about the development process has been collected in written documentation from working group meetings and notes from other meetings where this project was discussed. In the book "Qualitative Methods in Organizational Research" (eds Cassell and Symon, 1994) Forster discusses the reliability of such documents. They must be read and understood within the contextual framework of the actual research.

It should be noted here that unfortunately most of my own documents from the first years were sent to recycling when I left Perstorp in 1999. I am most grateful to the informants who provided me with the documentation required for the analysis.

3.5.4 Analysis of interviews and documents

The qualitative analysis is based on structuring, reduction and interpretation of the data that have been collected. The analysis performed in this research project follows the experience-based recommendations by Patton (1987), Merriam (1994) and Lantz (1993). It should be added that all of them refer to Guba and Lincoln (1981) concerning the structuring and "coding" of the data collected.

Reduction is a method where the amounts of statements are concentrated without losing their message content and essence.

The coding process was performed by reading the transcripts and, in some cases, listening once again to the recordings, while analysing the questions one by one and structuring the answers into defined categories. This is a time-consuming process, but it provided good results in terms of reduction and interpretation, enabling me to make in-case generalisations.

The coding process was done iteratively in order to sort out two separate lines of analysis and conclusions: my own interpretation of the answers as well as the informants' own opinions.

The results must be coherent and empirically based, i.e. it must be possible to show that the results are supported by the data collected. Furthermore, "cherry-picking", or the exclusion of relevant data, must be avoided. Finally

there must not be a gap between conclusions – in particular if they are more abstract than the empirical input – and the data collected (Merriam, 1994).

The aspects of validity and reliability must be considered when qualitative methods are applied. Merriam (1994) points at the importance of internal validity when qualitative methods are employed. The researcher must show that the results are in accordance with the reality and situation explored. One method of assessing internal validity is to send out the results from the analysis to the informants and ask them if they find the results true, relevant and acceptable. However, it must be taken into consideration that in certain cases informants may be reluctant to accept results that may have negative consequences for their own business or other individual interests. In this research project, the informants have been invited to comment on the case description and conclusions. Their comments are included in Chapter Six, Conclusions.

When working with quantitative, hypothetic-deductive methods there is a risk of bias, as researchers are striving to find evidence to prove their hypotheses. The efforts of identifying falsifying evidence may not be given proper attention. Such a risk may also occur in qualitative, inductive research. The risk of bias caused by a narrow-minded researcher's perspective combined with the ambition to draw the "expected" conclusions from the analysis is a risk where lack of knowledge can amplify the bias (Sahlin, 1992 and 2003). See Chapter Two, 2.7.

3.5.5 Experiences from data collection

With my background in journalism and with many years of experience of conducting interviews with businessmen and people at different organisational levels working in companies, it can be assumed that I performed my interviews in a more professional manner than if someone with no previous experience of an interview situation had performed them. However, this experience can also be a burden, as it may create exaggerated anxiety concerning the performance of the interviews. Experience is not only an advantage; it can also be an obstacle in terms of not allowing the interview situation to lead its own life. Routine may kill spontaneity.

One aspect that surprised me during the interviews was that some informants, both younger and older, had obvious memory problems. When this type of problem occurs during an interview it is important that the researcher does not push the informant in a certain direction. Allowing time

and using the silences that occur are good tools for helping the informant to reflect and remember. Also, the interviewer must not tell the informant what the expected answer is.

It can also be noted that performing more than one interview per day is not to be recommended. A series of long interview sessions requires concentration and focus, and as an interviewer you risk exhaustion and loss of focus if too much interviewing is performed in one day. For reasons of travel planning, two interview sessions had to be scheduled on the same day in Stockholm. This situation must be accepted, but the researcher must realise that all interviews could not be typed out directly after the interview.

Typing out the interviews is an effort-consuming but important first step in the work process. When listening to the interviews, you realise that even a skilled interviewer cannot make written notes about every important aspect mentioned by the informant. For this reason, the interaction of hand-written notes and the recorded interview is valuable in the subsequent analysis process.

One last comment on the experiences gained in the data collection concerns the questionnaire. This thesis is based on the answers provided in sections B and C in the questionnaire. (B: The process of formulating a specification of requirements placed on a new packaging system, C: The decision process). The answers from the other sections concerning business intelligence and the implementation of new packaging concepts have not been included in this thesis, in spite of the interesting results that have been extracted from these sections. The information provided by the informants is very valuable and can be used as source material in future research.

The qualitative approach requires the collection of a broad range of data, which will result in a “thick” or “rich” description of the process that has been researched. However, it is possible that the questionnaire used in this thesis was overambitious and provided too much data to be analysed.

4 THE PROCESS OF CREATING A BUSINESS-WIDE POOL SYSTEM IN SWEDEN. A DESCRIPTION OF THE CASE STUDY

The aim of this chapter is to provide the reader with a comprehensive description of the case that has been studied in this research project. Yin (2003) encourages researchers to compose their case descriptions so that they become engaging reading sessions. Yin mentions three properties that characterise a good case study description, namely engagement, enticement and seduction. He adds that these properties are seldom found in case study reports. To enhance the pleasure of reading, all evidence, documentation references etc. cannot be included. Yin recommends that such evidence should be referred to in footnotes or in appendices. However, a case description, regardless of the level of reading pleasure, cannot provide the whole description of the process in complete detail. For this reason a limited number of events have been selected. After the introduction, where when, how, who and why are discussed, a limited number of events are described. The events that have been highlighted are 1) the overall process of designing a specification of requirements for a returnable tray, including 2) test packing effort to define tray heights, 3) the issue of drained or closed trays and 4)the tender process and the final events before deciding on tray type. Hopefully these events will give the reader an insight into how the goal of this effort – from vision to decision – was successively reached.

4.1 Case study introduction

The research project covers the years 1992-1999. During this time, a group of logistics specialists throughout the Swedish food supply chain took part in a development and decision process that included much learning. The participants worked in companies across the Swedish food supply chain: growers, manufacturers, fillers, wholesalers and retailers. Some of them worked for business organisations formed by groups of companies within the supply chain (e.g. growers' associations, the manufacturers' association as well as the wholesalers' and retailers' associations).

The development and decision process includes many types of issues. I have classified the issues into a total of eight missions, performed by two working groups.

1. *Sell in the vision to all participants in the first working group (1992)*
2. *Plan and perform a large-scale pilot test (1992-1993), including project financing*
3. *Design an administrative concept for the pool system (started in 1993, then postponed to 1998, Mission 8)*
4. *Design a functional standard for half pallets (800 x 600 mm footprint), European standard, packaging material neutral (1993-1994)*
5. *Develop a returnable tray for vegetables at the request of the Swedish Board of Agriculture (1994)*

   End of first working group's mandate.

6. *Develop a specification of requirements to be placed on a business-wide, returnable tray, followed by a tender process (1995-1998)*
7. *Perform an environmental evaluation of a plastic tray (1996-1997)*
8. *Design an administrative concept for the pool system, form a part-owned pool company (1998-1999, continued from Mission 3).*

The first working group was established in April 1992 and cancelled in early 1995. That group accomplished missions 1-5 before closing. Later on in 1995, the manufacturers, wholesalers and retailers formed a new development organisation, including the second working group, whose efforts working with mission 6 are focused in the description of this case study. The second working group was active until 1999.

The description of the case study is based on notes taken during meetings, project documents, a travel report and interviews with the informants. To facilitate the reading of this case description, references are not made to every single event or fact presented here. If any reader is in doubt concerning the presentation of events and facts in this case description, he or she is welcome to contact Lund University to study the case study documentation.

Some of the informants have requested that their names would be withheld. For this reason the names of the participants in the two working groups are not published in this thesis.

4.1.1 The initial steps before the formation of the first working group

As described in Chapter 3, Methodology, the packaging supplier Perstorp Plastic Systems (now Schoeller Arca Systems) had identified a commercial potential for the Swedish food supply chain if the actors across the supply chain could decide on a business-wide, deposit-based pool system for returnable transport packaging.

During the autumn of 1991, contacts were established with the logistics manager at the market's leading retailer, ICA. She was interested but concluded that this was too big an issue to be decided by ICA alone; it required the acceptance of all stakeholders in the supply chain.

The next step taken by Perstorp Plastic Systems was to invite a logistics consultancy with the experience and competence to provide logistics flow and cost calculations for the Swedish food supply chain. On February 7, 1992, the consultancy sent a proposal for a pre-study, including the contributions they could offer to Perstorp Plastic Systems.

The overall objective was to identify the potential within the Swedish food supply chain for different types of returnable packaging. The project was to be driven on three fronts, as described in the proposal:

1. preparatory analysis, project planning and project financing
2. test and evaluation
3. market adaptation and continued selling-in activities with stakeholders.

As already described in Chapter 1, Perstorp Plastic Systems' costs for hiring this consultancy were paid by the Perstorp Group's innovation and business development system, Pernovo.

Since this consultancy had good relations with a large number of the key logistics people in the Swedish food and beverage supply chain, and thus also had access to relevant logistics flow data, the calculation effort was

accomplished in only a few weeks. The result was highly interesting for Perstorp Plastic Systems. The top management of the business area decided to give a go-ahead for the project plan presented by the consultancy.

The next step was to invite the possible future stakeholders to a meeting and inform them about the findings that had been provided by the logistics consultancy. The overall objective of that meeting was to create an interest in starting the project proposed by the Perstorp Plastic Systems and the consultancy.

In the weeks before the meeting, which was held in Stockholm on April 9, 1992, the consultancy was asked to check the interest in Perstorp Plastic System's proposal with certain senior key logistics people to achieve the top management "blessing" for the proposed project.

When the meeting agenda was designed, it was important to give an example of positive experience of a business-wide, deposit-based packaging pool. A recently retired senior logistics expert from the Swedish Brewery Association was invited to describe the introduction of the new system for the 20-bottle beverage crate for 33 cl returnable glass bottles that had been introduced in 1988-89 in Sweden.

In addition to this, the meeting agenda also included the environmental issue, which was given increased emphasis at that time, as the upcoming packaging legislation both domestically and in the EU had already been identified as a threat by the actors across the Swedish food supply chain. (See Chapter One, Introduction and Background, 1.5.) The growing awareness of the unsustainable waste volumes in society was another factor that influenced the future planning.

4.2 The formation of the first working group

At the meeting in Stockholm on April 9, 1992, a 45-minute discussion was scheduled at the end of the agenda. The list of participants shows that the meeting was attended by 20 people from different parts of the Swedish food supply chain. It may seem like a low number of participants and hence evidence of low interest on the part of companies. But it must be remembered here what has been shown in Chapter One: there were only three large retailers on the market at that time, and manufacturers, transporters and growers were represented by staff from their respective

business associations. So when analysing the 20 participants, it can be concluded that all parties identified as potential stakeholders were present.

In the discussion, some doubts about having a pool system were expressed. The arguments against a pool system included the risk for higher cost, more work for the retailers, more administration and costs for deposit handling, hygienic aspects and investments already in place where only cardboard boxes could be handled. One participant asked if a pool system was eligible if the transport work increased due to take-back transports. Furthermore, it can be observed from the notes taken during the meeting that although the parties interested in returnable trays were also present and active, the discussions were focused on pallets.

However, curiosity to find out whether this could be something worth testing overcame the arguments against a pool system. At the meeting a working group was formed, and a first meeting date was set to June 4, also in Stockholm.

The first working group consisted of one person representing retailers and wholesalers, one person representing manufacturers, one person representing transporters, one person representing outdoor growers and one person representing greenhouse growers. Additional members were two persons from the consultancy and three persons from Perstorp Plastic Systems. During the first year, experienced logisticians were asked to reinforce the working group: one person from a manufacturer and two persons from a retailer.

4.3 The first working group's activities during 1992-94

The first working group accomplished five of the eight missions:

1. *Sell in the vision to all participants in the first working group (1992)*
2. *Plan and perform a large-scale pilot test (1992-1993), including project financing*
3. *Design an administrative concept for the pool system (started 1993, then postponed to 1998, Mission 8)*
4. *Design a functional standard for half pallets (800 x 600 mm footprint), European standard, packaging material neutral (1993-1994)*

5. *Develop a returnable tray for vegetables at the request of the Swedish Board of Agriculture (1994)*

At the first meeting of the working group on June 4, 1992, the agenda was extensive. First, all participants were asked to give their personal and spontaneous expectations of this project, (Appendix Two), then objectives were discussed as well as formalities. A chairman, a senior logistician, well known and respected for his deep knowledge of the flow of goods and operational handling, was elected.

Activity and time plans were set up. The main objective was to have a proposal for a deposit-based pool system ready by December 1, 1992. That proposal should be based on experiences from a system test, which was planned to take place during the summer of 1992. At this stage, half-size pallets were in focus, although the participants from the growers' associations were lobbying for returnable trays to be included in a system test.

A study trip to Austria to look at a large-scale, operational pool system for trays was proposed by Perstorp Plastic Systems. The members of the working group were invited to participate in a trip to Vienna in September 1992. (Gustafsson, 1993).

The issue of how to finance the project was also discussed. The group decided to ask the consultancy to investigate the possibilities of making an application for funding to Nutek, the governmental agency for innovation and new business development. The main argument for looking for financing outside the business sector was that governmental funding would give the project a higher credibility and eligibility. (The arguments for and against applying for governmental funding for the development of new packaging systems are discussed in the next chapter, Analysis and Discussion).

The group met again on August 27. At that meeting, focus was on the preliminary final report from a test of returnable wooden half-size pallets in the city of Örebro that was already running when this working group was formed. The test results did not provide all the expected answers. The choice of products resulted in too slow a movement of pallets, plus a loss of 25 % of the pallets included in the test. Retailers keeping the pallets in their stores as display pallets accounted for most of the loss. Nevertheless, this test provided some valuable experience to be considered in the test planning in

this project. At this stage, the chairman pointed out that the upcoming test was a *system* test, not a test of different packaging materials. He concluded that the working group must have a material-neutral attitude and focus on the function requirements placed on a half-size pallet and on a pool system.

The consultancy reported on the first reactions from Nutek concerning their interest in financing testing of a packaging pool. There was a positive interest and an invitation to send in an application for funding.

4.3.1 Study trip to Austria

The study trip to Austria took place on September 9-10, between the second and the third meeting. Perstorp Plastic Systems provided the visit schedule and service from its Austrian subsidiary (which was the supplier of trays to the Austrian pool system; at that time 1.2 million trays were circulating among the 240 pool members).

Not all the members of the working group could attend, but three of the business sector actors and people from the consultancy and from Perstorp Plastic Systems attended, i.e. a total of seven participants. Everybody paid their own travel expenses. The two-day program included visits to large distributors, retailer warehouses and retailers. (Later that autumn a group of growers made a similar study trip to Austria.)

After this study trip, it was concluded by the working group that the cleaning of trays and pallets must become a high-priority issue in a proposal for a Swedish pool system.

The prospect of having a collapsible tray to allow transport economy for long-distance transports of fruit and vegetables was also discussed in Vienna, according to the travel report. The Austrians had decided to turn that option down, since the quality of collapsible trays was too low.

One interesting detail, not documented in the travel report, was the statement from the representative of one large Austrian retailer concerning the volumes of damaged products and product waste: before the introduction of returnable trays, damaged products accounted for about 12 % of the total product volume. After the introduction of trays, the figure fell to 3-4 %. One informant, who participated in the study trip to Austria with the growers in the autumn 1992, tried to get a straight answer concerning the profitability of the pool system from one retail distribution manager. The informant concludes that *"we got the impression that the level of damaged products had been cut by half or even more."* The participants representing the Swedish retailers could not accept such a high "before" figure. However, one of the other informants confirms that the actors in the Swedish food supply change have not made any extensive investigations of their real product waste figures.

(See discussion in Chapter 6, Conclusions.)

4.3.2 Project financing

During the following meetings, financing and test planning took up most of the time. An application for financing was submitted to Nutek in January 1993. In June the same year Nutek agreed to provide a total of SEK 735,000, which actually was SEK 100,000 more than the working group had requested. But there was one condition: SEK 400,000 must be paid to the national packaging research institute Packforsk (www.packforsk.se) due to Nutek's aim of improving Packforsk's knowledge and competence concerning systems for returnable packaging. For this reason a representative of Packforsk was invited to be a member of the working group.

Another application for funding was sent to Arbetsmiljöfonden, the Occupational Health Fund, a governmental agency that has been discontinued. In the 1990s this fund provided financing for a large number of projects aimed at improving working conditions and preventing occupational health problems. After the summer of 1993, this fund granted

SEK 400,000 to the project in order to perform ergonomic studies and consequence analyses of the handling of returnable trays and pallets in the tests.

At the meeting in August 1993, one of the growers' representatives reported that the government had decided to invest SEK 25 m in projects to improve the competitive factors for Swedish vegetable growers before Sweden entered the European Union in 1995. Packaging design was considered to be included in the scope of interest. The working group accepted the growers' proposal to apply for financial support to include a pool system design proposal. At the beginning of 1994, the project received nearly SEK 800,000 from the Swedish Board of Agriculture (the informant is uncertain of the exact amount; he states that it was around SEK 700,000 - 800,000. Notes from meetings in early 1994 are missing).

The administration of the governmental funding caused problems within the working group. VAT administration aspects, some of the group members' associations demanding payment for the administration of the funds provided, formalities concerning responsibilities etc. had to be solved without losing too much money on the way.

4.3.3 Test planning, implementation of tests and analysis of results

At the first meeting a bold time schedule was set; by December 1, 1992 a proposal for a pool system was to be ready. The proposal should be based on a system test on pilot level. As the test planning turned out to be more complex and complicated than had been anticipated by the actors in June 1992, the time schedule was repeatedly put forward.

The overall objective of the test was to perform four consequence analyses, where the pool system properties would be compared with the properties of the existing packaging system:

- logistics consequences
- economic consequences
- ergonomic consequences
- environmental consequences.

Already in August 1993, Packforsk, the national packaging research institute, declared that they intended to make a comparison between one-way and returnable packaging, including time studies, to be included in the system test. The chairman of the working group advised the Packforsk project people to refrain from performing time studies, since that would cause unnecessary concern among the workforce to be studied.

For some reason not disclosed in meeting documents or by the informants, lettuce was selected as the product to be used in the pool system test.

The planning included many activities: instructions for packing, invoicing, tray deposit administration, return transport handling, cleaning etc. The initial intention had been to run three or more parallel test flows, one in a densely populated region, one in a more rural region and one business-to-business (e.g. from grower to processing company or from grower to a catering company.) As described below, the ambition level was reduced to one business-to-business test and one test flow to a densely populated region (Stockholm).

At the beginning of the test planning process, there was plenty of enthusiasm and many interested growers who were willing to try a pool system. The distribution centres were more reluctant. At the ninth working group meeting on August 23, 1993, it is clear that the first test efforts during the summer had failed for several reasons. One was the weather; the growing season in 1993 turned out to be rainier than usual, causing less income for the growers and hence lower interest in participation in a test.

Other problems, even more severe, were caused by the distributors and the retailer distributors. One large distribution centre decided to step out at a late stage, and a new alternative had to be identified and persuaded to participate in the middle of the summer. During the discussions with different possible distribution centres, one of them demanded to be paid by the project to participate. Another distribution centre refused to send trays if they had to manage the deposit administration, while another distribution centre had no problem with that. Other potential distribution centres turned down the proposal of being part of a system test due to organisational changes or transition to new IT systems.

At the end of the summer, the working group concluded that it would have been possible to run at least one of the test flows – the business-to-business

test – but there had not been any time available for data collection due to all the problems of starting the other test flows.

The working group decided to continue the system test efforts after the lettuce season. New products were selected (consumer-packed carrots and potatoes from the island of Gotland in the Baltic were sent in system test flows during September and October 1993 to the Stockholm region). New growers, distributors and retailers had to be identified, contacted, informed and finally made to agree to participate. With the new experience from the failures in the summer, it was possible to accomplish this new version of a system test. In December 1993, the working group had collected enough data for the four consequence analyses, including a video documentation of harvesting, packing, and distributing carrots all the way to the retail shelf.

By then new problems emerged, e.g. the cooperation with Packforsk concerning their part in the reporting that turned out to become a crisis. Packforsk demanded to get paid in advance, before supplying their share of the reports. The working group was not willing to pay for something before they had been able to read it and accept it. On top of that, lack of money became an acute issue. The consultancy costs for the test failure during the summer and costs for trays had consumed a large part of the test budget. (It is worth observing here that Perstorp Plastic Systems did not sponsor the test trays. The people involved from Perstorp had to negotiate internally to receive a discount on the price of trays.)

By the summer of 1994, the consequence reports were finally completed, the financial problems solved and the test reports, including the report made by Packforsk, could be submitted to the governmental sponsors, Nutek and the Occupational Health Fund. The analyses showed that it would be possible to introduce a pool system that would have no severe negative effects on logistics, the economy, ergonomy and the environment.

The economic consequences analysis showed that the growers, manufacturers and fillers would be the actors who made substantial savings, while increased costs for packaging handling affected the economy of all the other actors along the supply chain. The working group concluded that this upcoming economic unbalance could be managed in the ordinary commercial negotiations.

4.3.4 Five missions completed

Initially, in 1992, the most important issue to start with was to make sure that all group members were equally aware of the potential of the pool concept. The overall objective was to create a packaging system with lower total cost for the supply chain. For this reason, the first mission was to sell in the vision of the pool system potentials. This effort started already at the information meeting in Stockholm in April 1992. During the first working group, all meetings included learning, since meetings were held at the participants' respective organisations or at one of the members' organisations.

Examples of such learning occasions are one meeting at a large retailer's central warehouse in February 1993 and the visit in June 1993 to one of Sweden's most successful lettuce growers. This type of study visits enabled the participants in the working group to get a broader picture of the complexity of the supply chain, especially in terms of packaging planning and handling.

It was, however, the study trip to Austria that was the most important milestone for accomplishing the first mission. The chairman of the first working group concludes that the Austrians actually had managed to get started, to roll out a system, and it was impressive that they had also managed to include a half-size tray (300 x 400 mm) that was compatible with the standard tray. But the Austrian system was not good enough to be copied by the Swedes. They identified flaws, primarily the hygienic aspects of cleaning the trays, which could not be accepted in Sweden.

The second mission – planning and performing the tests, including project financing – has been described above. The third mission was initiated in the summer of 1993, when three members of the working group were asked to look at the design of an administrative concept for a pool system. This task group maintained the basic prerequisites that had been decided very early in this process: the pool system must be commonly owned by the stakeholders, deposit-based, non-profit and must provide full transparency for pool system members. At a meeting in August 1993, the working group discussed the report from the task group. The need for initial capital had been identified as one determining factor. Seasonal variation in the need for packaging was another important problem to solve before starting a pool system. The working group accepted the proposal to create an

administrative depot, but not to plan and build any new physical depots or warehouses for empty packaging. The working group also concluded that at that stage, there was a need to contact legal and financial expertise so as to be able to get on with the planning of the administrative system in order to design a concrete proposal for a pool system. But at this point, the test problems took up all the energy of the working group, so this task was put aside and not addressed again until very late in this process (in 1998-99). It must be noted here that IT related issues were not discussed at all.

The fourth mission, to design a European, material-neutral and functional standard for half pallets was a short mission, which was finished in early 1994. One person took the lead in this mission, used the working group as a reference group and then sent in an application for a functional standard to the national standardisation organisation. This mission did not cause any conflicts, since it was fully understood that a functional standard would form a cornerstone in the upcoming tender process.

4.3.5 The proposal for a pool system was turned down

The fifth mission – to develop a returnable tray for vegetables at the request of the Swedish Board of Agriculture – became a follow-up analysis activity to the system tests. In November 1994, a report was published where the growers declared that they were ready to start and manage a pool system that could be used by other stakeholders, e.g. the meat industry, the dry grocery manufacturers and the bakeries.

The logistics prerequisites for this proposed pool system were a minimum level of 1.5 million trips per year, with a high-season circulation speed of 2.5 weeks, resulting in a need for 130,000 trays in circulation. The overall conclusion, however, was a minimum need of 200,000 trays in order to have an acceptable back-up in the system. In that report, the recommended tray type is a rigid, 90° wall design with no capacity for space reduction when empty. It was calculated that the economy would be acceptable also with this tray design. The growers' proposal also included returnable half pallets and the option of including other tray sizes, primarily a compatible half-size tray (400 x 300 mm) but also full-size trays with different heights.

At the beginning of 1995, the manufacturers and retailers were invited to a meeting at the Federation of Swedish Farmers' headquarters in Stockholm. The growers' association made a presentation of the proposal for a pool system. At this meeting a new logistics manager at one of the retailers

turned down the proposal, and the other participants from manufacturers and retailers decided to agree with him. The informants who had been involved in Mission 5 and were present at this meeting describe their disappointment at that response. They point out this logistics manager as the man who stopped the development process, resulting in the closing down of the first working group.

When I contacted this logistics manager in May 2005 to have his view of what occurred, he explained that the retailers saw an upcoming threat where several food sectors would introduce their own returnable trays, causing much extra handling in the stores. He felt that the vision of creating a pool system jointly owned by the manufacturers and the retailers and providing one type of tray for the whole business was the optimal solution.

4.3.6 Early closing on system and product requirements

As early in this development and decision process as 1992, both system and product requirements were discussed and decided on; this was not, however, documented exactly in the notes taken during the meeting. Some of the informants mention this but do not reflect on the consequences.

On the system level, the requirements were based on having an open-loop pool system, where all parties must be accepted as pool members. All packaging items sent out from the pool company should be accompanied by a deposit in order to achieve high circulation speed and reduce the risk of losing trays. The option of inviting a third-party pool operator was discussed, but the suggestion was turned down. The reason for this was that the stakeholders wanted to have full visibility into and control of system cost and performance. Finally the cleaning of used crates was identified as a high-priority system requirement.

On the product level, footprint dimensions for the trays were set to be 600 x 400 mm in order to be compatible with the European standard pallet modules. The trays should be made of 100 % recyclable thermoplastics (high-density polyethylene or polypropylene). The trays should have functions aimed at reducing loading space when empty. The design was to be a stack/nest function based on a 180º rotation of trays. For quality and hygienic reasons, the foldable or collapsible and bale-arm stack/nest tray designs were excluded.

4.4 The second working group's activities during 1995-1999

One of the informants, who had a central position at that time, remembers that the retailers and the manufacturers took over the initiative from the growers almost directly after the meeting at the Federation of Swedish Farmers' headquarters in Stockholm in early 1995. The first step was to form a new organisation to continue the process of defining transport packaging for the Swedish food supply chain. The focus was on both trays and pallets. During the spring of 1995, the informant reported on meetings attended by a large number of representatives from retailers and manufacturers that had been invited.

There is no documentation from these meetings. One of the informants provides this description of the very beginning of what would become a year-long and cumbersome process:

"We managed to attain a large group, and at the first meeting – we were running the meetings quite informally in the beginning – we asked the participants to submit all their existing specifications of requirements on their present tray systems. That way we would have something to start with. /……./ So I asked them to submit their specs, to allow me to make a compilation. After that we could have a new working meeting. Guess what was sent in? Drawings. Exclusively drawings. Not a word in text. It turned out that no one had a written specification of requirements! The drawing was considered a specification."

Later on in 1995, two interest groups were formed, one for trays and one for pallets. This case description focuses on the group for trays. The first meeting document is from August 24, 1995.

The group, subsequently called Working Group 2, accomplished the three remaining missions in this process:

6. *Develop a specification of the requirements placed on a business-wide, returnable tray, followed by a tender process (1995-1998)*
7. *Perform an environmental evaluation of a plastic tray (1996-1997)*
8. *Design an administrative concept for the pool system, form a part-owned pool company (1998-1999, continued from Mission 3).*

4.4.1 Mission 6, developing a specification of requirements

At a meeting on August 24, 1995, a first version of a specification of requirements was presented and discussed. It consisted of 34 commented requirements. The next version available as a processed document is dated December 6, 1996. It is divided into five subtitles (General, Product, Handling and Logistics, Marketing and Sales, and Hygiene) containing 41 requirements. A third version, dated January 27, 1997 seems to be the final version accepted by the working group at this stage. It contains 46 requirements. (The three versions are attached in Appendix Three, together with the fourth and final specification of requirements.)

The third version differs from the earlier two, as it specifies that 10-11 requirements should be met by the packaging suppliers on proof of test evidence. (The learning process in connection with the process of defining the specification of requirements will be discussed in Chapter Five.)

In between these three versions, many events took place. It seems to have been possible to define a large number of the requirements unanimously. However, the formulation of a few of the requirements seems to have caused conflicts between different product sectors. These problems will be described here. The aim is to provide the readers of this thesis with an "inside" view of how discussions resulted in tests, which provided new – in certain cases unexpected - insights that finally resulted in the third version of the specification of requirements.

Notes from the meetings are only sparsely available for the activities that took place in between the first three versions of the specification of requirements. During the interviews, the informants provided their descriptions of a number of events that took place throughout the process, in particular between the third and the fourth versions of the specification.

When this mission was initiated, the working group was more of a reference group. One mailing list of over 40 people has been found.

In 1995, after having found out that no one had any written specifications, the next step was to start the formulation of a specification of requirements. All participants were asked to note what requirements were prioritised by them. The retailers agreed to demand modular adaptation based on the 600 x 400 module. From that module, the other requirements would be successively added. Some of the informants describe the strategy as follows:

"And when we identify that a requirement from one party is conflicting with a requirement from another party, then we have to analyse the possibility of reconciling the different demands. We were focusing on the functional requirements. We just wrote it up, and it went quite well. It [the tray] *must meet physical limitations in warehousing, it cannot have more than a certain maximum height etc., and it must withstand a certain level of heat and also cold temperatures. It must meet the standard requirements on drop tests in cold temperatures."* This informant worked for the retailers. ('Functional requirements' can be explained as the functions expected to be fulfilled by the tray design. The working group decided to leave the challenges of the technical design to the manufacturers of plastic trays. Proof of all functions in place should be provided in defined standard tests.)

Another member of the working group, a representative of a number of manufacturers in one business sector, describes the process of formulating a specification of requirements like this:

"There were a lot of views of the design of this tray. And I thought that some of the views were very irrelevant. That is likely to happen in a situation where many different business sectors, characterised by their own history, their own culture, try to force their own system [requirements] *into the new concept. Then it is important to adopt a humble attitude, and for our products that was very easy. Our products can withstand mechanical stress, warm and cold temperature variations and so on. It is not like pâté… And further on, there was the requirement that a system for returnable trays must have better environmental properties than the existing one-way cardboard boxes. And the customers must like it. In fact, there were three* [overall] *aspects: it must be better for the environment, not more expensive than the existing system and the customers* [the retailers] *must accept it."*

One informant, who represented the manufacturers in the early stages but today represents both retailers and manufacturers, contributes his view as follows:

"From this perspective, when designing a common system for the whole food sector, making compromises was in focus. The retailers wanted a tray that could be used for many different types of products; they wanted one standardised tray in the stores. And there the difficulties start. The retailers want as few tray types as possible, and they must be as simple as possible to handle. And then we looked at different tray designs. The meat industry already had one tray, the 180º

rotation type. So it was already established. The bakeries had a rigid tray, and one can assume that the retailers did not want a rigid tray; they needed something nestable, which was their principal requirement. They focused on minimising space for return transports to the distribution centre. On top of this there were all the product-specific requirements, due to the large variety of products to be packed in the trays. Chilled, hot, consumer-packed, non-packed etc., and then this problematic process with conflicting views from different business sectors began."

One of the informants from the packaging industry provides his experience of multi-party based processes with the task to define consensus-based specifications of requirements:

"There are certain criteria which must be included in such a specification. Which type of product will be packed in the transport packaging? How much do they weigh, which type of logistics flow, transport distances, display aspects of course, in-store handling, ergonomics, design – exterior design. All that must be included. You must list all the requirements and weigh them against each other. Because when you design a system for transport packaging, there will always be compromises. And weighing requirements concerning compatibility with other packaging systems and so on. And then you design the packaging, while following the weighing list you have set up."

In order to increase the speed of the process of developing and deciding on a specification of requirements, the retailers and manufacturers decided in August 1996 to form a smaller working group consisting of eleven people, representing the retailers and manufacturers. The growers and the transporters were not represented, but people from the growers' associations were on the large mailing list. The people on the mailing list were to form a reference group.

Three participants from the first working group (1992-1994) were included in the new group. Much of the study visit strategy applied in Mission 1 was repeated. (It must be noted that throughout the lifetime of the second working group, a number of study visits were accomplished, both domestic and international.)

Test packing to define tray heights

During the discussions in 1995 and 1996, the working group concluded that there was a need for three heights for the 600 x 400 tray. The option of formulating a specification for a half-size tray (400 x 300 mm) was on the table now and then, but the working group decided to leave this option, preferring a low-height tray to a high-height half-size tray. The reasons for not having a half-size tray were:

a) the risk of problems with compatibility and stability when stacking full-size and half-size trays together in distribution centres, and

b) the group's ambition to introduce as few tray types as possible.

The overall aim during the definition of tray heights was to achieve full pallet load heights that could allow one pallet load to be stacked on another. This would increase capacity utilization in the trucks considerably. The normal situation in the existing system was to load transport packaging on pallets to reach a total height of 1.80 m. With two pallet loads with a height of 1.20 m each, resulting in a 2.40 m total height, the height capacity in the truck can be fully utilized. This was also discussed from an ergonomic perspective, as 1.20 m pallet loads are safer to unload in shop-floor handling. (IFA report, 1994)

At a working group meeting during a study trip to Finland in August 1996, it was decided to start a project to test how the most frequent products would fit into different tray heights. First, a test was designed and accepted by all participants. During October, a large number of test packing operations took place all over Sweden. More than 200 different products were included in the test. In order to achieve a unified height on loaded pallets, as well as acceptable fill rates, the following three heights were proposed and agreed upon in November 1996: 110, 140 and 165 mm.

In January 1997, the heights were described as 125, 155 and 180 mm. However, these dimensions refer to the same tray heights. At a late stage of this research project, one of the informants explained that 110, 140 and 165 mm refer to the maximum filling height, while 125, 155 and 180 mm are the total heights of the same tray.

It should be mentioned here that the trays now in operation in the Swedish pool system have the following total heights: 106, 167 and 199 mm.

Drained or closed tray

Another issue was the conflict concerning the physical design of the tray. Should it be drained, allowing liquids and vapour to be evacuated, or should it be closed to avoid the risk of liquids contaminating other packaging? This issue caused many time-consuming discussions that finally led to tests in order to explore if the arguments against a perforated tray were valid. Two of the informants gave their versions of this decision process. One of them has been selected to describe their views:

"… there were those who wanted a closed tray and those who wanted a perforated tray. That was a gigantic issue, because the meat industry wanted a closed tray, because if a package broke, the meat juice would leak through a perforated tray and contaminate other products. There were lots of discussions about this. But they were the only ones who wanted a closed tray. The others preferred open trays, otherwise their products would deteriorate. We came to the conclusion that it is not a tray problem if a meat package breaks. The meat industry had to check their product packaging to be sure that they the packages would not leak. The problem must be solved at the source, so to speak. And the result was that a perforated tray was OK for everybody."

The meat industry forcefully pursued another argument for closed trays, when they stated that the cold temperature would be kept in a closed tray. This argument was tested, with the following result:

"One of the meat guys put a thermometer in a closed tray and a thermometer in an open tray, both loaded with packed meat. The two trays were put on a distribution vehicle during a delivery tour. The doors of the truck were frequently opened, so the cold temperature was allowed to run out of the open tray. This was clear when the temperature was measured. There was a difference of one degree in favour of the closed tray. The closed tray was +8° C and the open tray was +9° C. But it turned out that the big issue was that, according to the regulations, the temperature should be a maximum + 4° C. So this was not a packaging issue. To lower the temperature by four degrees, you must take other types of measures. And when those efforts are implemented, closed or open trays are not an issue any more."

Earlier in this section, one of the informants concluded that a great deal of the discussions during the compilation of the specification of requirements was focused on irrelevant aspects. One such aspect was the iterated issue of selecting the colour of the tray. Finally the working group managed to postpone that decision, with the help of the packaging suppliers, who assured the members that the colour issue could be decided at a very late stage before the start of the production. Another such issue was the design of the handles whether they should be perforated or non-perforated. The solution of this issue was also to postpone the decision until the final design was set.

Confrontation between meat & cured meats and fruit & vegetables

As early as the autumn of 1995, the working group experienced that there were two conflicting parties in the process of formulating a specification of requirements for the trays.

The logisticians representing the meat industry, including cured meat, had a number of warehousing and distribution projects that were in their late planning stages, which caused stress concerning early decisions on e.g. tray heights that would fit into automated handling equipment. They argued loudly for their arguments. Tray height was one such issue, but the other one was even more critical, concerning closed or ventilated/drained trays.

The logisticians representing fruit and vegetables often found themselves in conflict with the meat industry.

At one meeting, the working group concluded that two questions must be used as "facilitators" when making decisions in situations where meat and fruit & vegetables could not agree:

1. "Which of these two product groups has the largest need for/use of a common tray?"

2. "Which of these two product groups has the largest product volume?"

Planning the tender process

In parallel with the process of defining a specification of requirements for a family of trays, the working group planned the tender process and established contacts with possible tray suppliers.

Notes from a telephone meeting in December 1996 describe the overall objective of the tender: *"a tender has to be so detailed that the manufacturers can make offers that are exact in terms of price and delivery time/punctuality."*

In early January 1997, the working group decided that offers should be submitted by April 1, 1997. The tender would be sent out to plastic manufacturers as soon as they had decided on the following aspects to be included in the tender:

- tray heights

- final formulation of the specification for requirements, including a test programme

- number of trays needed

- time plan for the production and implementation

In February 1997, a fax was distributed by the project leader to the members of the working group informing them of a "best case" time schedule. According to that plan, the trays were to be put in operation in December 1997. Before the next meeting in March, the working group members were asked to provide their best estimations of the number of trays needed in each business sector. One large meat manufacturer reported in March that they needed trays by the end of March 1998. After having collected the estimated tray needs from all the business sectors involved, the working group decided that the objective should be to have 70,000 trays on the market by February 15, 1998.

A negotiation group was formed. Their task was to be prepared to negotiate and to have prepared a contract with a supplier by August 20, 1997. This negotiation group consisted of three men, one logistician from the meat industry with a high reputation among the other actors in the working and reference groups; one purchasing manager from the same meat company and one purchasing manager from a bread company. A few weeks later, the

man from the bread company had to leave this group, since this task was not accepted by the management of the bread company.

At the early stage of the tender process, during 1996, the working group established a dialogue with plastic manufacturers. The reason for this was to keep in touch with product specialists to make sure that the specification of requirements that was in process would not cause any unnecessary increased costs due to a lack of product knowledge in the working group.

Later on, probably at the beginning of 1997, the first version of the specification of requirements was translated into English and distributed to a large number of identified manufacturers of trays in Europe. They were invited to meet with the working group and show their existing products and to give information about their new product development in this field. After the first meeting, where both Nordic and Continental manufacturers were present, two manufacturers on the Nordic market seemed to be considered the most interesting possible suppliers. These were the Norwegian company Dynoplast and the Swedish company Perstorp Plastic Systems (now Schoeller Arca Systems).

One of the informants gives his view of the reason for this early dialogue with suppliers of returnable transport packaging:

"This was a first step, because we wanted to know what was available on the market, and learn more, because we had realised that we needed input from those who could produce trays in order to have a feasible specification of requirements. We just could not sit by ourselves and compile a set of requirements that later on would be technically impossible or too expensive to meet with. And maybe there were other smart things out there that we had not considered." - - - - "About eight companies came up [to show their products at a meeting in Stockholm]. *We listened to their presentations and concluded afterwards that none of them had a tray that complied with our requirements. None of the trays lived up to expectations. And that was fortunate, a bit what we had anticipated before the presentations. We got the confirmation of how difficult this is, and how special we were. (Laughs)." - - - "We thought that we were smart, at least I thought so personally, because we gave all interested suppliers the same opportunity to participate in the tender process. This was very early, long before the test packing. At that stage no one had a tray ready for multi-product purposes."*

During the next few years, up until 1999, the companies Dyno and Perstorp were frequently invited to show their latest designs for a 180º stack/nest tray and give the working group their views concerning the choice of tray heights as well as closed or ventilated tray and handle design.

The large test packing effort in order to decide on tray heights was performed by Perstorp Plastic Systems. One informant explained that Perstorp were asked to perform that test because they had year-long personal relations with the logisticians at all large food manufacturers in Sweden.

Cost calculations were performed by a man who was a newcomer in the working group. The overall result, which was distributed to everybody involved, showed that a total of SEK 70 m would be saved per year within the Swedish food supply chain if a pool system for transport packaging were introduced. The informants have made disparaging comments on these cost calculations.

One informant felt that the calculation was based on a cost comparison for cardboard boxes that was 75 % higher than their actual price for cardboard boxes. Another informant said ironically that *"this business is totally relieved of making follow-up statistics on product quality, waste and other quality parameters"*. He claimed that it was impossible to perform a reliable cost calculation at that time – and it is still impossible today, due to a persistent lack of available and reliable follow-up statistics on total logistics costs for the supply chain.

In order to support the calculation, however, there had been some efforts to obtain the operational costs for the meat tray used by Transbox in Finland. Those figures are attached to the notes from one of the meetings.

One informant states: *"If we look at some of the most prosperous retailers in Europe, as Albert Heijn, Tesco, Sainsbury; - take Tesco and Albert Heijn, both of them are busy in major roll-outs of these systems* [he refers to company-internal pool systems for transport trays]. *We talked with the companies that delivered trays to these two retailers. One was Wavin and the other was Paxton. And there was a third one in the UK, Linpac. None of them were capable of delivering trays to a Swedish project. Not for many years. This proved to us that there must be something in it, otherwise these large retailers would not have made such considerable investments in returnable packaging." - - - "We can't just say that they have made the wrong calculations."*

It must be noted here to guide the reader that the second generation of bale-arm stack/nest trays for Tesco was not available to other customers at this time. The plastic tray manufacturer Paxton (now part of Linpac) was not allowed to show the new design. One informant described the situation: *"We missed the Tesco tray. It was launched six months later, and we missed it."* ---- *"Before that* [the launch] *it was top secret, being an exclusive Tesco project."*

Somewhere at this stage in the tender process, one or several of the actors identified a new type of tray, which was only available on the market in the spring of 1997. As the events from then on determined the outcome of this development and decision process, the continued story can be read in section 5.5 after a presentation of the remaining two missions.

4.4.2 Mission 7, Perform an environmental evaluation of a plastic tray (1996-1997)

The informants, who entered into the process when the second working group was set up, describe how they perceived this development process as environment-driven, at least from the beginning. The environmental issues were frequently discussed and there was an agreement concerning the need for establishing evidences on the anticipated less environmental impact as a result of a shift from one-way to returnable transport packaging.

At this stage, the packaging industry – both cardboard and thermoplastics – took a common initiative when contacting the packaging professor Gunilla Jönson at Lund University. The packaging industries were interested to participate with their facts and figures to perform an LCA – Life Cycle Inventory Assessment – where the environmental properties of one-way packaging and returnable packaging would be compared. (Consoli et al, (eds), 1993)

In the large reference group there were some doubts about the selected research method. One retailer representative raised objections against the selection of the LCA research method. He recommended that an additional effort should be made, based on *"scenario build-up or thermodynamic derivation, based on logic reasoning rather than 'drill of figures', which allows for further development and is easier to follow and understand for most people, than is an LCA."*

At Lund University, a number of M.Sc. students were given this task as their master thesis projects. The result of the studies showed that it is

impossible to compare two packaging systems; the packaging material is just one side of many influencing aspects. The LCA revealed that the distribution system properties and transport distances are the diverging aspects concerning system environmental impact. (Jönson, 1997)

Later, in September 1997, an environmental consultancy presented their investigation concerning the environmental considerations, which was not based on an LCA study. Instead, they had performed a value-based analysis, resulting in the conclusion that returnable packaging could be accepted based on the society values concerning resource management. There are no comments in the interviews or in meeting notes concerning the decision of inviting this consultancy. One informant has provided his hand-written notes from the meeting where the report was presented. From the notes, it can be concluded that the consultancy was using the four principles declared by "The Natural Step" (Swedish: Det Naturliga Steget), based on thermodynamics and the belief that the society must be based on non-fossil, renewable natural resources (Holmberg, 1995; Upham, 1999). The reaction from one member of the reference group against using LCA as the evaluation method mentioned above, had probably resulted in this initiative.

4.4.3 Mission 8, Designing an administrative concept for the pool system, forming a part-owned pool company (1998-1999, continued from Mission 3)

There is just one documented piece of evidence of how this mission was taken up again. The informants do not provide any background details; they talk about the formation of the pool company and how the people already working for the pool company were also involved in the working group activities.

The first working group had made an analysis as early as 1993 (see 5.3.4), but at that stage the problems concerning the system tests took up all their time and energy, so this mission was postponed until late 1999-2000.

During the autumn of 1996, the effort was resumed, and the first steps were taken as the company Svenska Retursystem AB was formally created on November 1, 1996, with 50/50 ownership shared by the manufacturers' association DLF and the retailers' association Dulog. The new company was officially registered by the Swedish Patent and Registration Office

(www.prv.se) on January 1, 1997. During 1997 two subsidiary companies were formed, one for managing trays and one for managing pallets, but these two companies were closed down already in 1999. At that time there was a decision to keep all activities within the same administrative body.

In notes taken during a meeting in May 1997, there is a report from a group called "Rules and Regulations Working Group", which worked in parallel with the tray and pallet working groups. There is, however, no information about what type of report was given.

The board of the new pool system company started working on the formulation of rules and routines for the pool system. This effort in combination with the purchasing activities took up most of the time of the manager of the pool company during 1997-1999. The build-up of an administration system, the identification of a state-of-the-art cleaning technology to be implemented in a new plant in Helsingborg, negotiations with transporters and financing the purchase of trays and pallets are some of the activities described by two of the informants with a good insight into this process.

The informants describe how IT-related problems occurred when the pool system was launched in 2000. As that problem falls outside the scope of this research project, it will only be mentioned here as information to researchers who are interested in follow-up research on the planning and implementation of the pool system's physical and administrative operations.

4.5 "…and then came the U-turn."

During the spring of 1997, the working group came closer to deciding on a final version of a specification of requirements (see the four versions of specifications in Appendix Three). A new design for a 180º stack/nest tray was emerging, with a space reduction capacity of 50 % when empty nested. All parties seemed to be satisfied with this solution. What happened then is described by an informant in the following way:

"The meat people were happy, of course. And nobody else disapproved. The restaurant people said, we will have a tray – that's good. The retailers were happy, too, as long as liquids could be evacuated from the tray. Everybody was happy. Then I went to Transpack. In Brussels. I had been there to make a speech. So the year after, I went there, too. And then I met two gentlemen from

Paxton. They had paid a little to display their new trays. And I thought, this was funny, they had a tray with something called 'dual height'. It was a low tray. I got two of them, and checked them in as hand luggage and brought them home. The thing was that that the bale-arms could be adjusted in triple heights, and when empty the trays had a space reduction capacity of 90-95 %." ---- "As a matter of fact, I brought them home more for the fun of it, and I showed them at a meeting, and then they were put aside together with lots of other examples of tray designs. After a while, I don't remember exactly, I got a sort of aha experience, and I decided to invite a few people from the retailers to have a look at these trays." - - - -"And I felt that this will be a tough job; are we going to make a total turnaround in this project now? Because [at the retailer meeting] we all agreed that this was the tray we wanted. There was one guy from COOP's store development department; when he tried the bale-arms he concluded 'wow, you can lift the tray by the handle', thus enabling a daily relocation in the refrigerated display counters. Such handling was extremely difficult, as you couldn't get a grip of the trays. This was perfect. And another guy put the trays on top of each other and concluded that this was leaner than the other [trays], *this is perfect." - - - - - "There was a total revolution. Because there the retailers said: 'we want to have this type, it should be a bale-arm tray and it compresses 95 %'. And it doesn't matter how we calculate, because if the retailers conclude that 95 % space reduction is OK, then we had no choice, we had to switch over to this track."*

After this meeting, a study trip to England was planned in June 1997. A group of people from the working group and the reference group as well as some interested private owners of large stores participated; they came back filled with enthusiasm and were even more convinced that they preferred the bale-arm tray design. An evaluation report dated August 26 sums up the discussions at a working group meeting a few days earlier*: "At the working group meeting on August 20, the English system was emphasized as a possible principal alternative in the evaluation of tray systems. One of the reasons for this is that the trays compress double the capacity of other comparable systems."*

Several of the interviews confirm the anxiety expressed by the informant above concerning the risk of a total turnaround at a late stage in the development process. The other informants describe the situation as a u-turn (in Swedish 'kovändning'), or said that *"it went from evolution to revolution".*

However, this event did not totally upset the still ongoing arguments concerning a closed or ventilated tray design; nevertheless, further tests that supported the ventilated tray alternative had been performed during the summer.

The solution in this new situation was to evaluate two trays with a 180º design (Dyno and Perstorp) and one bale-arm tray (Paxton) and at the same time evaluate the issue of closed or ventilated trays. The participants in the working group were given three evaluation checklists (see Appendix Four) and were encouraged to make quantified evaluations that would facilitate system comparisons.

On September 1, the pool system company sent out a fax to the working group members, where the chairman and the vice chairman of the company urged the working group to consider the advantages for the entire business sector when they evaluated the tray systems. They emphasised that everyone must pay attention to what was best for all of them, or otherwise the whole project would be at risk.

The results of the evaluation showed that the parties had not listened to the urgent request from the pool company:

-The bread sector could not accept any of the tray systems as being suitable for them.

- The retailers concluded that the Paxton tray was their choice and were in favour of a ventilated tray.

- The fruit and vegetable wholesalers concluded that they were in favour of the ventilated tray and that the Paxton tray was by far the most efficient one due to its space reduction capacity. One calculation example was provided, showing that the fuel consumption would be reduced by 50 % for the return transports of empty trays. One wholesaler asked for more facts based on an objective comparison concerning fill rate, space reduction capacity and distribution costs.

- The business sector for cheese preferred a ventilated tray with a closed bottom and a non-perforated handle. Furthermore, they wanted a more solid basis for a decision in terms of environmental impact, economic consequences, views from their own sales force, staff, unions, occupational

health ombudsmen etc. They also requested guarantees concerning the availability of trays. Finally, they wanted to go to England to see the Paxton system in daily operation from manufacturer to store/consumers.

- The restaurants and catering kitchens replied that they preferred tray alternatives from Dyno and Perstorp. Paxton's trays were not recommended, since they have disadvantages in terms of moving details and nooks that are difficult to keep clean. They preferred both closed and ventilated trays.

- The meat and cured meats business sector concluded that they wanted to adhere to the original specification of requirements. The arguments against the Paxton tray were that it is difficult to clean, and not possible to interstack with cardboard boxes, that it is to weak for industrial handling, that chilled air will pass out through the perforations of the ventilated tray, that meat freezing requires that all meat must be packed in plastic bags, which will cling to the meat. They concluded that if the Paxton tray were elected, extensive problems would generate amounts of extra work for the meat industry. Instead, they preferred the closed 180 mm tray that Perstorp had designed. Attached to their response is a letter from a top veterinary at a large controlled abattoir as well as a statement from the National Food Administration. A state inspector, who had been given trays from Paxton and Perstorp, concluded that Perstorp's tray fulfils the legal requirements concerning ease of cleaning, while Paxton's was turned down as it seemed difficult to clean and not suitable for the handling of intestines, meat and cured meat.

- The dairy industries pointed out that modular adaptation is important, in particular for special products. They were in favour of a returnable tray from an environmental point of view, but they also thought that the energy and chemical aspects in relation to one-way packaging needed further investigation. They preferred the trays from Dyno and Perstorp , but the space reduction capacity of the Paxton tray was a primary argument. Furthermore, they also pointed out that the economic consequences must be given a deeper analysis. The upcoming CCG standard was also mentioned as a reason for further analysis of consequences, since that standard may be implemented on the Swedish market.

The working group met again on September 15 to sum up the results from the evaluation and to make a recommendation to the board of the pool

company. The working group recommended the Paxton MaxiNest tray system. This recommendation is based on a better total economy due to less transport kilometres than with other tray systems. It is also pointed out as an environmental advantage. A more sophisticated cleaning facility would be required, resulting in the need for a central washing plant. The working group recommended ventilated/drained trays. Finally the working group recommended that a new tender including the new prerequisites should be sent to the tray manufacturers. The letter to the board of the pool company includes a reservation from the meat industry where they say that they can understand the logic of the reasoning of the other members of the working group but that the meat industry cannot agree with this recommendation *"based on negative handling and business economy consequences in their own operations".*

At the end of September, the working group was informed that the board of the pool company had not been able to make a decision concerning the choice of tray system. The board hesitated for several weeks – and during the coming months. The reason is partly described in documents and in the interviews. Many of the manufacturers, with the meat industry at the front, had strong objections to the bale-arm tray system. They wanted to continue the tender process with the 180º stack/nest tray system.

In mid-November, the working group was informed of the events at the pool company. By then the board had decided to invite a logistics consultancy. The assignment was described in notes from a meeting as follows: *"investigate why it has not been possible to make a decision concerning a tray system and identify further needs in order to be able to make a decision."* As time was running out, the consultancy was asked to report the result of this assignment at a meeting on December 16. By then, the board would have two alternatives:

1) follow the recommendation from the working group, or

2) give the consultancy a second assignment: *"to investigate which alternative system would be better for the Swedish distribution of fresh food products."*

In June 1998, a new tender was sent out. It provided a comprehensive background, describing the reasons why the Swedish actors had spent so much time on the decision process before this new tender was distributed. (A translation of the tender may be found in Appendix Five.)

The tender reports on decisions that were made during the first half of 1998. In May, the board of the pool company accepted the bale-arm tray system for the fruit and vegetable sector. The reason for this approval was based on the full agreement along the supply chain of fruit and vegetables, combined with the fact that this business sector had the largest product volumes.

In June, the bale-arm tray system was approved for dairy products as well as for meat and cured meats, since the complete supply chain could accept the bale-arm tray in order to achieve large-scale advantages.

These two decisions formed the basis for a decision to order a family of bale-arm trays with full compatibility for the whole food sector. However, there was still a request for a closed tray from the meat industry.

A total number of 1.6 million trays were ordered, with options for additional volumes amounting to 5 million trays.

Offers were given in August 1998 by Dyno, Paxton and Perstorp. The evaluation of the offers resulted in yet another evaluation process among the business sectors. The evaluation results showed that Paxton's offer was the highest in price and second best in space reduction capacity. Nevertheless Paxton was recommended, since it is a tray already in circulation in large volumes in an operational system in the UK. In addition, Paxton was the only company to offer a tray with two functional heights, the so-called Dual Height tray.

The evaluation and decision process went on until December 1998. At a meeting, it was concluded that there was no clear winner among the three offers. The working group found that all three offers would meet the specification of requirements. At this meeting it was decided to appoint a negotiation group led by the pool company's vice chairman. The assignment of that group was to select one or several authorised suppliers of trays to the pool company.

In May 1999, the working group decided to adjust the specification by reducing the number of requirements. There was also a decision to skip the total height as a definition. Instead the inner payload height was focused *"as being the most important for the product and thus the optimal system utilisation"*.

There was a discussion of the importance of introducing as few tray sizes as possible.

Finally, a decision concerning the colour of the trays had been taken. They are to be grey with differently coloured bale-arms to facilitate sorting different tray heights at the cleaning facility.

Compatibility was still a central issue. The meat industry pointed at the risk of transport damage if Paxton's trays were stacked in direct contact with cardboard boxes.

At this stage, the working group had realised that there was a need for a half-size tray as well, even if this option had been turned down in January 1997. Now the meat industry was showing an interest in a half-size tray, thus supporting the fruit and vegetables sector, which had been stating the need for half-size trays all the time.

(The new specification of requirements can be found as the fourth version in Appendix Three.)

In May 1999, the owners of the pool company provided the capital, credits, bank guarantees etc. required to sign the contracts for pallets. Later in 1999, the contract was signed with Paxton, cleaning technology was purchased and a site for the first central cleaning plant for trays and pallets was established in the city of Helsingborg in southern Sweden.

During the year 2000, the first returnable trays were put into operation. During 2004, 40 million tray trips were made. For 2005, it is estimated that more than 60 million tray trips will be made. During the first quarter of 2005, more than 12 million trays were used, the double number as compared with the same time period in 2004. It can be noted that 10 % of the trays that were used in the first quarter of 2005 were delivered to customers outside Sweden, both in the fruit & vegetables and in the meat & cured meats sectors (Svenska Retursystem AB, 2005a and 2005b).

5 ANALYSIS OF THE DEVELOPMENT AND DECISION PROCESS

First the informants' own descriptions and analysis of the development and decision process will be presented. They provide a well formulated and rich analysis, based on their own perceptions of being participants in the whole, or parts of, the process of defining the properties of a returnable tray for the Swedish pool system.

The next step in the analysis is to apply theories of product development and change management described in Chapter Two, Frame of Reference. Further on, a comparison with a large British retailer's process of developing a returnable transport tray will be made and commented on. Finally the research questions will be answered.

It must be repeated here that this thesis focuses on the qualitative aspects of the development and decision process, as it progressed from vision to decision. The system-level quantitative aspects concerning e.g. evaluations of logistics efficiency and pool system total cost analysis were agreed upon at an early stage in the development process.

5.1 The informants' own analysis

5.1.1 The development process

In the analysis of the comments provided by the informants, a pattern emerges. The answers to questions B1, B4 and B5 reveal almost identical opinions of how a similar packaging logistics development process should be conducted on the basis of the lessons learned in this process.

Question B1: *How did the early product development process work? If you did not participate in it yourself, how do you perceive that an early development process is conducted, how do you define a new type of packaging, e.g. a transport tray or a pallet?*

Question B4: *From where did the initiative to create a new packaging system come?*

Question B5: *From your point of view, who should be the driver of the process of formulating a specification of the requirements to be placed on a new packaging system?*

The answers to the question concerning the quality of the early development process (B1) show that the informants felt an increasing frustration with the low speed and lack of decision-making power within the second working group (1996-1999). The following are some of their most frequent comments:

"Very, very slow and sluggish process"
"One step forward and two steps back" – "Rambling back and forth"
"It went like one layer on the other, and then it started all over again"
"Took enormous amounts of time" – "Inquiries and tests took too long"
"Giant leap – stop – giant leap – u-turn"
"Iterative development process – and then came the revolution"

"DLF delayed - Dulog were skidding"

The informants make almost identical comments on the probable reason causing the problems (to be further discussed in section 5.2.):

"*Probable reason: insufficient support between steering group and owners"*

"Owners were indistinct".

The answers to the question that aimed at identifying the drivers of the development process (B4) show a larger variation. This can partly be explained by the fact that all the informants had not been involved in the whole development process.

The informants identified the following parties or factors as drivers of the development process:

Informant no	Consultancy	Perstorp	Business sector	Growers	Environment
1	X	X		X	
2			X		
3					X
4			X		
5			X		
6			X		
7				X	
8			X		
9		X			X
10					X
11			X	X	
12			X		
13 don't know	-	-	-	-	-
14			X		
Total	*1*	*2*	*8*	*3*	*3*

Table 5.1: Informants' views of what actors were the drivers of the development process.

The definition "business sector" includes both retailers and manufacturers, as six of the informants point out both parties as drivers. It should also be noted that three of the informants point out the growers as the drivers. These three informants were involved from the beginning in 1992 or entered the first working group. Environmental aspects (i.e. packaging waste legislation, reduction of emissions from transports) were also identified as drivers by three of the informants.

Finally, the answers to question B5 show that a majority of the informants have drawn their own conclusions about how to create efficient processes when developing future packaging logistics within their business sector.

Table 5.2 shows that most of the informants reached the conclusion that the process of developing new packaging logistics concepts must involve all parties along the supply chain in order to reap the optimum benefits of a new concept.

The value of applying this insight has been demonstrated in one of the papers appended to this thesis, Appended Paper Three, the IKEA tea candle case. When IKEA had identified a need for improving their packaging logistics concerning one of their high-volume products, they invited all the parties involved in the supply chain, from raw material suppliers, machinery suppliers to transporters as well as all internally involved departments within IKEA. That case also shows the impact and importance of performing pilot tests.

(The results from question B5 will be further analysed in section 5.2.)

Informant no	Multi-party process	Retailers
1	X, user focus	
2	X	
3		X and government
4	X	
5	X along the supply chain	
6	X but not only involving logisticians	
7	X	
8	X and retailer hands-on perspective	
9	X look at the interdependency	
10	X including the transporters	
11	X	
12	X	
13		X
14	X	
Total	*12*	*2*

Table 5.2: Informants' views of which actor should be the driver in a future development process.

5.1.2 The decision process

The answers to questions C9 and C14 have been studied for the analysis of the informants' views of the decision process.

Question C9: *From your point of view, how do you think that the other actors within the food supply chain have handled their roles in the decision process?*

Question C14: *What lessons can be learned from the decision process, internally and overall, respectively?*

One of the informants that had been more or less involved throughout the whole process from 1992 to1999 expressed his views by describing the initial situation as complex and difficult when the vision of the pool system concept was introduced to such a large number of actors. The process of gaining acceptance will be further discussed in section 5.2. The large number of stakeholders also resulted in the fact that a number of different opinions had to be processed in order to identify compromise solutions that a majority would accept.

What he described as even worse was that some of the representatives of the companies or the product sectors did not have the mandate from their organisations to participate in any majority-based decisions. This seems to be one of the causes for the iterative feature of the development and decision process.

Another aspect of the complexity was to communicate the results of the working groups' efforts to all other parties within the Swedish food sector – and the difficulties of receiving feedback from the parties. This informant commented that there was a high risk of controversy, since the information that was distributed was not read or taken seriously by all actors in the business sector.

It seems justified to add one comment made by at least six of the informants concerning their views of their corporate managements' interest in logistics. One of the statements provides a good example of these views: *"these issues* [referring to logistics] *are not considered to be very sexy, if I may say so – what kind of board members get excited by a pallet project!?"*

The informants who were in the position of having a good overview of the business sector, i.e. five of them, point at the lack of decision power among

the retailers. However, they cannot point at one specific reason for this hesitancy. They assume that the retailers' corporate managements were not committed enough to show the interest that would have been necessary to accelerate the decision process. Another assumption is that there was no demand from the customers (e.g. the retailers) that could be the facilitator of the process for the manufacturers. *"No-one was shouting out loud: we want this tray!!!"* as one of the informants described the situation.

This situation can be compared with the case of the British retailer described in Appended Paper Two (Jönson et al, 2005), where a member of the board of directors clearly showed his personal interest and commitment, thus supporting the process and empowering the members of the project group, both in their negotiations with the tray supplier and in their initial contacts with the first tier of food suppliers who were asked to deliver their products in the new returnable transport trays. The importance of top management commitment and support will be further commented on in section 5.2.

Two informants, both with a good overview and with leading positions in the business sector, pointed at one lesson to be learned from this process. One of them said: *"the largest risk is that only logisticians have been working with this. The marketing departments should have been invited; the process needed an earlier connection to the commercial forces."*

The other informant concluded: *"the logistics* [people] *kept working on their own for too long, we should have included the marketing aspects much earlier, and then we could have avoided the situation of not being prepared and ready later on."*

This may be considered as a paradox, since many of the informants at first said that the retailers did not show enough decision power. But at a late stage, it was actually the representatives of the retailers that created the "U-turn", as they identified the Tesco/Paxton tray design to be the best alternative due to its empty-space reduction features.

One frequent comment was that the informants saw the decision process as messy, and that the corporate managers that took the formal decisions were not fully aware of the consequences of their decisions. This will be further discussed in section 5.2.

The analysis of the answers to Question C14 (*What lessons can be learned from the decision process, internally and overall, respectively?*) shows that the informants seem to have drawn conclusions similar to those concerning the development process, i.e. the need for a holistic, supply chain perspective as well as dialogues resulting in majority-based decisions.

The need for a professional project management was pointed out by four of the informants. The project management should be responsible for the transfer of information, making sure that all the parties involved have access to reports providing the full picture. This view includes information transfer, not only to the members of the working groups but also to all the companies involved as members of the several product and/or business organisations (i.e. DLF, Dulog, the association of meat industries).

The importance of top management support is also emphasised, as is the need to make a careful selection of the members of the working group, including securing their mandates to make decisions.

It should be mentioned that the informants pointed at the learning issues as lessons to be applied to future packaging logistics projects. One informant made the following statement: *"Anyone who is inside the [packaging] system must understand it very, very clearly; everybody must understand the purpose of a pool system, i.e. the economy lies in the circulation speed of the packaging units."*

Finally, one comment concerning the frequent postponements of the time schedule*: "This type of business-wide projects must be allowed to take some time, you have to respect that".* This comment is confirmed by Håkansson and Johansson 2001 (see also 2.5.1).

5.1.3 Project financing

One aspect that is interesting to discuss is how this type of development process should be financed, and whether a certain design of financing solution would influence the speed of development and decisions.

The informants' answers to question C10 provide many arguments. (*Nutek and the Swedish Board of Agriculture provided funding for tests with returnable packaging during 1993 and 1994 (a total of approx. SEK 1.5-2 m.). Did these governmental funds have any impact on the decision process?)*

Nine of the informants were in favour of governmental funding, particularly at an early stage of a development process. On the other hand, five informants were against governmental funding. None of them could see that the early government funding in this process had any impact on the decision process.

The informants in favour of public funding put forward the following arguments:

"This is a large value chain where one individual winner cannot be singled out. The government has to take an overall responsibility, subsidize with money. Then, if there is an individual large winner, that potential winner must take the costs."

"…in some cases in new development processes there may be a need for governmental funding to get started, test an idea and show it to potential stakeholders who may be willing to provide funding for a large-scale implementation."

"Since a process like this is so time-consuming, there is a need for support to reach a general acceptance for a new packaging concept. From that point of view, the governmental funding has provided long-term payback."

"In general, I believe that when you look at research and future plans you need governmental support as well as support from the municipal level; otherwise the process will stop. This applies as long as it is a multi-party project. Later on, when it comes down to every single company, they have to pay. It is there and then that the actors must invest their own money. And it is maybe understandable that companies are a bit careful at the beginning."

"Yes, it helped to create those groups, to start a dialogue and have tests…the [public] *funds work as an initiator. Because what carries weight in this business is that one actor with a good idea, or one single company, cannot start a process like this and get the others to join in. (….) Our contribution - my working time - was what my company was willing to invest. And the same attitude was prevailing everywhere else among the actors; they provided man hours and technical resources, but no ear-marked money."*

The informants who were against public funding had the following arguments:

"I don't believe at all in governmental support! That is not good for creativity."

"If there is willingness, there is money. Compare with other industrial actors, e.g. Volvo and their suppliers; they form partnerships and work towards a common goal."

"Well… governmental support to…development work, development processes of any kind is important when there are no commercial drivers creating new prerequisites. However, in this case I am extremely doubtful whether it is needed. At that point in time, there were very powerful actors in favour of the production of the type of packaging system looked at here. There was a commercial interest among large manufacturers of trays who of course would have been given the opportunity to act. And supporting them [with governmental funding]*, why should that be necessary?"*

"…there must be a comfortable balance between the power of the market and the power of society, influencing the development. To summarise: it is good if the government provides support for a new development, a little money. And then, those who will profit from the new concept must do their share."

Kanter (1984) points at the importance of having the necessary funds before a change project is initiated. However, her discussion does not include the possibility of having public funding. She focuses on in-house sponsoring provided by "tin-cupping", i.e. begging, since the entrepreneur walks around in the organisation to win support for her or his project.

5.2 Analysis based on product development theories

The Swedish case shows that it is possible to manage a multi-party process and eventually reach the realisation of a vision. The actors all entered the two working groups with different ambition levels and time schedules based on their own companies' plans for investments in production, warehousing and distribution. Consequently the first challenge was to enable the actors to raise their perspectives from the company level to the supply chain level.

A skilled project manager is required to handle such group dynamics issues, where facilitating the process of being able to create a common group perspective on the supply chain level can be emphasised as a basic prerequisite for a successful multi-party development process. It must be

possible to apply the supply-chain level perspective in parallel with the various company level activities.

In the process described here, three or four people can be defined as having been project managers over the years. It is obvious that skill as a project manager is of great importance for the progress and success of a development process of this kind. The case documentation contains evidence of professional differences in the project managers' skills. Some of the informants commented on this, stating that some of the project managers were not capable of driving the process at such a speed that decisions could have been made more swiftly.

The organisation of a project team is part of the task of the project management within product development. Ulrich and Eppinger (2000) present seven criteria that determine the speed of obtaining the goals of the project (see 2.5.1). It must be emphasised that those criteria are not designed for multi-company product development processes along a supply chain. Such processes as the one described in this case study are more complex, since the project manager has to deal with a number of team members who do not work full-time with their assignments and who have other loyalties rather than reporting directly to the project manager, thus not always giving priority to the decisions made in the project team, etc. A proposal for a revised set of criteria is presented in section 5.2.1.

Negotiation skills are even more important in multi-party processes, where conflicting views must be handled. Project managers must keep their ears to the ground in order to detect early warning signals of upcoming conflicts and be able to sort out different views at an early stage.

On the basis of this case study it can also be concluded that the product development task gradually went from discussions of engineering details to the task of defining the tray functions to be solved by the manufacturers as they apply their professional engineering skill. This is a result of the team learning accomplished in this process. (Senge, 1990; Håkansson and Johansson, 2001).

5.2.1 Criteria for the planning of multi-party packaging development processes

After having analysed the case study in this thesis, a modification of Ulrich and Eppinger's (2000) seven criteria is suggested here in order to facilitate

the planning of multi-party packaging development processes along a supply chain:

1. Before starting the product development process, all parties involved must confirm their willingness, capacity and ability to take part in a multi-party development process that will require that everybody understands the demands placed by all actors along the supply chain.
2. Process ownership must be defined.
3. Sufficient resources, i.e. economic and relevant man-hour input in terms of necessary competencies, must be secured before the process starts.
4. A skilled project manager must be appointed and possibly assisted by one or two deputy project managers representing complementary professional skills.
5. Members of the project team should establish the rules for their participation in terms of man-hour input, mandates to make decisions, information management and feedback to the companies in the supply chain that they represent, etc.
6. Key functions involved in the supply chain activities must be included in the project team (e.g. procurement, sales, marketing, logistics, quality assurance, finance, IT)
7. Rules for communicating results, decisions and discussions and for exchanging of ideas must be decided upon by the project team and coordinated by the project manager.

5.3 Analysis based on change management theories

When analysing a multi-party development and decision process with no clear driver, or no dominant designer (Koehurst et al. 1999), it may be tempting to focus on all the problems and conflicts that seem to be dominating the process. However, it must be pointed out that many of the strategic decisions were made at an early stage, without discussions and conflicts. The analysis of the development and decision process shows that the actors had no difficulty agreeing on the *system* level, i.e. the design of an open, deposit-based and nation-wide pool system for transport packaging. This is pointed out in the invitation letter written by the project leader to the bidding companies in June 1998, (Appendix Five): *"It is important to emphasize that it is primarily the complexity of the tray type selection that has*

caused the slow speed in this process, and not the design of a common pool system."

The reason for the high level of acceptance on the system level can be explained by referring to the Swedish Association of Breweries. For decades, they had been operating a brewery-wide, national pool system for beverage crates and bottles. Thus, familiarity with pool systems and system understanding were not a complete novelty to the parties involved in this process.

The analysis of this change process provides an interesting result. When Sarv's V-man theory is applied, everybody involved in a change process must see and understand the prevailing reality, see and understand the vision and the objectives to be accomplished and understand what actions need to be taken on the way to realising the vision. (See 2.6.5)

Sarv concludes that not until these first four parameters are fulfilled can the actors be expected to be *willing* to join in and make their contributions. When analysing this process, it is interesting to point at the assumptions that a) many of the actors did not know enough about the prevailing reality, and b) they could not see the way to realising the vision. Still, the vision was strong enough to overcome these obstacles and create the willingness to participate in this process, although noone knew from the beginning if it would succeed or not. But a few individuals with strong confidence in the potentials of a pool system managed to sell in the vision to a sufficient number of stakeholders to be able to get the support required to start the process.

5.3.1 Early closing of important design parameters

Already after the completion of Mission 2 (Plan and perform a large-scale pilot test, 1992-1993), a number of important system and packaging properties were decided upon:

System requirements:

- open-loop pool system, all parties accepted as members of pool system
- deposit-based pool system, in order to achieve a high circulation speed and reduce loss of trays, key parameters for pool system total economy (Stahre, 1996)

- no third-party pool system solution in order to keep full control over system costs and development
- cleaning of used crates a high-priority system requirement.

Product requirements:

- tray footprint 600 x 400 mm
- tray based on 100 % recyclable thermoplastics (high-density polyethylene or polypropylene)
- stack/nest functions based on 180º rotation of trays
- no foldable/collapsible or bale-arm stack/nest tray due to bad quality of existing trays (e.g. hinges) and hygiene (difficult to clean).

It can be argued that the early specification of certain design parameters formed the basis for the "U-turn" turbulence that occurred at a late stage of the decision process. The first working group had decided to exclude the bale-arm tray design for quality and hygienic reasons. This was commented on in Stahre (1996), who describes Safeway's high loss of trays due to weak material in the bale arms.

By focusing on the stack/nest design based on 180 º rotation, both working groups missed improvements in product development that had taken place during the years. The possibility of improving the capacity to reduce empty-tray space by looking at new developments in design was neglected. The working group did not have the ambition – or the competence – to challenge the packaging supplier to come up with new, "impossible" design solutions, as Tesco did (see 5.3).

The working group failed to fulfil their business intelligence task, i.e. to keep an eye on ongoing development projects in the food grocery sector in other countries. One informant mentioned that they heard of the Tesco project at an early stage (about 1994), but at that time Tesco was still keeping the new tray as an in-house confidential project and had prohibited Paxton, the supplier, from starting to market the new tray design to other customers. This may have been one reason for the late introduction of the new, second-generation bale-arm tray with a considerably higher product quality and better space reduction capacity. There could still be objections

to this tray design for hygienic reasons, but the quality problems had been solved after it had been decided in 1993 to exclude this tray design.

5.3.2 The process of defining the specification of requirements for a family of trays

The process of defining a specification of requirements for a family of returnable trays to be used in the pool system shows how the working group gradually went from the technical perspective to a perspective where functions were defined and given to the manufacturers to solve. The manufacturers had to demonstrate by means of standardised test procedures that the required functions were realised in their tray designs. The working group had frequent contacts with at least two selected tray manufacturers (Dyno in Norway and Perstorp Plastic Systems in Sweden). The continuous dialogue with the manufacturers and their designers resulted in the type of business network learning described by Håkansson and Johansson (2001). The learning process included new insights into how to describe customer demands in product development. The reader of this thesis can follow this learning process by reading the four versions of the tray specification that are presented in chronological order in Appendix Three.

5.3.3 Power and empowerment

As already mentioned, the process described in this case study did not have any clear driver in terms of an individual or an organisation throughout the years. This was confirmed by the informants, who came up with several actors in trying to identify the driver. Many of them pointed at a mix of concerted efforts on the part of the manufacturers and the retailers, as both of them are identified as the driving forces.

The issues of power and empowerment are critical components in a change management process. "The Change Masters" by Rosabeth Moss Kanter (1984) will be used as the main theoretical platform in the analysis of power issues. (In Chapter Two, Frame of Reference, section 2.6, readers will find a more extensive presentation of the research field of change management.)

Kanter (1984) points out three "basic commodities" as the power tools of a successful change project: *information, resources* and *support*. She also discusses the way of creating power to change by bargaining and negotiation instead of just "grabbing" it. It is possible that a fourth "basic commodity",

gaining acceptance, must be added to Kanter's three power tools. This will be discussed in Chapter Six, Conclusions.

The Swedish way of dealing with conflicts by means of democratic, majority-based consensus decisions must be mentioned here. Kanter (1984) discusses alternative ways of being in command, concluding that the time is gone when corporate managers could give their orders and the underlying hierarchy did what they were told to do. Already in the early 1980s, creating change, innovation and creativity became increasingly dependent on a management's ability to pre-sell and convince their subordinates and the grass-roots, to win their acceptance, their buying-in and sharing of the vision.

The learning process is closely linked to the process of convincing or persuading (Senge, 1990). Without the creation of new insights that result in new understanding, it is difficult to make people accept change.

The British case described in Appended Paper Two and the IKEA cases in Appended Paper Three are both examples of how large and powerful retailers handle their power. These two companies have learned that processes of logistics development must be driven by themselves as customer-demand processes with top-management support. However, they have also understood that their external supply chain actors (e.g. suppliers and transporters) must be invited to be involved in the development process. This way of implementing change could be defined as *participative dictatorship*. The results show that the speed of the development and implementation processes is higher in this type of development processes, where a *dominant designer* (Koehurst et al. 1999) puts his foot down.

As mentioned by the informants, the Swedish retailers could have been expected to make better use of their power. However, the analysis of the development process shows that the most decisive steps were actually taken after decisions made by – the retailers.

The first demonstration of retailer power came in early 1995, when the logistics manager at one of the retailers turned down the proposal to start a pool system managed by the growers (see Chapter Four, 4.3.5).

The second demonstration of retailer power came in 1997, when the new generation bale-arm stack/nest tray developed by Tesco was identified as an

interesting alternative to the 180º rotation stack/nest tray that all parties involved had agreed on as early as 1993.

One assumption is that the retailers' knowledge of returnable transport packaging had increased over time. They understood that certain logistics parameters (e.g. empty space reduction) are more decisive than others. This formed the basis for their strong positioning in favour of the Tesco tray. They were prepared for the "U-turn" process.

5.3.4 Top management support

As described earlier in this chapter (5.1.2), the informants' analyses of the decision process show that they saw two sides of their top managers' participation in the decision process.

The first side is lack of interest. During 1996-1998, very few signs of top management involvement can be detected in the written documentation, and the informants confirm this as they describe the low interest in logistics issues on top management level. It can be discussed whether this process would have been accelerated or if it would have been stopped at an early stage if top managers had been more involved in and committed to this process.

However, the anticipated low interest in logistics and packaging issues on the part of top management could also have been an advantage. The situation allowed the working groups to proceed at the best speed that the multi-party process could cope with. Learning processes, based on iterated tests and queries, allowed the parties to reach their consensus as new insights helped the decision process to mature over time.

The second side was observed by the informants when the process required decision-making on top management level with signatures on contracts. There was still a lack of interest, but top managers showed their confidence in the logisticians' competence in proposing a nation- and business wide pool system. Some informants did not experience that their managers showed any confidence in the logisticians' proposal but felt that they were not fully aware of the consequences of their decision. One of the informants stated that only one of the top managers asked his financial director to have a look at and approve the appended calculations for the pool system, before he accepted to sign the contract.

A paradox from the implementation process, which is not included in this thesis, confirms the gap between top management decisions and decision-making in the logistics operations. Although the head of one of the largest fresh food suppliers in Sweden accepted and signed the contract without any discussion, this particular company turned out to be reluctant and late when invited to introduce the transport trays in their warehousing and distribution system.

The importance of top management attention and commitment is described in section 5.3 and in Appended Paper Two.

5.3.5 Information as a power tool

Kanter (1984) has identified information as one of three power tools for successful change management. When analysing what kind of information was provided to this process, the informants describe how a great deal of the basic information about logistics and material flows was informal, rule-by-thumb, and not documented in business-wide descriptions of logistics efficiency.

The very first information basis for the introduction of the pool-system vision is one A4 size page of calculations, where three types of pool systems are described with cost estimations compiled by the consultancy that helped Perstorp to start the pool system process. The logistics costs were taken from different studies made by the consultancy for DLF and for the Swedish Association of Breweries.

The analysis of the interviews provides few, if any, examples of actors having a set of indicators of logistics key performance. One of the younger logisticians in the group interviewed is frank in his criticism of the insufficient availability of data on e.g. measured volumes of damaged fresh food products. In his opinion, it is impossible to evaluate the full impact of a plastic tray when data on e.g. measured volumes of damaged products were not collected before the introduction of the pool system.

In a report published by the county of Skane in southern Sweden (2002), this view is confirmed by one of the large retailers who explains the difficulties of calculating waste volumes as they estimated their damaged fresh food products and product waste to 10 % of the of the total volume of products delivered to the stores.

The numerous tests and queries during 1996-1999 may be a result of the lack of information. The actors did not know enough about product and packaging integration (Saghir, 2004) to make decisions concerning e.g. tray height. They had to give each other homework assignments in order to increase their knowledge and eventually be able to define the optimal tray heights.

The lack of written documentation concerning the existing packaging requirements is an example of how the daily operations have been prioritised before making structured, documented descriptions of the operations. The introduction of quality management systems (e.g. ISO 9000) had not reached the logistics departments of manufacturers and retailers by the mid 1990s, when the second working group started their effort of defining a specification of requirements to be placed on a transport tray.

5.4 Comparison to a British retailer's development process

In the interviews in this research project, the British grocery retailer market has been identified as "state of the art" concerning packaging logistics development. The British grocery retailers form a benchmark for retail grocery logisticians in Sweden. The transition from stockholding to rapid movement, especially within the fresh food sector, that took place in the 1990s in Great Britain has been described by Smith and Sparks (1986, 1993, 1998, 2004).

To accomplish the transition from stockholding to rapid movement and no stocks, the development of new systems for transport packaging of fresh food seems to have been a component that contributed as a facilitator (see Appended Paper Two). The analysis provided here is based on a comparison between the Swedish project described in this thesis and a similar process within the grocery retailer Tesco.

The tray that was eventually selected for the Swedish market was the Tesco second-generation bale-arm tray. For this reason, it might be interesting to see what the drivers in the development of this second-generation tray were. The source of this section is a transcript from a seminar held in Lund, Sweden, in April 2002 by David L.G. Smith, former head of the primary distribution at Tesco during the 1990s.

Like the Swedish actors, Tesco had examined the upcoming EU packaging legislation, and after an analysis based on in-house statistics, the management of Tesco decided to regard this as a business opportunity, not only for the logisticians but for the whole business operation, including the commercial department, suppliers and retail stores. In addition to this, the management of Tesco also saw opportunities in terms of good citizenship for the company, since environmental benefits could also be identified.

The board of Tesco decided to create a new solution for their retail stores concerning the management of empty transport packaging. All transport packaging, including cardboard, wood and plastics, should be collected at the stores and then transported to specialised recycling service units, RSUs, where cardboard and one-way plastics are sent for recycling and reusable plastic transport packaging is cleaned and made ready to be picked up by suppliers to be filled with new products.

The introduction of a second generation of plastic trays for transport packaging was a development process based on a multi-party cooperation between Tesco departments and their suppliers. The commercial department decided which of the product groups would benefit from lower costs by using the plastic tray rather than corrugated transport packaging. The logistics department identified solutions where handling and stacking operations were improved by using the plastic tray, and the suppliers involved reduced their costs for packaging by using the plastic tray.

The implementation of the first stage of the new plastic tray took place during 1992-1994. The management of Tesco decided to create a standard design for all the RSUs in terms of operations but also in terms of how to minimise the costs for land and building. For this reason, Tesco identified the need for reducing empty tray space, the empty nesting ratio, as a vital issue. The old, first-generation trays had a reduction capacity ratio of 1:2 (i.e. two empty trays took up the same loading height as one full tray). To achieve an acceptable economy for the RSUs, Tesco calculated the need for a capacity ratio of 1:4 (i.e. four empty trays take up the same loading height as one full tray). When Tesco informed the supplier of trays of this empty nesting requirement, the first reaction was that "this is impossible". However Tesco representatives, supported by one of the board of directors, continued to argue for the necessity of meeting this requirement, pushing the tray designers to go beyond existing tray features. Finally, a tray with a nesting capacity of 1:4 was ready for delivery.

The commercial department had identified fresh fruit and vegetables as the first product group where the new plastic tray would be introduced. The savings for the suppliers were easy to calculate, as they could shift from high-cost, good quality corrugated cardboard to the plastic tray. The number of plastic tray circulations per year formed the basis for the cost per tray that the suppliers would pay instead of buying corrugated cardboard packaging. In the initial stage, that cost was estimated at 27 pence per trip. This cost was too high for many other product groups, so Tesco had to find a way to reduce the tray cost. By introducing additional product groups, the number of trays in circulation could be increased, and thus the cost per tray could be reduced. The next product group to be included was fresh meat and poultry. As the production system for these products had been changed, it was now possible to pack the finished products directly in plastic trays and distribute them swiftly to the retail stores.

Tesco's management set an objective where the increasing number of products using plastic trays would reach an annual volume of 100 million tray trips by 1997. As the cost dropped to about 21 pence per trip, an even greater number of products could be packed in the trays. The third product group to be included was specialist bakery products, such as croissants and pastries.

As mentioned above, this was a multi-party process, where suppliers were involved as well. Tesco decided to demonstrate their new packaging strategy with the recycling service units (RSUs) and the second-generation plastic tray to their suppliers on special 'supplier days' held at their recycling service units. Small groups of suppliers met Tesco staff representing the commercial, technical, quality assurance, supply chain and logistics departments as well as staff from the retail stores. At these meetings, the objective was to define and agree on the optimum configuration of products in a tray, and also to discuss the implications of the packaging change. During these sessions, suppliers would shift their assessment from the tactical to the strategic channel level and make the decision to get into this despite some technical difficulties that they were able to resolve by then. These meetings turned out to be important events where creativity resulting in new ways of thinking was encouraged, which resulted in benefits for Tesco as well as for the suppliers.

At these meetings, manufacturers decided that they approved of the benefits offered by the plastic trays but pointed out that different retailers had their

own different sizes and specifications. This complexity resulted in problems in their production and distribution processes. The manufacturers asked the retailers to act together and agree on a common standard for transport packaging.

5.4.1 Analysis of the British development process

The Tesco packaging development process can be used to emphasise the importance of utilising the three basic power tools for change management defined by Kanter (1984), i.e. information, support and resources.

The availability of in-house statistics and a set of key performance indicators that provide the basis for decisions on creating the recycling service units (RSUs) is an example of the importance of having access to relevant and reliable *information*.

The impact and importance of top management *support* is also demonstrated, as Tesco's management settled at an early stage on a new strategy to comply with the upcoming packaging legislation by considering it as a business opportunity. However, the management did not only initiate the process; there was also a personal commitment on the part of one of the board directors who supported the insistent demand for a 1:4 empty tray nesting capacity.

Since the top management at Tesco had identified the handling of empty packaging as a prioritised activity to be solved in due time, there was an awareness of the need for multi-party activities to accomplish the task. The proper *resources* from the commercial and logistics departments, the retail stores etc. were appointed, so that they could contribute their expertise as well as their relations with the suppliers during the supplier days at the RSUs.

The learning process that occurred at the supplier day meetings at the RSUs provides a good example of how information, support and resources, when properly controlled, can facilitate a change process.

It may be argued that it was easier for Tesco to accomplish their goals in a considerably shorter period of time than the Swedish process. However, Tesco took the opportunity of becoming the "dominant designer" (Koehurst et al. 1999), thus being able to be the driver of both the outcome and the speed of implementation.

It seems quite obvious that Tesco's process was driven by an awareness of the opportunities rather than the more problem-oriented attitude described in the Swedish process.

It is possible that a fourth "basic commodity", *gaining acceptance*, must be added to Kanter's three power tools (1984). This will also be discussed in Chapter Six, Conclusions.

	UK case	**Swedish case**
Pace of development	Rapid development period, 2 years	Slower development period, 8 years
Top management approach	Driven by Tesco Board as a business priority	Management support from companies, but essentially passive
Importance of logistics	Board level priority	Not on the agenda at board level
Functional approach	Logistics and supply chain orientation; hence multi-functional teams introduced	Some multi-functional components, but mainly separate identities maintained
Awareness of technology	Technological improvements requested to 'fix' problems	Acceptance of current technological state
Group dynamics	Imposition by Tesco, but some dynamic 'following' – industry as a whole came into line later	Good working-group and study-tour dynamics. Involvment and learning together encouraged interaction. Wider discussions ensued.

Table 5.3: Attitudes towards handling critical issues; a comparison between the British case and the Swedish case. (Source: Appended Paper Two).

5.5 Answers to research questions

The overall research question is formulated as follows:

"How are strategies for change management and decision-making established within multi-party based packaging logistics development?"

This case shows that the participants in a multi-party development process strive for consensus, or at least majority-based decisions, based on fresh knowledge gained from pilot test results and study visits. The results of the pilot test form the bases for learning, guidance and empirical evidence of the feasibility of the vision. Fresh knowledge derived from multi-party learning is applied as a tool for persuading hesitant, reluctant or unwilling parties. Strategies are not openly discussed and decided upon but seem to have emerged as ways of driving the development and decision process forward. Similarities are identified with the theories of overt and covert strategies, where overt strategies are defined as formal and covert strategies as emergent, both described by Mintzberg (1983, 1994). In this case study, strategies are covert and emerging.

In addition to the overall question, five underlying questions have been formulated:

- How are the processes for product development and for the formulation of a specification of requirements driven in this type of multi-party cooperation?

  In this project, the members of the two working groups were constantly striving for majority-based decisions. If that was not possible, the second alternative was to look at who had the largest volume of a certain flow of goods. The third alternative, when the first and second ones did not work, was to postpone difficult decisions until a later stage.

- How are demands concerning system economy, technical aspects, ergonomics and environmental requirements dealt with in this type of development process? What parameters dominated the discussion and decision-making?

  Participants in this project agreed on the system parameters at an early stage. It can be argued that they may have agreed on all system parameters too early. The discussions and decision-making were dominated by parameters of tray design details (e.g. defining three tray heights, ventilated or closed trays, colour of trays, design of handles).

- How are shared views and a willingness to cooperate created and established within a group of actors who are normally competitors or dependent on each other in supplier-customer relationships?

  The informants pointed out the formation of working groups that include representatives from all parts of the supply chain and are guided by a skilled project manager as an important prerequisite. Study visits, time for social activities and time for analyses of present and future situations are primary components. Study visits at group members' companies form an important platform for supply chain learning.

- Why do certain actors step on the accelerator, while others push the brake when confronted with demands for new systems? How can a development pace be established that is acceptable to all participants, without losing speed?

  This is probably the most difficult question to answer. Kanter's (1984) theory of segmentalist and integrative company cultures provides part of the answer. Those who step on the accelerator are probably employed in integrative companies, where new ways of working are regarded as business opportunities. Those who step on the brake may apply the philosophy of being no 2 in adopting a new packaging logistics system, based on short-term economic perspectives. They prefer to wait and see, and let other companies take on the initial costs for the introduction and implementation of the system, cure "child diseases" and make all the adaptations that are necessary when starting up a new system.

- What role do individual efforts play in terms of an entrepreneurial approach in driving the development process?

  The informants point at the importance of a skilled project leader, an entrepreneur, working together with single individuals who have the roles of missionaries, guides, facilitators. The most important competency is their ability to communicate the vision and gain acceptance from all parties that will be affected by the new concept.

6 CONCLUSIONS, CONTRIBUTIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The overall conclusion of this research project is to emphasise the need for the owners of all types of multi-party, supply-chain oriented packaging change processes to apply both quantitative and qualitative skills as well as an open-minded leadership. This is the major contribution of the present thesis.

The conclusions presented here can, of course, be applied to all types of change processes. However, logisticians as a group of professionals have so far based a great deal of their change management activities on such quantitative parameters as e.g. calculations, material flow studies and simulations in order to simplify as a means of facilitating their understanding of the complex processes within logistics and packaging (Nilsson, 2005). For this reason, it is particularly interesting to introduce the qualitative aspects of how to manage change processes within packaging logistics.

The conclusions referring to change management in supply-chain oriented packaging developments will now be presented.

6.1 Supply chain management

The definition of supply chain management provided by the Council of Supply Chain Management Professionals, CSCMP, www.cscmp.org (formerly known as the Council of Logistics Management, CLM), states that "…*Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers"* (my underlining). The thesis presented here supports the statement made in that definition, and the case study described in this thesis serves as an example of how coordination and collaboration processes with channel partners can be developed and established.

According to Whetten (1989), all new theory building should include descriptive as well as explanatory elements, answering the questions what?, how?, why?, who?, where? and when? When this recommendation is applied to the case study in this thesis, it seems that the theory building within logistics and packaging logistics should expand its scope from often restricting itself to answering the what? question only and neglecting the benefits that an analysis of the answers to how?, why?, who?, where? and when? can provide.

The CSCMP's definition states that coordination and collaboration among channel partners are important improvement factors. Thus, the what? question is answered. However, CSCMP may need to focus more on how?, why?, who?, where? and when? in order to provide a definition for supply chain management that can facilitate the improvement of existing supply chains as well as help to establish new, often global, projects in supply chain management.

6.1.1 Supply chain management within food retailing

The definitions and theories in this field have their origin in British research on food retailing. The British market situation is different from the Swedish food retailing sector, although in Sweden as well there is one large, dominating retailer that could assume the role of channel captain (see 2.6.3). Historically, the Swedish food retailing sector has been dominated by the large manufacturers, and it is only in recent years that retailers have begun to initiate the process of taking command in order to eventually become channel captains (e.g. by introducing private brands to compete with the large manufacturers).

Nevertheless, the case study presented here shows that the Swedish retailers took command at two stages of decision-making during the process described in this thesis. First, in early 1995 (see 4.3.5), the dominating retailer in Sweden stopped the growers' proposal for a national pool system. Secondly, the retailers headed the "U turn" process (see 4.5) that resulted in the final decision concerning the logistics efficiency properties of the tray design.

It is important to include the power issue in the conclusions. Cox (2004a) concludes that *"…supplier development and supply chain management tend to work best in circumstances when buyers have dominance over suppliers or, at the very least, there is an interdependence in the power relationships between them."*

(2004a: 350).This case study confirms this statement by Cox. The power issues are complex, and it must be remembered that Sweden is a small society, where social networks are important in the exercise of power. As a researcher, I can conclude that there have been a great deal of secret decisions that delayed the process but also helped it proceed from vision to decision.

6.2 Change management

This section is the larger part of this chapter. The reason is that change management theories have formed the basis for the analysis of the case study in this thesis.

6.2.1 The features of a multi-party development and decision process

As described in the case study of this thesis, a development and decision process driven by a number of different companies along a supply chain is a true challenge, where the risk of failure caused by conflicts of interest, controversy concerning process ownership or decision making procedures, unclear mandates from top management etc. must be dealt with in order to fulfil the tasks and eventually make the vision of the process come true.

Nevertheless, individual actors have been basing their arguments on the needs of their own companies throughout the whole process.

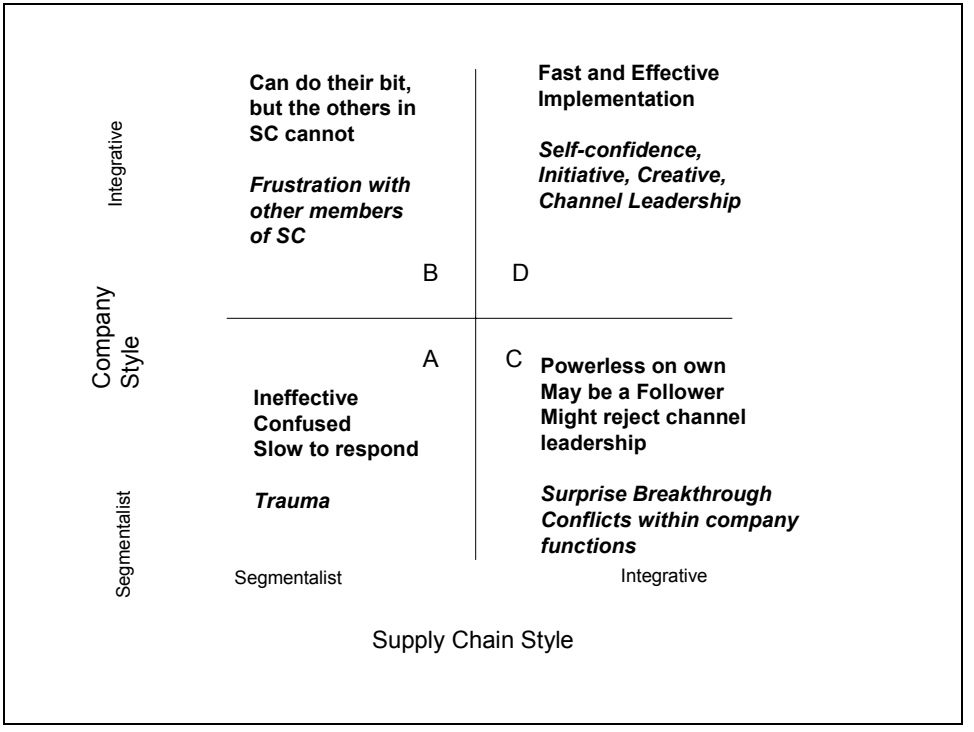
6.2.2 Segmentalist and integrative company cultures

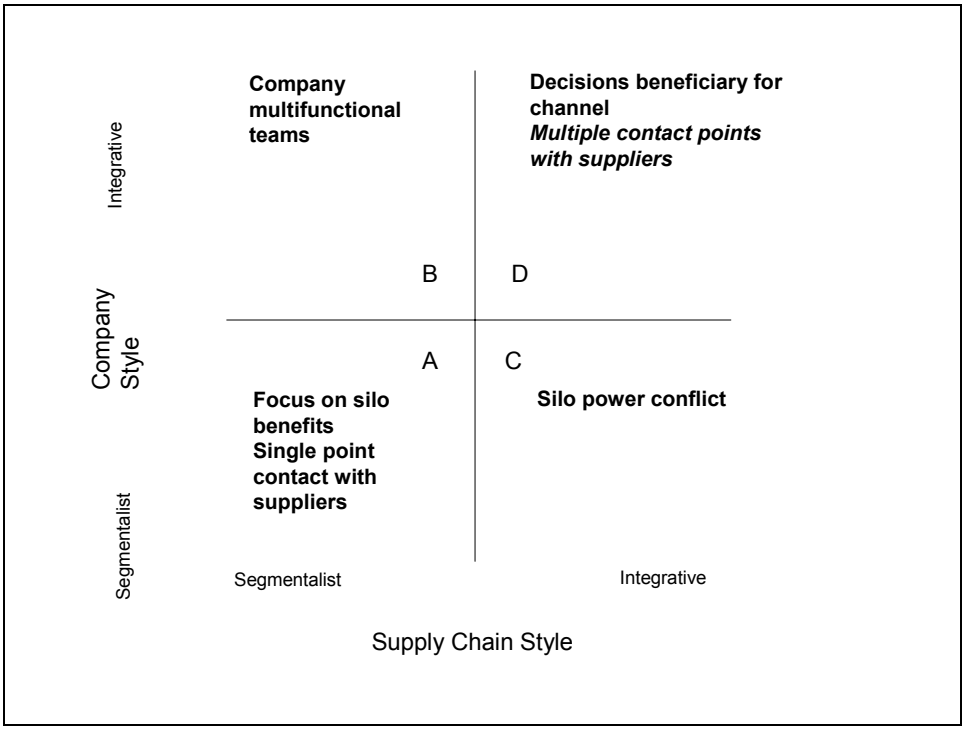
Kanter (1984) has identified two types of company cultures, the segmentalist and the integrative (see 2.6.1). Change processes can be expected to be easier to manage in integrative companies than in segmentalist companies.

When a multi-party based working group is formed, the project manager must make a careful analysis of the conditions at each participating company in order to identify which of the two company cultures they represent. By forming "silent" alliances or asking for support from the actors who come from integrative company cultures, the working group can apply the features of the integrative culture, i.e. the overt, tolerant and participative ways of driving a change process, based on curiosity and learning. The project manager and his/her allies or supporters must also be

keenly aware of and prepared to handle all signs of segmentalist behaviour within the working group (e.g. lack of information, not being open and honest, not participating in a dialogue, 'wait and see' attitudes etc.).

The two matrices presented below describe the relations between integrative and segmentalist companies and integrative and segmentalist supply chains. (Source: Gustafsson, Jönson, Smith and Sparks, Packaging Logistics and Fresh Food Retailing, Kogan Page, London, to be published in 2006)





6.2.3 Applying Kanter's three power tools to a multi-party process

Kanter (1984) identifies three power tools for successful change management processes: *information, support* and *resources*.

As far as information is concerned, the process described in this thesis was repeatedly delayed, because the actors did not have enough information at certain stages where conflicting views could not be handled directly due to lack of knowledge. The members of the working group had to go home, collect the necessary facts and figures and subsequently return to the working group equipped with new data that could then form the basis for decisions concerning the tray design.

As for support, the informants have described the lack of interest in the process displayed by top management. There was, however, support from the management level in logistics departments, which was enough to keep the process alive and slowly progress over the years.

As far as resources are concerned, the first governmental funding provided the financial resources for the initial pool system tests and thus gave the actors evidence of the feasibility of introducing a national, business-wide pool system for the grocery supply chain in Sweden. An understanding at the system level was accomplished. Later on, resources for defining the requirements to be placed on the transport trays were mostly based on man-hour input from the actors. The time-consuming process might have been reduced if a more generous funding had been supplied by the actors to finance consultant fees in order to support the project manager.

The analysis of the case study in this thesis confirms Kanter's theory of the three power tools. However, it is possible to identify a fourth important power tool that may be applied both at an early stage and during the subsequent stages in this type of multi-party processes.

6.2.4 The fourth power tool: gaining acceptance

Both Kanter (1984) and Sarv (1997, 2003) point at the importance of selling in a vision. Information and support are basic tools in the process of acquiring resources for a new concept. It can be discussed what should be included in "information" as a power tool. Quantitative facts and figures must be provided to establish a good understanding of the prevailing situation and of the need to change it in order to improve results.

There is also a qualitative side that must be emphasised. In the process discussed here it was not enough to point at the factor of economic improvement. The actors needed to see the potentials from a number of other perspectives: organisational, ergonomic and environmental. Much of the information needed for these non-economic perspectives is qualitative, being based on learning and understanding.

A multi-party process where all actors involved are expected to participate and contribute their full capacity must be based on openness, discussion and dialogues leading to consensus-based decisions.

For this reason, the process of *gaining acceptance* is so important that it can be defined as a fourth power tool to be applied before and/or in parallel with the information power tool.

The process of starting a multi-party development and decision process is described graphically in figure 6.1.

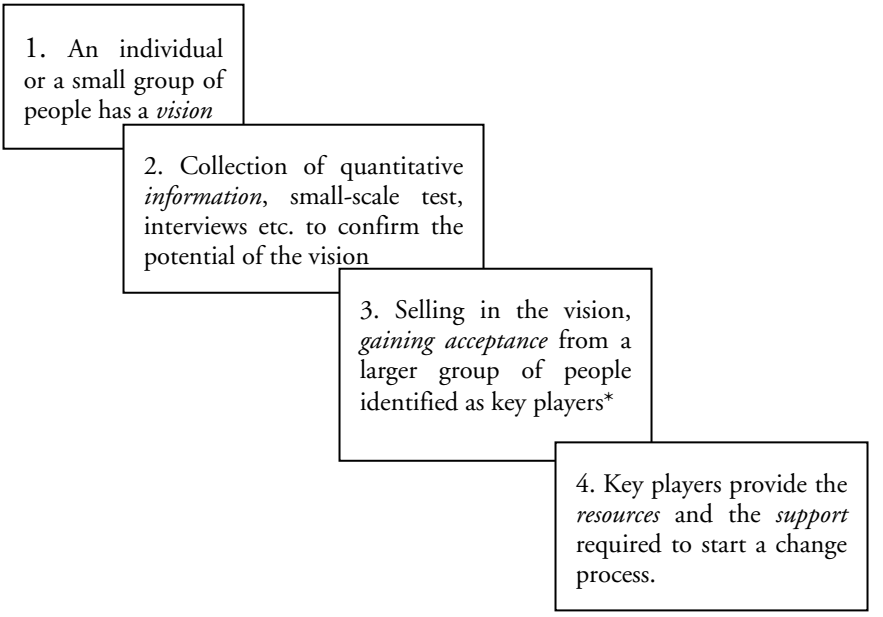


Figure 6.1: The process of initiating a change process

* *The definition of 'key players' includes more than top management people; key players may be defined as a number of groups of people on several organisational levels, not least the grass root levels, who provide the operational skill, knowledge and experiences required.*

The process of gaining acceptance should be repeated throughout the development and decision process as a tool for cementing the building of new knowledge step-by-step and ensuring the feasibility of the vision.

6.2.5 Participative Dictatorship; an alternative way to manage multi-party packaging development and decision processes

The informants described the Swedish process as an iterative, never-ending process characterised by a myopic interest in tray design detail issues. As discussed in the analysis in Chapter Five and in Appended Papers Two and Three, the Swedish process had no clear ownership that could be described as a dominant designer (Koehurst et al., 1999).

Tesco and IKEA, the other multi-party development processes that the Swedish case is compared with, both have a clear leadership and process ownership, since they make full use of their roles as key customers of the other parties in the development process. They could have chosen to use their power in a traditional way, "like it or leave it", but instead they made a considerable effort in order to *gain acceptance* from their partners in the supply chain. Klevås (2005) has described IKEA's way of working with integrated packaging, logistics and product development.

These two large retailers had reached the level of understanding how to manage change processes. By applying a *participative dictatorship* they challenged their suppliers and partners along the supply chain to achieve what was considered impossible, i.e. the 1:4 nesting ratio requirement for the Tesco tray. The learning aspects of the supply chain have been explored by Tesco and IKEA.

By establishing a creative dialogue based on learning with their supply chain partners, Tesco and IKEA managed to convince their suppliers of the advantages to be obtained, not only for Tesco and IKEA but also for the suppliers, if the vision could be transformed into real-life operations.

6.3 The informants' comments on the conclusions

In May 2005, two of the appended papers (Appended Papers One and Two) were distributed to the fourteen informants. The purpose of this measure was to receive their opinions of the conclusions presented in the papers. Seven of them responded. In addition, I had telephone contact with two informants who were interested in contributing their comments but were too busy to participate. Six of the responses are written, while one informant gave his comments on the phone, while I took notes and typed out his views immediately afterwards.

Six of the informants accept the conclusions in the papers. Now, several years later and having retired from his position, even the most oppositional person among the informants during the "U turn" concedes that it all ended in a positive way. Another informant, still active in a high position, concludes that *"even if it went slowly in Sweden, I am convinced that we will be the long-term winners with our national initiative."*

It is interesting to see that three of the seven informants still refer to the European, or even the global, vision of introducing a common, international standard for transport packaging and introducing a European pool system for transport packaging and pallets.

The seventh informant is not in favour of the Swedish process based on majority decisions and consensus. Instead, he recommends the British and the IKEA way of driving a process (i.e. channel captains applying participative dictatorship). He points out the purchasing departments with the Swedish food retailers as the power centres and describes the retailers' logistics departments as hopeless agents of change.

6.4 Contributions and recommendations for future research

This thesis provides an insight into a multi-party development and decision process aimed at creating consensus and characterized by the vision of introducing a business-wide, national pool system for transport packaging. Its main contribution is to tell the story on the basis of the information supplied by 14 informants in interviews and documentation. This thesis will hopefully increase our understanding of how to initiate and manage multi-party development and decision processes in the packaging area, although a great number of the conclusions are also applicable to many other types of change processes. The complexity and difficulties as well as the potentials of multi-party processes have been described and discussed.

A majority of the informants concluded that all types of future packaging development processes must be based on multi-party processes, including all the actors along a supply chain, in order to be both effective – 'doing the right things' – and efficient – 'doing things right' (Porter, 1996) and to reap the full potential of the vision. The major contribution to future theory building provided in this thesis is that many of the prevailing theories within supply chain management and product development are not adequate when applied to multi-party, supply-chain related packaging development processes. Future theory building must also include the qualitative aspects, i.e. those answering the how?, why?, who?, where? and when? questions – not only the what? question. Furthermore, theory building must expand its scope from the company-internal level to the multi-company, supply chain level.

In future packaging change processes where it is not possible to apply the concept of participative dictatorship, a multi-party process must be managed by a skilled project manager who has the social competence required to build bridges and establish creative dialogues. However, this social competence must be complemented with good competence in packaging logistics. A task force consisting of two or three persons, each representing in-depth, specialised knowledge and competence, could be a viable alternative to a single individual project manager.

The issue of the importance of individuals who are early adopters of a vision has been addressed. Yes, they are indeed important! If it had not been for a number of enthusiastic and persistent – even headstrong – drivers, this process would not have succeeded in its mission of taking it all the way from vision to decision. This is also proof of the importance of the fourth power tool suggested in this thesis, *gaining acceptance*, in order to be able to conduct multi-party packaging development along a supply chain.

This fourth power tool, *gaining acceptance*, is thus a contribution from this thesis to theory building in future research within the areas of packaging logistics and supply chain management.

There are a number of issues that have not been dealt with in this thesis and that are thus open for other researchers to explore. One such issue is the next step after decisions have been made, i.e. how the implementation phase should be managed. The Swedish case can be further analysed, as it can provide additional inside, eye-witness information of the roll-out of the pool system. As Kärkkäinen et al. (2004) point out, there is a need for further theory building in the area of the operational management of pool systems for returnable packaging. The Swedish case is of great interest in the search for such theories of operational management.

Integrative and segmentalist companies and supply chains – how do they develop and mature over time? What combinations will survive and improve, and what combinations of integrative and segmentalist organisations will fail to improve supply chain performance? This issue is of great interest and deserves a deeper study with a focus on the development and improvement of integrated packaging logistics.

Another issue to be further explored is the environmental aspects and the possibility to compare different packaging systems. This field has not been

analysed in this thesis to any great extent. Many of the informants expressed a wish for an improved basis for decisions concerning sustainable development and resource management within packaging logistics.

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ATTACHMENT ONE: DIFFERENT TYPES OF RETURNABLE TRANSPORT PACKAGING SYSTEMS - A TYPOLOGY WITHIN BUSINESS-TO-BUSINESS DISTRIBUTION

This typology is an attempt to describe and explain the logics of different types of returnable transport packaging systems. The opportunities and risks connected with such packaging systems will also be discussed, since they are topics to be examined before a business decision is taken to introduce returnable transport packaging within business-to-business distribution. This attachment focuses on business-to-business packaging systems exclusively, the purpose being to provide a background for readers with no or limited knowledge of returnable transport packaging and packaging pool systems.

The definition of "typology" can be found in the Encyclopaedia Britannica: *"system of groupings (such as "landed gentry" or "rain forests"), usually called types, the members of which are identified by postulating specified attributes that are mutually exclusive and collectively exhaustive — groupings set up to aid demonstration or inquiry by establishing a limited relationship among phenomena. A type may represent one kind of attribute or several and need include only those features that are significant for the problem at hand.*

Because a type need deal with only one kind of attribute, typologies can be used for the study of variables and of transitional situations". (Accessed Oct 24, 2003 at <http://search.eb.com/eb/article?eu=75946>)

Terminology

The different types of transport packaging that can be returned to a filler for reuse are defined as *returnable* packaging.

Reusable packaging is another definition commonly used as the opposite of one-way packaging. The reuse can take place in-house, in the same or in another supply chain, for the same or for any other type of products.

Recyclable packaging is a definition of the possibility to recover the *material* of the packaging for reuse as new packaging material or as raw material for other products.

Returnable packaging can be made of a variety of materials, normally wood, cardboard, thermoplastics or steel. (ISO/CD 21067, SS-EN 14182).

An example of the arguments commonly used for returnable packaging is provided by Linpac, one of Europe's largest manufacturers of returnable packaging:

"The use of returnable transit equipment continues to increase as our customers seek to reduce their reliance on one trip packaging and the associated waste recovery and recycling costs. The advantages of returnable systems continue to stack up.

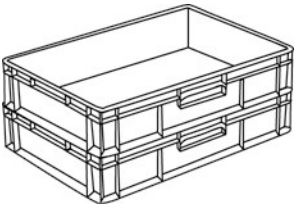
- *Improved product protection.*
- *Better temperature control.*
- *Standardisation of outer [dimensions] enables more efficient use of pallet and vehicle space.*
- *Elimination of need for packaging assembly increases operating productivity.*
- *Primary packaging reductions and cost savings.*
- *Packaging waste reduction.*
- *Benefits of using plastic transit container as merchandising unit in terms of product presentation and speed of loading onto shelf."*

(Excerpt from Linpac's website, www.linpac.com, September 2003)

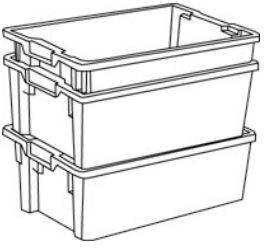
Trays, boxes, totes, crates, pallets and pallet containers

Returnable transport packaging includes the following items:

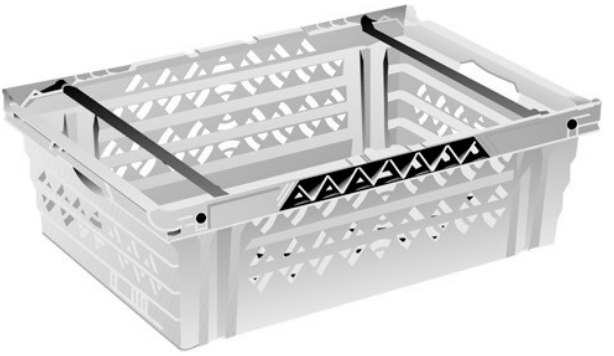
- **Trays, boxes, totes, crates**: common footprint 600 mm x 400 mm, 400 mm x 300 mm; height varies due to product and filling requirements. Trays, boxes and totes can have lids, separate or attached to the box. When stacked, the top lid can have an additional stack securing function.



- Trays, boxes, totes and crates can be *stackable*, i. e. they can be stacked in such a way that the top design fits with the bottom design of the boxes to be put on top of each other. The design also secures the stack from collapsing. Maximum stacking height varies, but working safety regulations within the European Union recommend a maximum stacking height of 1.20 meters. This results in loading efficiency; if two pallet loads, each 1.20 meters high, are stacked on each other, the loading capacity of a trailer or a container is fully utilised (provided that the maximum weight limit is not exceeded).

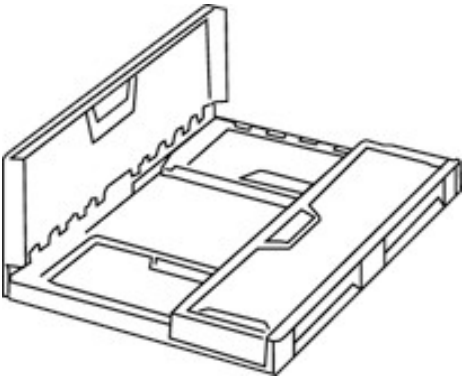


- Boxes can also be *stack- and nestable*. The nestable function is a common requirement in all returnable packaging systems, as this allows for space reduction when transporting empty packaging back for cleaning and refilling. The stack and nest function influences the volume capacity of the box, since the rigid walls cannot be 90 degrees in relation to the bottom of the box. Instead, the box is designed to have a conical configuration to allow nesting. The nestable function can be acquired in two common ways: *180-degree rotation* of a conical box, or a *swingbar/bale arm* construction on a conical box where the swingbar/bale arm works as support for the box above in a stack. Swingbars/bale arms are easily folded up when the packaging is empty, thus allowing a nesting capacity of up to approximately 75 %, i.e. four empty boxes will take up the same loading height as one filled box. The empty nesting capacity is then defined as 1:4.



- *Interstackability* is a requirement in focus within food distribution; i.e. different types of returnable boxes as well as one-way boxes can be stacked together with the same security as if there were only one type of transport packaging in the stack. Stackable boxes normally have vertical (90-degree) rigid walls. However, interstackability can also be obtained with boxes with conical walls.

- The third type of returnable box is the *foldable* or *collapsible* box. The walls of the box can be folded down, thus resulting in a maximum reduction of space needed for empty packaging. This type of box allows maximum inside volume for optimal space utilisation. The drawback is the need for more physical handling when raising and collapsing this type of packaging.



- Trays, boxes, totes and crates in returnable systems are normally made of thermoplastics, high-density polyethylene, HDPE, or polypropylene, PP. It is also possible to find systems where trays, boxes or crates are made of wood, plywood, often metal-enforced, steel or cardboard of such quality that transport packaging items can be reused.

- **Bottle trays:** as glass beverage bottles are successively phased out, being replaced with reusable or one-way PET bottles, there is no longer any need for heavy-duty beverage crates. Instead, a special type of tray is introduced, thus enhancing logistics efficiency. This tray forms a self-supported pallet load, with no need for filming or strapping. If one-way PET bottles are used, empty trays can be nested into each other, thus reducing return transport space capacity by more than 50 %. As this type of tray is not in direct contact with food, it is possible to use recycled plastic raw material from old, ground-up bottle crates as raw material for the production of bottle trays. This type of returnable transport packaging for beverages may very well be used by other business sectors where products are filled and delivered in bottles.

- **Pallets**, normally of standard size footprint, EUR 1200 mm x 800 mm, or 1200 mm x 1000 mm. There is also a half-size pallet of 800 mm x 600 mm. Even a quarter-size pallet of 600 mm x 400 mm is in use in many European countries. Returnable pallets can be made of wood in accordance with European and/or national standard requirements for returnable wooden pallets. Returnable pallets can also be made of thermoplastics, normally HDPE or PP, which also meets European and/or national standard requirements concerning temperature stability, dynamic and static loading capacity etc.

- **Pallet containers** normally have the same footprint standards as full-size pallets, but are equipped with rigid or foldable walls. The use of pallet containers reduces the need for primary packaging of the products thanks to the protective strength of the pallet container. Pallet containers are usually made of metal-enforced plywood or thermoplastics. Plastic returnable pallets and pallet containers may

be equipped with in-mould radio frequency identification (RFID) chips. This technology offers the users of returnable pallets and pallet containers many types of advantages.

Common types of applications for returnable transport packaging

Returnable transport packaging can be designed for:

- single-product use
- multi-product use
- single-loop pool systems (one company to one company; from company A to company B and then back to company A again etc.)
- multi-loop pool systems (from one company to many companies and then back to the filler again etc.)
- open-loop pool systems (multi-user, multi-product)

All types of applications mentioned above may be deposit-based or not. There is also an option to design the system so that each user pays a certain fee per usage. This fee is normally lower than the cost for one piece of a corresponding type of one-way packaging. But there are also systems without any kind of deposits and/or fees whatsoever. The reasons for not having deposits or fees are that some companies consider it more expensive to introduce an extra order line into their business management system as well as being forced to introduce more time-consuming administrative routines to be followed (source: Perstorp Plastic Systems, now Schoeller Arca Systems, 1994).

Single-product use

This type of returnable transport packaging is designed to carry and protect just one type of product or a family of products with similar physical dimensional requirements concerning foot-print size and height. Single-product returnable packaging is most common in single-loop systems, but it can also be found as a packaging unit used in multi-loop systems, e.g. bread trays.

Multi-product use

Returnable transport packaging designed to carry and protect many different types of products must meet a longer list of requirements. Often the result is a compromise.

One example of a compromise is to decide if the packaging, in this case a tray, should be ventilated or not. Certain products require ventilation in order to keep their freshness, while other types of products must be kept in a completely closed storage to avoid contamination from outside or to prevent the risk of liquids leaking from carried products, which may contaminate the outside.

Single-loop pool system

This is the most simple and non-complex type of returnable packaging pool system. The supplier/filler delivers his products in returnable transport packaging, such as trays, pallet containers and/or pallets to one customer. When emptied, the returnable transport packaging items are sent back to the filler again. This type of packaging can be either for single-product or for multi-product use.

In purchasing transport services, the supplier needs to negotiate return transport services from the customer to get his returnable packaging items back again. Normally this type of take-back transports can be obtained at a favourable cost by using unbalances in the transport system and by allowing the transport company to take back empty transport packaging during non-rush hours.

Multi-loop pool system

In a multi-loop pool system, one supplier/filler delivers his products in returnable transport packaging such as trays, pallet containers and/or pallets to several customers.

In a multi-loop pool system, the requirements placed on logistics skills increase. In order to control and get the returnable packaging items back from all customers, the supplier/filler must design an administrative system that, by using certain tools, encourages the customers to send empty packaging back. Such tools can be deposit systems, or systems where the customer is invoiced a fee per day or per week for employing returnable packaging in his operations.

Also, in a multi-loop pool system the supplier/filler must negotiate return transport services. At this stage of complexity many suppliers/fillers start to consider third-party solutions to get rid of all the work caused by ordering return transport services, checking and tracking where empty packaging is located, invoicing customers etc.

Open-loop pool system

This is the most complex logistics system for returnable transport packaging. But it is also the system level where both large and small companies can be members on equal conditions.

There are two common ways to run an open-loop pool system:

1. A group of companies (normally along a supply chain) identify a general need for returnable packaging. They form a membership organisation, which in turn opens a separate non-profit pool company, which is the legal owner of all returnable packaging items. The members/owners of the pool company provide the financing tools required to invest in returnable packaging. The main task of the pool company is to operate the pool system, establish a control system, design the administration and – if needed – operate or manage a washing and maintenance facility. The non-profit pool company is operated with full transparency for the members.
2. A third-party, commercial logistics services provider offers returnable transport packaging items to many types of companies, some of which are in a supply chain, some not. The availability issue

is one of the most important aspects. The third-party company guarantees that each customer with a need for returnable transport packaging will be supplied in accordance with his needs. The user of returnable transport packaging is invoiced a fixed fee per item usage. The third-party company is responsible for arranging return transports, for cleaning and maintenance.

The difference between types 1 and 2 in operating an open-loop pool system is the cost for using returnable packaging. Members of non-profit pool companies argue that they have a lower cost per used item, that they have an overall view of the system's functionality and that they are empowered to improve the system over time. (Kisten-Pool, Travel report, Austria, 1993)

When arguing for a member-owned pool company, the indirect costs for manpower input must be taken into consideration. As a member, you must be interested in taking an active part in the planning and execution of the operations, and you must see the commercial advantages of having access to full visibility and transparency that a member-owned pool company provides.

When arguing for a third-party solution, on the other hand, a company may see the advantage of not being forced to get involved in the management and physical operations of a pool system. There is a certain level of convenience to be achieved, naturally depending on the reliability of the third-party service provider. One reason for companies *not* to use third-party service providers is fear of the night-mare events that may occur if the service provider cannot keep his promises and a supplier suddenly has no packaging available to fill with products.

Why do companies choose returnable packaging?

The overall dominating primary reason for actors in business-to-business distribution to introduce returnable transport packaging systems is the potential of **total cost savings**. When simple calculations show that the pay-off time for a system with returnable transport packaging can be 1-3 years, the parties involved may see the opportunity of creating cost savings. These calculations include costs for purchasing one-way packaging or fees for use of externally owned pallets compared with year-based costs per trip use of returnable transport packaging. The uncertainty factor in this calculation is estimating the number of trips per year. The higher the speed of circulation

and the number of trips, the better the economy is. The problem, however, is having to estimate the circulation speed in advance and identify what parameters may endanger and reduce the circulation speed.

If the parties involved try to include more logistics parameters in their calculations in order to get a more precise comparison, there will be a better basis for decisions, but some uncertainty will remain depending on the difficulty of predicting the overall performance of the planned returnable transport packaging system. This uncertainty can be remedied by suppliers of returnable transport packaging, who can provide valuable advice by using their extensive experience of packaging pool systems performances in existing systems in operation within the actual business sector.

The loss ratio is the second most important parameter that may jeopardise the success of a returnable transport packaging system. How should the system be designed to minimise loss due to theft or non-authorised use? (Non-authorised = returnable transport packaging being used for other purposes not included in the pool system setup.) A deposit system may be one measure in order to prevent losses in business-to-business pool systems, especially if it is a multi-party pool system. The introduction of tags or in-mould equipment, such as microchips or RFID (radio frequency identification devices) may prevent un-authorised use or theft.

Finding ways to reduce the amount of damaged products can be another main driving force in certain business sectors. Normally returnable transport packaging is tougher and provides better protection against shock than one-way packaging (of course, one-way packaging can offer enough product protection as well, but normally that would require more packaging material at a higher price, which may cause an increased waste handling problem at the customer's production sites).

Since returnable transport packaging has such protection properties, there is a potential for certain suppliers to skip primary packaging and thus save money and time. Also for the customer there will be a time saving potential, when delivered products do not need to be unwrapped before being put into the production.

Costs for waste handling can be the third driving force. Every minute or second that can be saved in handling workforce costs is worth a lot in many business sectors. (DULOG, 1997). Normally the handling of returnable

packaging requires less input of manual work than the handling of empty one-way packaging. This parameter is, however, much discussed from different perspectives and not valid in many cases.

Space reduction of empty packaging items, especially trays, is a key success parameter. If the actors can use collapsible trays, cost savings can be achieved as compared with return transports of rigid-wall trays. There is also an environmental aspect, namely that the need for emission-causing transports must be kept at a minimum.

Administration and control of returnable packaging systems

The control and administration of returnable packaging systems can be designed in many different ways, depending on several factors. If the products which are transported have a high value, it is necessary to design a control and administrative system, allowing the actors to follow each pallet load individually by using the track and trace technology, based on barcodes, microchips or RFID.

With a deposit-based system there is a need for adding some extra items (i.e. additional order lines and stock keeping units, SKUs) in the business management system, so that the deposits for returnable packaging items are included in the invoice to the customer. The deposit system serves a double purpose, first to secure the speed of the packaging system, as the number of trips per year is the denominator for the profitability of the system and secondly to set such a high deposit that the actors using the packaging items are forced to send them on to the next user as soon as possible.

A similar administrative requirement is applied when the present user of returnable packaging is charged with some kind of fee. In certain cases, e.g. when using full-size returnable pallets, it is more effective to establish a fee system rather than using deposits, where the user of a pallet pays for the number of hours or days the pallet stays within his domains (Svenska Retursystem, 2003).

Financial aspects

Capital binding is something to be avoided in today's corporate finance. Investing in returnable packaging will result in increased fixed costs, which must be balanced against the cost savings due to not buying one-way packaging. The investment will also increase the balance sheet.

One solution is not to own the packaging items. Leasing can be an interesting option. Another way to go, especially in a multi-user, multi-product transport packaging pool system, is to establish a non-profit pool company, where all packaging users can become part-owners and members. A fee per usage is invoiced the producer/filler, and that cost replaces the cost for purchasing one-way packaging. That cost will also include capital costs, the cost for central cleaning – if necessary – and transport costs from the last user to the cleaning centre and the subsequent transport to the next producer/filler.

Risk of unbalances in the system

One major obstacle in nation-wide or international returnable packaging systems or systems covering large geographical regions is the risk of unbalances. For example, large volumes of empty packaging may stack up in geographical areas far away from the fillers.

One of the primary purposes of the deposit system is to prevent unbalances by keeping a high speed of circulation in the system. When it is an economic disadvantage to allow empty packaging to stack up in the backyard of an assembler, wholesaler or a retailer, the risk of unbalances in the packaging system can be reduced.

Another risk causing unbalances is when the need for packaging shows seasonal variations. This is a difficulty which requires much creativity from the logistics managers in order to be solved.

The parties involved have, however, many options in order to manage seasonal variations. Much depends on the type of products involved and the characteristics of the business sector – and, last but not least, the creativity of the people involved in the problem solving.

When designing a returnable packaging system, the volume of packaging items may not cover the highest peaks of seasonal variations. Such peaks are normally solved by using one-way packaging; otherwise there is a risk of having too many packaging items standing on storage during off-peak, thus causing extra costs to the packaging system.

Key performance factors

To conclude the discussion above, a number of key performance factors can be listed. When these factors have been investigated, and if the results can be considered favourable, the returnable transport packaging pool system will be a profitable business for the parties involved.

- Total cost savings
- Speed of circulation, maximising numbers of trips per year
- Space reduction of empty returnable packaging
- Dimensioning of typical need for packaging units (per day, per week, per month)
- Minimised loss of packaging items
- Minimised geographical unbalances
- Administration cost and control system
- Management of seasonal and peak variations

Companies or groups of companies along a supply chain must be able to identify and quantify the potentials of a returnable transport packaging pool system before they can make any decisions. As mentioned above, the experience and know-how that suppliers of returnable transport packaging systems can provide is a key parameter in providing sufficient, fact-based information to facilitate such decisions. (For additional discussions, see Stahre, 1996, only available in Swedish, however).

Appendix One: Questionnaire

Appendix Two: Expectations at first working group meeting

Appendix Three: Four versions of the specification of requirements

Appendix Four: Evaluation checklist

Appendix Five: Final tender, 1998

APPENDIX ONE: QUESTIONNAIRE

A. Personal data on the informant

1. Name
2. Age
3. Number of years in this business
4. Educational background
5. What positions have you held during your years in business?
6. How much further education within the fields of logistics, including packaging, have you received over the years?
7. If your further education has not been fulfilled by participating in training courses, from where have you acquired new knowledge to keep up with developments in logistics?
   - Conferences and seminars (in Sweden or abroad? Where abroad?)
   - Trade journals
   - Colleagues
   - Superiors
   - Competitors
   - Study visits

B. The process of formulating a specification of the requirements to be placed on a new packaging system

1. How did the early product development process work? If you did not participate in it yourself, how do you perceive that an early development process is conducted, how do you define a new type of packaging, e.g. a transport tray or a pallet?

2. What technical, economic, ergonomic and environmentally related requirements are placed on new packaging systems today?

3. What requirement parameters outweigh the others? Please rank in order of importance!

4. From where did the initiative to create a new packaging system come?

5. From your point of view, who should be the driver of the process of formulating a specification of the requirements to be placed on a new packaging system?

6. Who actually took command during the years of this development process? Why that actor/these actors in particular?

7. How important is it that a Swedish system for returnable packaging should be compatible with other European packaging systems (keeping in mind that much of the trade with fresh food is border-crossing)?

8. Capacity for change: How much new thinking are you capable to cope with within your organisation? Which actors are sluggish and which are quick in accepting new concepts?

9. Has your organisation cooperated with any or some of the other actors in this development process? If yes, to what extent?

10. What role have the suppliers of packaging played in this development process?

11. What is the importance of the communication process (i.e. distribution of information, exchange of information to, from and between the actors) in a multi-party development process?

12. When a specification of requirements is formulated for a new packaging system, there is always an ambition to create a system that is state-of-the-art and as optimal as possible (the best one available at that specific moment). Do you think that the actors have accomplished to create the optimal and best system?

C. The decision process

1. Describe in your own words how you experienced the decision process from 1992 and onwards. (If you were not involved from the beginning, please describe how it has been described to you by those who were involved from the beginning.)

2. For what reason did your organisation participate/not participate in this decision process?

3. Did the proper actors participate in the process?

4. Did the proper actors take command?

5. Who, from your point of view, took command in the decision process? Why that actor/those actors in particular?

6. How was the decision process supported within your organisation?

7. How active was the top management of your organisation in this decision process?

8. At which organisational level within your organisation were the final decisions taken? For what reasons was this issue assigned to that specific organisational level?

9. From your point of view, how do you think that the other actors within the food supply chain have handled their roles in the decision process?

10. Nutek and the Swedish Board of Agriculture provided funding for tests with returnable packaging during 1993 and 1994 (a total of approx. SEK 1.5-2 m.). Did these governmental funds have any impact on the decision process?

11. Has the risk of restrictions in competition that may be caused by a national system for returnable packaging been discussed in connection with the decision process?

12. What were the most important arguments in your internal decision process?

13. What were the most important arguments in the common, overall decision process?

14. What lessons can be learned from the decision process, internally and overall, respectively?

15. How important is the effort provided by driving individuals?

16. How could a similar decision process be driven in a future multi-party development project?

D. Business intelligence

1. How do you follow developments in your business environment within your organisation? (Indicate ”a lot”, ”a little” or ”not relevant”)
   - through trade journals
   - through business magazines and daily newspapers
   - through contacts with colleagues
   - through contacts with competitors
   - through contacts with customers
   - through contacts with suppliers
   - through contacts with our owners/shareholders
   - through searching the internet
   - through professional consultants on business intelligence
   - through contacts with other sources of information

2. How do you think that your colleagues and competitors in this business sector handle their business intelligence activities? Who is particularly good at this? Who is really very bad at it?

3. What changes in your surrounding environment have the greatest impact on the business activities within your organisation?

4. Can you give any examples of how changes in your surrounding environment have influenced the decision making within your company/organisation?

5. What threats are you exposed to from the surrounding environment?

6. What are your opportunities in your surrounding environment?

7. How do you think that changes in your surrounding environment will influence your activities from now and onwards?

8. What is your opinion about the packaging industry's attitude to the changed market situation caused by the process of introducing returnable packaging?

9. How would you describe the role of the different business organisations in this development process?

E. Creating support for a new packaging system in the daily operations

1. Which workforce categories participated in the tests that preceded the final decision concerning the selection of a common packaging system?

2. How was the workforce informed before the tests?

3. How did your organisation gather feedback and views from the operational workforce during the tests?

4. How was the workforce informed when the decision was taken, and how is it informed now that the new packaging system is being implemented?

5. What feedback and views have you received so far concerning the new packaging system from those who work in the daily operations?

6. How do you think that an optimal support selling-in process should be performed in the daily operations?

7. What actors are especially skilled at selling-in change in their daily operations?

8. What categories within the workforce have been involved before the transition to the new packaging system?

9. Which of the workforce categories have been the easiest and the most difficult to convince of the advantages of introducing business-wide transport trays and pallets?

10. Have the workers' and employees' unions been active during the tests and during the process of creating support for a new packaging system?

January 8, 2002

APPENDIX TWO: WORKING GROUP 1, INITIAL EXPECTATIONS OF THE DEVELOPMENT AND DECISION PROCESS AT THE FIRST MEETING ON JUNE 4, 1992

"It is important to establish standard norms, so we can produce a specification of requirements. These norms must be formulated in such a way that all types of /packaging/ materials can be used for a half pallet.

A functional standard is the most important part. We must determine the requirements on bending, load, shock resistance and drop test. For the future building of a pool system we must study what is happening in the world around us. The Danish half and quarter size pallets must also be considered." *Retailer logistician*

"Our objective is to start a deposit system similar to that in Austria as soon as possible." *Grower representative*

"The environmental perspective is a key issue. For the transport sector the environmental aspects are becoming an increasingly important issue for the future. In the newly formed transport industry group they have so far focused mostly on infrastructure issues, but the environmental issues are gaining more and more attention. We would like to participate in a test of a deposit system, and in that process our main interest is to evaluate the environmental and energy aspects concerning transports."
Transport representative

"It is very important with a functional standard for a half pallet. Our experience from the Örebro-trial must form the basis for the continued work. We see that the process to develop a pool system must be driven in parallel: half pallets *and* trays for the fruit and vegetable growers."
Manufacturing industry representative

"My interest is to show the good profitability which can be achieved by simple, non-bureaucratic pool systems. We have worked with "smallbox" issues for many years, and we are convinced of the great potentials for the industry, distribution and retail sectors."
Logistics consultant

"Handling operations in wholesale and distribution can be simplified when goods are put on half pallets that can go unbroken directly to the stores. Here are opportunities to reduce handling cost. The pool system that we and Perstorp have drafted will result in economic effects which would be handled as a negotiation issue between the actors. Here it is important with an organisation and rules that everybody follow. The deposit for the pallet is a pure commercial flow."
Logistics consultant

"For some years now as a marketer, I have been approached by customers with demands for pool systems for different types of packaging. If only we could get started somewhere, there would be a 'ketchup effect' at many of my customers within the food supply chain. All are just waiting for something to happen."
Packaging supplier, marketing

"The study we have performed together with the logistics consultancy in combination with experience from our European organisation show that there is a considerable potential for pool systems. We see great opportunities in developing new types of load carriers, where material combinations may be considered, to allow easy separation for reuse and recycling."
Packaging supplier, engineering and design

"In the summer 1991 we contacted ICA to listen if they are interested in a pool system based on load carriers made of recycled plastics. Since then we have become increasingly convinced of the environmental and energy savings potentials for the business sector when changing over to a waste-reduced pool system. It will become simpler and cheaper than the handling of the one-way /packaging/ material."
Packaging supplier, environment and communications

APPENDIX THREE: FOUR VERSIONS OF THE SPECIFICATION OF REQUIREMENTS PLACED ON A TRANSPORT TRAY

Translation of documents in Swedish.

Version 1, dated August 24, 1995

1. Environmentally friendly
2. Quick cooling of product
3. Drainage independent of tray tilting
4. Cold storage
5. Freezer storage
6. Even sides
7. Even bottom
8. Lid
9. 400 x 600 mm
10. Shock resistant
11. Exact tara weight
12. Light-weight
13. Possible to handle manually with product in it
14. 15 kg handling weight including product
15. Stable during handling
16. Stable when stressed diagonally
17. To be lifted in stacking machine
18. Conveyor belt
19. Identity: barcode, radio frequency
20. Stackable
21. Self-centering when stapled
22. Stable pallet loads, minimal securing
23. Place for label, easy to attach, easy to wash off
24. Holder for routing slip. The slip will fall out when the tray is turned upside down
25. Option to attach display material directly on the tray

26. Compressible
27. Compatible with other load carriers
28. Few types and models
29. Stable stacks of empty trays
30. Self-locking pallet loads of empty trays
31. Easy to clean
32. No water and dirt adsorption
33. Handling in dishwasher
34. Dry heating after washing

Version 2, dated December 6, 1996

Specification of requirements – tray for fresh food for the food sector

General

1. The aim of the development of the returnable tray is that, when used, it should reduce environmental impact in the distribution, improve working ergonomics for those who handle it and reduce the total costs for the distribution of products.
2. The tray is intended for distribution of products from filler of product right up to point of sales in the store as well as to restaurants and large-scale kitchens. The tray must also be suitable for display of products at point of sale in store.
3. The tray must fit all types of fresh food, e.g. meat and cured meat; bread; fruit and vegetables; cheese; eggs; dairy products etc. Furthermore, it must be possible to use the tray for other products than fresh food that are included in the daily distribution, such as journals.
4. The material of the tray must be 100 % recyclable and must not contain any heavy metals.

Product

1. Good ventilation. Certain products will be warm when filled into trays, others will be chilled or damp.
2. Cool storage
3. Freezer storage
4. Tray heights adapted to product range. As few heights as possible. Specify heights.

Handling, logistics

1. 400 x 600 mm outer dimensions without +tolerance
2. Conical so-called "180-degree-trays" that are nestable when turned 180 degrees. Specify compressibility.
3. Lid with option for sealing
4. Exact weight, <±5% difference
5. Specify weight
6. Maximum 15 kg handling weight, including product. (Possibly lower weight depending on upcoming regulations.)
7. 200 kg load from tray on top
8. Shock resistant
9. Stable during handling
10. Stable when stressed diagonally
11. Conveyor belt
12. Stackable
13. Withstand -35° C during handling with product
14. Dimensions stable when stressed in heat. Specify /handwritten note: max heat, dishwasher equipment)
15. Lifting in stacking equipment
16. Robot handling
17. Possible to use hook to pull a stack
18. Self-centering when stacked
19. Compatible with cardboard boxes
20. Stable pallet loads, minimal securing during distribution and return. Specify
21. Maximum height of unit load 1,250 mm (including pallet). Specify
22. Unique identity for each tray, barcode, clear text, transponder
23. Space for label, easy labelling, easy washing off
24. Holder for routing slip. Slip will fall out when tray is turned upside down
25. Compatible with other returnable load carriers and trays. Specify

Marketing, sales

1. Option to attach display material directly on tray
2. Attractive colour and layout
3. Stackable with a half-tray displacement

Hygiene

1. Easy to clean
2. Not collecting water or dirt
3. Handling in dishwasher
4. Dry heating after being washed. Specify heat resistance during drying
5. Maximum 5 grams of water remaining after drying. Specify drying system

Version 3, dated January 27, 1997

Specification of requirements – tray for fresh food for the food sector

General

1. The aim of the development of the returnable tray is that, when used, it should reduce environmental impact in the distribution, improve working ergonomics for those who handle it and reduce the total costs for the distribution of products.

2. The tray is intended for distribution of products from filler of product right up to point of sales in the store as well as to restaurants and large-scale kitchens. The tray must also be suitable for display of products at point of sale in store.

3. The tray must fit all types of fresh food, e.g. meat and cured meat; bread; fruit and vegetables; cheese; eggs; dairy products etc. Furthermore, it must be possible to use the tray for other products than fresh food that are included in the daily distribution, such as journals.

4. The material of the tray must be 100 % recyclable and must not contain any heavy metals.

Product

1. Good ventilation and drainage. Certain products will be warm when filled into trays, others will be chilled or damp.
2. Heat **test**
3. Cool storage **test**
4. Freezer storage **test**

Handling, logistics

1. 400 x 600 mm outer dimensions without +tolerance

2. Conical so-called "180-degree-trays" that are nestable when turned 180 degrees. Specify compressibility.

3. Three heights. Outer dimensions:
   125 mm
   155 mm
   180 mm

4. Lid with option for sealing

5. Exact weight, <±3% difference (handwritten changed to 2 %)

6. Specify weight

7. Maximum 15 kg handling weight, including product. (Possibly lower weight depending on upcoming regulations)

8. 200 kg load from tray on top. **test**
   (Handwritten note: "During transport and handling. During different temperatures. Specify how simulations have been performed.")

9. Shock resistant. **test**

10. Stable during handling **test**

11. Stable when stressed diagonally **test**

12. Conveyor belt. **test**
(Handwritten note: "Possible to handle, in both directions of tray.")

13. Stackable **test**

14. Withstand -35° C during handling with product
(Here the word "test" has been deleted.)

15. Dimensions stable when **test**
stressed in heat. Specify

16. Lifting in stacking equipment

17. Robot handling

18. Possible to use hook to pull a stack

19. Self-centering when stacked

20. Compatible with cardboard boxes

21. Stable pallet loads, minimal **test**
securing during distribution and return. Specify

22. Maximum height of unit load
1,250 mm (including pallet). Specify

23. Unique identity for each tray, barcode, clear text on a minimum of two contrasting sides with legibility when trays are nested. Possibility to place transponder afterwards.
(Handwritten note: "Each tray size is marked with volume or

height.")

24. Space for label, easy labelling, easy washing off

25. Holder for routing slip. Slip will fall out when tray is turned upside down

26. Compatible with other returnable load carriers and trays. Specify.

Marketing, sales

1. Option to attach display material directly on the tray

2. Attractive colour and layout

3. Stackable with a half-tray displacement

Hygiene

1. Easy to clean with environmentally labelled detergents

2. Not collecting water or dirt

3. Handling in dishwasher

4. Dry heating after being cleaned. Specify heat resistance during drying

5. Comply with the Swedish Food Administration's requirements for bacteriological cleanness.
(Handwritten note: "Bacterial tests in accordance with a scale 1-5 depending on bacteriological cleanness. 5 good < 2 bacteria colonies")

6. Maximum 5 grams of water remaining after drying. Specify drying system

Testing

1. In accordance with standard XXX
   Plus amendment YYY

Version 4, dated May 12, 1999

Translated from a slide presentation made at a meeting on May 12, 1999.

Slide 1

Specification of requirements – trays

Table of contents

- Background
- Purpose
- Objective
- Specification of requirements
  1. Measures and design
  2. Material requirements
  3. Handling requirements
  4. Test procedures
- Facts

Slide 2

Specification of requirements – trays

1. Measures and design

- Approved drawings
- Bale-arm construction
- Tara weight

- Tolerances
- Other properties, e.g. ventilation and design requirements

Slide 3

Specification of requirements – trays

1.1 Measures and design

- Drawings approved and signed by both parties from each supplier's actual tray sizes. We own the drawings.

- Module measures for full-size tray must be 400*600 mm and 400*300 for half-size tray.

- Measure tolerance requirements are specified on drawings and should functionally guarantee avoidance of trays wedging up in stacks.

- The utility heights of the system must be 110, 140 and 165 mm with minimum build height. These measures should be specified in accordance with approved drawings.

Slide 4

Specification of requirements – trays

1.1 Measures and design, continued

- Minimum weight related to material strength requirements +/- 2% difference.
- It must be possible to identify trays with a logotype prescribed by SRS and by agreement to provide the uniqueness demanded by SRS.
- The tray should be ventilated in accordance with an approved design drawing.

Slide 5

Specification of requirements – trays

2. **Functional requirements**
    - The tray
    - The bale arm
    - Recycling
    - Requirements contra content handled
    - Colour

Slide 6

Specification of requirements – trays

2.1 Material requirements

- Approved for food handling in direct contact in accordance with the regulations from the NFA, the National Food Administration (www.slv.se).
- The material must be reusable for producing new trays and bale arms respectively, must not cause any negative impact concerning function and material strength and must not contain any heavy metals.
- The colour of the trays must be grey, specification no. -----
- The colour of the bale arm 1 must be -----, bale arm 2 ---- (differing)
- The material must withstand -35 to +40 degrees C as well as cleaning at max. 85 degrees C.

Slide 7

Specification of requirements – trays

3. Handling requirements

- Loading capacity- /tray /stack
- Stacking
- Compressing
- Compatibility
- Cleaning

Slide 8

Specification of requirements – trays

3.1 Handling requirements

- Loading capacity 15 kg + safety margin double load per tray
- Compressing capacity per tray size minimum 70 %
- Loading capacity for stack maximum 2,500 mm, which results in a requirement that each tray must withstand 250 kg load on top within required temperature range and without any functional problems
- Comply with washing in accordance with specification ----------
- Handling in accordance with given requirements within the temperature range -35 to +40 degrees C

- Compatibility between trays included in the system as well as with other bale-arm trays for stacking

Slide 9

Specification of requirements – trays

3.1 Handling requirements, continued

- It should be possible to identify each tray by EAN label and by reading on two opposite sides even when nested. For full-size tray on the long side and for half-size tray on the short side
- Label space to be provided with measures given on drawing
- Holder for loading slip given on drawing
- Identification of different tray heights possible by different colours on bale arms
- Handling on conveyor belts possible in all tray directions given in spec
- Accessories to the system: lids, dollies and securing details between stacks

Slide 10

Specification of requirements – trays

4. Test procedures

- In accordance with Draft pr EN CEN 261 WI 195
- Bale arm tests

APPENDIX FOUR: CHECKLIST FOR EVALUATION OF TRAY SYSTEMS AND TRAY DESIGN (CLOSED OR VENTILATED TRAY)

The checklist contained the following items:

Store

Display
Handling time in store, compare systems
Ergonomics, compare
Empty space reduction capacity of trays
Product quality
Crush (=damaged products)
Labelling
Other important comparisons

Distribution centre

Picking from pallet
Picking to roll container, pallet and dolly
Ergonomics, compare
Crush (=damaged products)
Product quality
Distribution
Empty space reduction capacity of trays when transported back
Labelling
Other important comparisons

Supplier/filler

Filling of trays
Placing load
Ergonomics
Labelling
Crush (= damaged product)
Product quality
Distribution
Empty space reduction capacity of trays when transported back
Other important comparisons

Checklistan innehöll följande punkter:

Butik

Exponering
Hanteringstid i butik, jämför systemen
Ergonomi, jämför
Komprimerbarhet av tomma lådor
Produktkvalitet
Kross
Märkning
Övriga jämförelser som är viktiga

Distribunal

Plockning från pall
Plockning till roll container, pall och dolly
Ergonomi, jämför
Kross
Produktkvalitet
Distribution
Komprimerbarhet returtransport
Märkning
Övriga jämförelser som är viktiga

Leverantör/fyllare

Fyllning av lådor
Lastläggning
Ergonomi
Märkning
Kross
Produktkvalitet
Distribution
Komprimerbarhet returtransport
Övriga jämförelser som är viktiga

APPENDIX FIVE: TENDER CONCERNING RETURNABLE TRAYS FOR FRESH FOOD IN THE SWEDISH FOOD SUPPLY CHAIN

Background

The Grocery Manufacturers of Sweden, DLF, and the Retailers' Development Council, DUR, formed by ICA, Coop, Axel Johnsson and the association of food retailers, SSLF, formed a jointly owned company in October 1997, Svenska Retursystem AB (Swedish Pool System Ltd).

The business concept is to "act to create an efficient and environmentally friendly pool system of standardised returnable units within the fresh food and grocery business sector".

The background of the formation of Svenska Retursystem AB is that during several years DLF and DUR have considered the opportunities to create a sector-wide pool system, as there are financial and environmental advantages to be gained.

The origin and the formation of Svenska Retursystem build on a shared vision among suppliers and retailers concerning the obvious advantages of establishing a common pool system that works along the whole supply chain. A consortium agreement was signed by DLF and DUR resulting in Svenska Retursystem AB, with the two parties each owning 50 %. Several projects were already in progress, particularly within the fields of transport trays and pallets, and these project groups were transferred to the technical groups that were established within Svenska Retursystem. After an extensive effort in the tray group during the first half of 1997, a vision of a future transport tray was emerging, and parts of the meat industry were eagerly awaiting a final decision on the type of tray. In this crucial phase a technically more advanced tray alternative entered the scene, one that the majority considered would have obvious advantages (transport economy, manual handling). However, all parties involved did not regard this new alternative as being better (washability, automated handling). Depending on different views of evaluation parameters within different product sectors as

well as not having had the time to conclude a formally correct tender process, it was not possible to reach a final decision during 1997.

At the beginning of 1998, not even an investigation performed by a consultancy could provide any clear answers (that could be accepted by all) concerning how to proceed, even if it provided increased knowledge. On the basis of this investigation, the board decided that it was possible to accept both a bale-arm tray and a 180-degree tray in accordance with the specification of requirements and recommendations by the Svenska Logistikbyrån [the consultancy], dated March 2, 1998. However, each product sector (fruit and vegetables, dairy, meat and cured meats, bread and others) must agree on which type of tray they prefer. Views from the whole supply chain, which includes suppliers (fillers) as well as wholesalers and retailers, will be taken into consideration. In practice, this can result in the acceptance of two parallel tray systems in order to get on, even if that would be an unfortunate solution.

The present situation

It is important to emphasise that it is primarily the complexity of the tray type selection, and not the design of a common pool system, that has caused the slow progress in this process. The work that has been accomplished so far has formed the basis for the ongoing tray effort. Since a couple of months the process has been managed by the board of Svenska Retursystem, and in a certain number of issues time has enabled us to proceed in a joint effort.

Discussions based on investigations and contacts with other countries have been held with different product sectors, and the following conclusions can be drawn:

- It is possible that at least 5 million trays will be needed to serve the market in Sweden.
- There are no absolute demands from any of the product sectors or from any parts of the supply chain that would stop any party from accepting a certain type of tray.
- The economic aspects of a pool system are obviously positive, irrespective of type of tray in all product sectors.

On the basis of the conclusions described above, the board has continued its effort from a holistic perspective for the whole supply chain, which means

that the work can be focused on the creation of a good solution based on an economic perspective.

Handling tests have taken place in an environment that attempts to mirror manual handling along the whole product supply chain, and in these tests the bale-arm tray turned out to be somewhat better than a 180 degree tray based on the following criteria:

- faster to handle
- less damaged products
- perceived as more ergonomic.

On May 11, 1998 the board of Svenska Retursystem decided to accept the bale-arm tray within the fruit and vegetable product sector, as the whole supply chain was unanimous and this product sector has the largest volumes.

On June 15, 1998 the board of Svenska Retursystem decided to accept the bale-arm tray for dairy, meat and cured meats, as the whole supply chain could accept a bale-arm tray in order to achieve large-scale advantages.

On the basis of the decisions described above, it was decided that a family of bale-arm trays should be created, with full compatibility for the whole food and grocery sector.

The tray company is activated, supported by the technical group, a new tender is sent out and negotiations are started with potential tray suppliers. In parallel with this process, it is investigated if there are sufficient needs (the total economy will guide) for a non-perforated tray alternative to be produced (a requirement from the meat and cured meats sector).

Information concerning request for tenders

Tenders should be submitted by the latest August 10. The address is:

Anders Kandelin
Klarabergsviadukten 90
10613 Stockholm.

If there are any questions, please contact Anders Kandelin (difficult to reach weeks 28-30, mail most reliable).

Mail anders.kandelin@retursystem.se
Tel 08-6988153, 070-5455844
Fax 070-6155844

The specification of requirements and test program in accordance with appendices attached. If any item in the specification of requirements should cause a considerably higher price, or be impossible to comply with, you are nevertheless welcome to submit a tender. In such a case, it must be clearly indicated how large the deviation is from the specification of requirements.

Terms for guarantee must be stated. One suggestion is that the guarantee provides a total guarantee for the first year, covering all damages with a certain excess for the buyer, and subsequently a guarantee related to the test program covering x further years.

The type of tray selected and the design will belong to the buyer after the deliveries are accomplished.

Your tender should include a plan for when and where the production of trays will take place, and your production capacity after production start must be stated. The pool system is expected to start during May [1999].

The buyer has the right to select all or parts of the tender; e.g. different trays may be produced by different suppliers. If this should result in changed prices, this must be indicated in the tender.

The tender is valid until November 15, 1998.

Price of product at factory gate must be stated. As a suggestion Free Carrier (Incoterm FCA). Terms of payment must also be stated.

Indicate suggested colour and how other colours may influence the price.

Tender is expected to include the following tray quantities and additional quantities of up to a total of 5 million trays:

Type of tray with approximate heights as below, or trays which fulfil similar payload volume	Tray need
125 mm	300,000
155 mm	300,000
180 mm	1,000,000

Indicate also the estimated price of a non-perforated variant of a tray of the same family in the highest height as well as of a perforated tray in the highest height.

Indicate under what circumstances you can allow the production to be performed by another manufacturer.

Svenska Retursystem AB

Anders Kandelin

Project Manager

June 28, 1998

Specification of requirements – tray for fresh food for the food and grocery business sector

General

1. The purpose of the development of a returnable tray is that, in the cases where it will be used, it should reduce environmental impact, improve working safety conditions for those handling it as well as reduce the total cost for the distribution of products.
2. It should be possible to use the tray for the distribution of products from fillers to retailers, on to point of sales in stores and to restaurants and large-scale kitchens. It must also be possible to use the tray to expose products at point of sales in stores.
3. It should be possible to use the tray for all types of fresh foods. Examples of fresh foods are meat and cured meats, bread, fruit and vegetables, cheese, eggs, dairy products. Furthermore, the tray should, within the present legal situation, be suited for other products than fresh food, such as journals and magazines.
4. The material of the tray should be approved for contact with food in accordance with the rules set by the National Food Administration [in Sweden].
5. The material of the tray should be recyclable and may not contain heavy metals. Specify the material content in all tray components.

Product

1. Good ventilation and drainage. Specify. Certain products will be warm when filled into trays, others will be cold or damp. Specify if certain products require a closed tray in parts of the supply chain.
2. The tray dimensions should be adapted to standard packaging of ready meals.

Handling, logistics

1. Outer dimensions 400 x 600 mm without + tolerance, and a half tray with the dimensions 400 x 300 mm
2. Max 15 kg handling weight, including product
3. Stackable trays
4. Trays that can be compressed; specify space reduction capacity
5. Three heights for payload volumes that are normally reached with outer dimensions of about 125 mm, 155 mm, 180 mm
6. Within the heights proposed above, as large an inner volume as possible; specify payload heights and payload volumes and the [inner] bottom dimensions.
7. Maximum height of unit load 1,250 mm (including pallet); the same unit load for all tray heights; specify
8. During handling in different temperatures, trays with different heights should be completely compatible both when carrying payload and when returned empty; if this requirement is difficult to meet, specify problems that would occur
9. Lid with sealing options and drainage
10. Exact weight, <±2 % difference
11. Specify weight
12. 250 kg load from tray above during transport at -35, 23 and 40°C; trays may not sink into each other or become deformed; specify how test is performed and results
13. Double stacking with EUR pallets (1,200x800 mm) should be possible, which means that four trays must have the capacity of carrying one EUR pallet of 1,000 kg during transport at -35, 23 and 40°C.
14. Shock resistant
15. Stable when handled
16. The tray must be handled in conveyor belt systems and other types of automated handling
17. Possible to handle on transport belts and conveyor belts in both tray directions
18. To be carried in stacker
19. Specify if hooks can be used to pull a stack of trays
20. Facilitate simple stacking
21. Compatible with cardboard boxes
22. Stable pallet loads, minimal need for securing during distribution/return. Specify

23. Unique identity for each tray, barcode, clear text on at least two opposite sides with legibility when trays are nested; specify how transponder could be added on afterwards
24. It must be possible to identify each tray height in a stack; specify how
25. Space for labels, easy to stick label, easy to wash off
26. Option for label holder; specify how labels can be removed
27. Specify the systems that are compatible with the tray in upper and lower edge (CCG, IFCO, Maxi-Nest).

Marketing and sales

1. Specify options to attach commercial displays directly on tray

Hygiene

1. Easy to clean with environmentally accepted detergents
2. Not collecting water and dirt
3. Handling in dishwasher
4. Heating when dried after cleaning; specify heat resistance during drying
5. The tray must fulfil the requirements placed by the National Food Administration concerning bacteriological cleanliness after washing after five years of use; specify which dishwasher and which detergent meet this requirement
6. Specify amount of grams of remaining water after drying; specify drying system.

Testing

Test of trays must be performed in accordance with *Draft prEN CEN 261 W1 195, Reusable, rigid plastics distribution boxes, Part 2: General specifications for testing*

with the following alterations:

4.2 last paragraph, *Tolerances on nominal tare weight shall not exceed 2%.*

6.2.2 Drop test 1

Conditioning should be performed at -35°C ±2°C.

6.2.3 Drop test 2

Conditioning should be performed at -40°C ±2°C.

The drop height should […text ends here, incomplete]

APPENDED PAPERS

Appended Paper One

Multi-Party Based Development And Decisions for a Nation-Wide Packaging Pool System

Accepted for presentation at the 9th Annual LRN, Logistics Research Network Conference 9-10 September 2004 in Dublin, Ireland. (Peer-review of abstracts.)

Appended Paper Two

Plastic Trays in Retailing: The Challenge of Implementing Change in Packaging Logistics

Accepted for presentation at the 13th Annual Conference of EAERCD, The European Association of Education and Research in Commercial Distribution 29 June- 1 July 2005 in Lund, Sweden. (Double blind peer-review of papers.)

Appended Paper Three

Packaging logistics and retailers' profitability: an IKEA case study

Accepted for presentation at the 13th Annual Conference of EAERCD, The European Association of Education and Research in Commercial Distribution 29 June- 1 July 2005 in Lund, Sweden. (Double blind peer-review of papers.)

Appended Paper One

Multi-Party Based Development And Decisions for a Nation-Wide Packaging Pool System

Accepted for presentation at the 9th Annual LRN, Logistics Research Network Conference 9-10 September 2004 in Dublin, Ireland. (Peer-review of abstracts.)

MULTI-PARTY BASED DEVELOPMENT AND DECISIONS FOR A NATION-WIDE PACKAGING POOL SYSTEM

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Abstract

Planning and implementing an open-loop, business-wide national pool system for transport packaging (trays and pallets) is a complex process. This research project is focusing on the driving forces in the development and decision processes. During 1992-1999, a group of logistics specialists within the Swedish food supply chains took part in a development process, which included much learning and new thinking. The process contained eight separate missions, described in this paper. The collection of data is based on interviews. Documents from meetings support the analyses of the interviews. The theoretical platform for this research is based on change management theories, including learning processes. Results so far show the importance of establishing a common vision at an early stage, where shared understanding forms a driving force for logistic development. Another conclusion is that all future development of packaging and logistics systems must be based on co-operation and an active dialogue between the actors along a supply chain. Supply chain transparency is an important driving force, enabling parties to see where costs and savings come up. Study visits and pilot tests have been identified as the most efficient methods to acquire new knowledge concerning logistical development.

Keywords
Packaging logistics, packaging development, packaging pools, change management

Introduction

After several years of discussions, tests, investigations and new tests, the suppliers and the retailers within the Swedish business sector for food and commodities formed a jointly owned non-profit company in 1997, which started its physical operations in 2000. This company, Svenska Retursystem AB (www.retursystem.se), now has the mission to introduce returnable transport packaging into the Swedish food supply chains. The product range includes a family of nestable and interstackable plastic trays and plastic pallets in two sizes. This pool system is unique, since it is the only open, business-wide and national pool system in operation in the world. It is also an example of a development where there has been no clearly dominant or driving actor. Instead the process has been driven by suppliers and retailers in a negotiation- and majority-based consensus way of decision-making.

Research questions

The research project investigates the following question: *How are strategies for change management and decision making formulated within multi-party based logistic development?*
Underlying questions are:

- How is an early product development and requirement process driven in this type of multi-party co-operation?
- How are common views and the willingness to co-operate created and established within a group of actors who normally are competitors or are dependent on each other in supplier-customer relationships?
- Which parameters dominated the development and decision processes?

Purpose

The purpose of this paper is to describe and analyse how a multi-party logistic development process has been conducted, with focus on the last of the underlying research questions: Which parameters dominated the development and decision processes?

Literature review

A literature review shows that there are only a few studies that have been made in the fields of returnable transport packaging, packaging pools, the development process of such pools and how they are managed. Diana Twede has published a number of papers arguing for the advantages of returnable packaging from logistical and financial points of view (1992, 1999a, 1999b). Stahre (1996) provides a broad description and analysis of the operational logistics prerequisites for different pool systems and gives explanations on the arguments for certain business sectors to choose returnable transport packaging. Koehurst et al (1999) describe the process of developing a pool system, however not a business-wide, open-loop packaging pool. Kärkkäinen et al (2004) conclude after a multi-case study that there is a need for more research concerning updating of management theories on operational packaging pool systems.

The theoretical platform for the analyses is based on change management theories (Moss Kanter, 1984), including learning processes (Sarv, 2003). Moss Kanter points at the importance of allowing innovative change processes in large companies, by empowering visionary entrepreneurs with top management support and provide them with certain tools to accomplish their missions. Sarv points at the need for using systemic learning as a basic tool for change management processes. Stock (1997) points at the importance of applying theories from other disciplines to logistics.

Definitions and terminology

Transport packaging containers have many names: boxes, containers, trays and totes. In this paper the word *tray* is selected, since it is the most commonly used in the UK. There are two words used to describe that trays can be used more than once: reusable and returnable. Since the word *returnable* indicates that the tray is physically returned, this word is selected for this paper.

Concerning definitions and terminology for packaging pool systems, there is a way to describe different types of transport packaging and pool systems in order of complexity:

Transport packaging design:

- single product (the packaging is designed for one specific type of product)
- *multi-product* (the packaging is designed to fit many types of products)

Pool system design:

- single-loop (from one supplier to one customer and then back again to the supplier)
- multi-loop (from one supplier to many customers and then back again to the supplier, or one large customer provides a number of suppliers with customer-owned returnable transport packaging)
- *open-loop pool system* (many suppliers, many customers, deposit- or fee-based to reduce loss and provide higher take-back speed.)

For all the above mentioned types of returnable packaging systems, there are four main success factors that determine the profitability and usability of the system (Stahre, 1996):

- the speed of circulation of packaging items, defined as trips per year
- the level of loss ratio of packaging items
- the geographical coverage and transport costs
- seasonal variations (growing seasons as well as holiday seasons)

Methodology

The research is based on a single case study. Ellram (1996) points at the advantages of using case studies as a basis for the formulation of new theories. The qualitative case study method has been selected since it can provide answers on “how” and “why” questions, as well as providing an in-depth understanding of complex processes that is difficult to obtain with other research methods. (Yin, 2003).

Data has been collected in interviews and from documentation. 14 informants have been selected. They represent the time frame of the process, 1992-1999, as well as all the parties involved throughout the supply chain, i.e. one grower, five suppliers, two wholesalers and four retailers. Two of the informants come from packaging companies. Interviews were performed in 2002. Documents provide verification of informants' statements. The informants' capacity of remembering discussions and development steps has been checked against available meeting notes.

Case study description

The research project covers 1992-1999. During this time period a group of logistics specialists throughout the Swedish food supply chains took part in a development and decision process, which included much learning and new thinking. As the development and decision processes include many types of issues, they have been categorised in a total of eight missions.

Working Group 1, 1992-1994

The first working group was active 1992-1994. This first group completed five missions:

1. Selling-in of the vision to all participants in the first working group (1992)
2. Plan and perform a large-scale pilot test (1992-1993)
3. Design an administrative concept for the pool system (started 1993, then postponed to 1998, Mission 8)
4. Design a functional standard for half pallets (800 x 600 mm footprint), European standard, packaging material neutral (1993-1994)
5. Develop a returnable tray for vegetables on demand from the Swedish Board of Agriculture (1994)

Initially in 1992, the most important issue to start with was to make sure that all group members were equally aware of the potential of the pool concept. The overall objective was to create a packaging system with lower supply chain total cost. Additional objectives were: increased product quality due to less transport damage, improved ergonomics, in-store handling as well as waste reduction. The informants who were involved in 1992 conclude that mission 1 was accomplished after the study visit to Austria, where the Kisten-Pool system actors were visited. (Gustafsson, 1993).

After Mission 2, a large-scale pilot test, the working group agreed on a number of system and product requirements:

System Requirements:

- open-loop pool system, all parties accepted as pool system members
- deposit-based pool system; in order to achieve a high circulation speed and reduce loss of trays, key parameters for pool system total economy
- no third-party pool system solution in order to keep full control on system cost and development
- cleaning of used crates a high-priority system requirement

Product Requirements:

- tray footprint 600 x 400 mm
- tray based on 100 % recyclable thermoplastics (high-density polyethylene or polypropylene)
- stack/nest functions based on 180º rotation of trays
- no foldable/collapsible or bale-arm stack/nest tray due to bad quality of existing trays (e.g. hinges) and hygiene (difficulties to clean)

The group was closed in the beginning of 1995, when the logistics manager at the largest retailer in Sweden stopped the vegetable growers from taking the initiative in driving the development of a packaging pool, an option opened while working on Mission 5.

Working Group 2, 1995-1999

Two new working groups, one for trays and one for pallets, were formed during 1995 as a result of a common initiative by the suppliers and the retailers.

When the Working Group 2 was formed in 1995, new group members entered the scene. Knowledge continuity was secured as three of the informants from the first working group became members of the second group. The study visit strategy in Mission 1 was repeated.

The following missions were accomplished by Working Group 2:

6. Develop a specification of requirements on a business-wide, returnable tray, followed by a tender process (1995-1998)
7. Perform an environmental evaluation of a plastic tray (1996-1997)
8. Design an administrative concept for the pool system, form a part-owned pool company (1998-1999, continued from Mission 3)

Mission 6 has been selected for an in-depth description and analysis, as it provides the basis for the description of how multi-party cooperation concerning change management, learning, reaching consensus and decision making has been managed in this process.

In 1995-1996, two conflicting parties were identified by the working group. They continued to fight for their own interests throughout the process:
- suppliers of meat and cured meats, poultry and delicatessen
- suppliers of fruits and vegetables

The issues that the two groups had difficulties to agree upon were:
- ventilated/drained or closed tray
- tray height dimensions
- colour of tray
- design of handles, perforated or non-perforated

The working group identified two questions to be carefully considered when deciding on tray properties:
- which of these two groups has the most urgent need/use of a common tray?
- which of these two businesses have the largest volume?

Certain issues were iterated repeatedly or deliberately postponed. The decision-making was based on a negotiation- and majority-based consensus decision strategy, which was time-consuming.

The definition of tray heights is one example of this. At a working group meeting during a study trip to Finland in August 1996, it was decided to start a project to test how the most frequent products would fit into different tray heights. First, a test protocol was compiled. During October, a large number of test packing operations took place all over Sweden. More than 200 different products were included in the test. In order to achieve a unified height on loaded pallets, as well as acceptable fill rates, the following three heights were proposed and decided upon in November 1996: 110, 140 and 165 mm.

In May 1997, one group member came back from a trade fair in Brussels, where he had seen a new type of tray with interesting properties. It was the second generation bale-arm tray developed by Tesco. The empty nesting space reduction capacity was an impressive 75 %, to be compared with the 50-55 % offered by the 180º rotation stack/nest trays. This parameter, *empty tray space reduction*, had not been in focus earlier in the development process, since the working group had decided on the 180º rotation stack/nest tray concept, excluding other space reduction solutions for quality and hygienic reasons. The Tesco tray soon gained high attraction from the retailers' point of view, thanks to its space reduction features. Now the process entered into what is described as *"the U-turn"* by four of the informants. Or as another informant described it: *"it went from evolution to revolution".*

The second half of 1997 and 1998 were turbulent, as the retailers formed their argumentation for the Tesco crate while the meat industry together with other suppliers fought for their positions, formally agreed upon in the working group's specification of requirements for a returnable tray. The informants conclude that lots of action took place behind the scene during the last stages of this process.

In May 1999, the pool system company is finally provided with the investment capital required for concluding the contracts concerning pallets and trays. The Tesco tray supplier is selected as supplier

to the pool system. During 2000, the first trays are introduced in the market. (It can be noted that the heights of the trays in operation today are somewhat different than what was decided after the large packing test in 1996: 199, 167 and 106 mm.)

Discussion and Conclusions

Mission 1 was critical to plan and perform in order to reach a common vision. The importance of assuring that all players in a change process share the same vision has been pointed out by both Moss Kanter (1984) and Sarv (2003). As Mission 1 was in part repeated when Working Group 2 was started, the new members could be introduced and enabled to share the vision of the process. Study visits - both abroad and within the national supply chains - and large-scale pilot tests have been identified as the most efficient methods to acquire new knowledge on packaging and logistics.

All informants comment on the time consuming process. At the same time they conclude that future development of packaging and logistics systems must be based on co-operation and an active dialogue between the actors along a supply chain. Koehurst et al (1999) refers to a theory proposed by Lee et al (1995), as they point at the importance of having a "dominant designer", who pushes the development by making the proper decisions. In the Dutch case described by Koehurst et al (1999), the large retailer Albert Heijn together with the packaging company Wavin are defined as dominant designers. This theory is confirmed by Smith (2002), when describing how Tesco managed to develop and implement their second generation bale-arm tray within two years. The suppliers had little opportunity to influence tray design in these both cases. In the Swedish, more time-consuming process, all actors had a possibility to argue for their interest in co-operation with other actors who could accept their proposals on specific design issues.

The early closing of certain design parameters was a reason for the "U-turn" turbulence late in the decision process. The first working group had decided to exclude the bale-arm tray design for quality and hygienic reasons. This has been commented in Stahre (1996) where he describes Sainsbury's high loss of trays due to weak material in the bale arms. By focusing on the stack/nest design based on 180 º rotation, both working groups missed that product development went on during the years. The possibility of improving the empty tray space reduction capacity by looking at new developments was neglected. Not until a late stage, the new second generation bale-arm tray with a considerably better space reduction capacity was introduced by the retailers. Still hygienic aspects could be raised against this tray design, but the quality problems had been solved since the decision in 1993 to exclude this tray design.

Two patterns can be identified on how difficult issues were solved within the second working group. The first pattern shows how tricky questions were postponed, in some cases more than twice, in order to be solved later in the process. Certain issues had to be taken off the agenda, since too much attention and time was spent on issues that could be defined as second priorities. (E.g. choice of colour of the trays.) The second pattern was used to solve certain issues by pilot tests or internal investigations within group members' own organisations. (E.g. test packing of 200 most frequent products to define tray heights and tests with closed and perforated trays.)

So far, four conclusions can be presented. They point at general management issues that can be applied on any type of development or change process. However, it must be stressed that the logisticians that were involved in this development process were not fully aware of the impact of these prerequisites:

1. The management of the initial process is of utmost importance: the forming of a common objective, or a commonly shared vision, which all participants wish to reach. In this case the commonly shared vision was to obtain logistical efficiency enhancement, including the understanding of the impact of applying a supply chain total cost savings perspective.
2. The importance of creating a common understanding within a development project and its working groups, as well as a common knowledge platform, upon which new knowledge can be successively added. Study visits, domestic as well as abroad, prove to be an efficient tool to create both common knowledge and better group dynamics.
3. Creating transparency throughout the pool system is an important factor enabling parties to see where costs and savings come up. Transparency provides better understanding of which actions needed to be taken to improve system properties. Transparency is an important aspect when parties

sit down at the ordinary commercial negotiations on prices and terms, as costs and savings unbalances caused by the returnable packaging system must be adjusted there.
4. This type of development and decision process must include other professional specialists. The informants – all logisticians – pointed at the need for including professional skill from the commercial departments at their companies, both procurement and sales, into the preparation work within the decision process. This would probably have facilitated the forthcoming implementation of the pool system.

Future research

Kärkkäinen et al (2004) have pointed at the need for further research concerning the formulation of an updated theory on the management of returnable transport packaging systems, based on data collected from multi-case studies. This paper is also pointing at this need, as well as the need for collection of data from existing full-scale, business-wide pool systems to determine the success – as well as the failure – factors in order to provide updated, empirically based theories in this field. Such theories can be of high value for decision-makers within the industry.

Finally it must be noted that today, the product development within returnable transport packaging is showing that the foldable/collapsible trays are the growing part of returnable transport packaging. This type of tray accounts for 150 million of a total of 275 million returnable trays now being used in Europe. (Gustavson, Arca Systems, 2004). In only one year, 2002-2003, the number of foldable trays increased by 15-20 million. There are some 90 million rigid and stack/nest trays in circulation and some 35 million bale arm trays, and none of these types of trays show any increase in use. There is a need for research on how expanding knowledge concerning returnable transport packaging will result in improvement of tray design in order to reach enhanced logistical properties.

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Appended Paper Two

Plastic Trays in Retailing: The Challenge of Implementing Change in Packaging Logistics

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Plastic Trays in Retailing: The Challenge of Implementing Change in Packaging Logistics

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Plastic Trays in Retailing: The Challenge of Implementing Change in Packaging Logistics

Summary
Packaging logistics is fundamental to the success of retail supply chains. Implementing system-wide change in this field is however complex. This paper introduces packaging logistics in retail supply chains and compares and contrasts the change processes in the introduction of plastic trays to retail food systems in the UK and Sweden.

Introduction

It can not escape even the casual consumer's notice that the way in which fresh food is sold has changed. This is evident across Europe both in the changing formats of food retailing, but also in the ways in which fresh food is presented and retailed within shops. Transformations of the retail structure in many countries have altered the supply system and logistics requirements, as retailers have gained power and control from manufacturers, producers and wholesalers (e.g. Burt and Sparks 2003, Fernie and Sparks 2004). Some logistics changes have been driven by enhanced legal requirements on the safe and healthy handling and supply of food products. Others arise from alterations to consumer demands and requirements and the development of new products by manufacturers and retailers. New approaches to supply chain activities, such as ECR, and new developments in technology have also played a part.

Substantial retail logistics change has been enabled by a realisation that supply chains, particularly in fresh food can be simplified and reorganised, so as to become more efficient and effective (see Fernie and Sparks 2004). The packaging, handling and movement of products have become of vital concern for all involved in supply chains. In particular the scope for improvements in packaging logistics to produce better solutions for timely and appropriate handling and supply has been considerable. Packaging logistics takes a supply chain approach to the development of packaging, seeking efficiency and effectiveness across supply chains by the co-ordinated development of packaging activities and solutions. However, identifying changes that need to be made in supply chains to make them more efficient is one thing. Carrying through and implementing such changes is more problematic, with many opportunities for delays or errors.

The aim of this paper is to understand how change has been implemented in the area of retail fresh food packaging logistics. It examines the introduction of plastic trays into fresh food logistics systems. In the United Kingdom, such trays have become ubiquitous in both distribution and shop floor settings. The United Kingdom situation is compared and contrasted with the implementation of a similar change in Sweden. The two situations are used as exemplars of different retail power bases and culturally different approaches to change management. Through such a comparison it is anticipated that implications for companies, supply chains and academic conceptualisations may be developed. In this discussion the intention is to raise the issues and to point the way for further research. The paper is structured into four sections. First, we provide an introduction to packaging logistics in retailing. Secondly, a brief methodological section is provided. Thirdly, the two cases of the Untied Kingdom and Sweden are compared and contrasted. Finally, lessons are drawn.

Packaging Logistics in Retailing

Packaging is the underbelly of logistics and supply chains. It is absolutely essential to the efficient functioning of supply systems, but has a tendency to be taken for granted or ignored. An analysis of six recent UK textbooks in the supply chain and logistics field shows that consideration of packaging and packaging logistics is uncommon. Only three contained any reference to packaging and these were no more than three pages in length and concentrated in two cases solely on the basic functions of packaging. This reinforces the literature searches by Johnsson (1998) and Saghir (2002) who found few articles that examined packaging from a logistics viewpoint. Indeed Johnsson (1998) noted that packaging was generally only discussed from a protection and palletisation perspective. This lack of coverage is rather strange given that packaging acts as a logistics and supply chain integrator and brings considerable channel benefits.

There is an initial distinction to be drawn amongst primary, secondary and tertiary packaging. Primary packages hold the basic product and are brought home from the shop by the end consumer. Secondary packages, or transport packages, are designed to contain several primary packages. A secondary package could be taken home by the end consumer or be used by retailers as an aid when loading shelves in the store. The third level of packaging, tertiary packages, comes into use when a number of primary or secondary packages are assembled as for example on a pallet. Figure 1 considers the package life cycle as a whole.

As might be anticipated from Figure 1, there are different purposes and functions of packaging depending on the type and role of the packaging involved and its place in the distribution channel. Figure 2 attempts to provide a guide to the most important functions of packaging at different levels. The main levels of protection, performance and information are subdivided into further functions. Figure 2 also summarises the drivers influencing packaging and the benefits deriving from packaging. It is clear that many elements of the performance component and of the benefits have direct impacts on logistics and supply chains.

Fresh food includes fruits and vegetables, meat, poultry and fish as well as dairy products. Normally fruits and vegetables are packed directly into transport packaging, while other products must be packed in consumer packaging before they are put into transport packaging. Protection of a product is usually ranked as the most important packaging function as it is the package that will ensure that the product reaches the consumer at an agreed and expected quality. The fragility of the product must be known, covering all factors that can influence the product during production, transport, handling and storage. The choice of a suitable packaging system is dependent on available packaging systems, costs and marketing demands as well on the demands of the product during its life, including for how long it is transported and stored, under which conditions (i e frozen, chilled, ambient etc) and climate (temperature, humidity, atmosphere) the product is handled and the microbiology of the product.

In addition to the demands arising from the product characteristics, packaging has other logistics dimensions. In all systems there are issues of unitisation and inter-stackability. Packaging has to be designed so as to allow both the easy development of standard unit sizes and the ability of different sizes and shapes of packages to be ‘stacked’ together in one load. This minimizes

handling costs and provides more secure loads, with less damage to the product. Packaging also has to consider the environment. There is much concern over excess packaging, particularly at the consumer end of the channel, and legal requirements to minimize packaging have been developed by the European Union. There are thus potential efficiency and productivity benefits from considering packaging as an environmental issue. Additionally, depending on the product, there are concerns over packaging hygiene and the need to ensure that any packaging used is inert.

There is also store level interest in packaging. From a channel productivity perspective, there is some evidence that the largest handling costs occur at the store when products have to be placed on display. Packaging design and packaging materials can help reduce costs and time in this regard. Secondly, there are aspects of visual merchandising. Packaging carries information for consumers both in technical and in visual attractiveness terms i.e. what does the display look like?

These concerns have resulted in retailers looking very carefully at how they package and supply products. However the changes are most effective when the supply system as a whole adopts one system. However, getting retail businesses to agree common standards is not an easy task. In the case of retail fresh food in the early 1990s, the 'solution' to many packaging logistics issues seemed clear. It involved the introduction of a reusable plastic tray system. Whilst there was some resistance from corrugated cardboard manufacturers, the channel was moving towards using plastic. But, whilst the basic approach seemed straightforward, getting the details right, agreeing standards and implementing change was by no means easy. It often involved many parties with their own particular ways of working and positions and sunk costs to defend. The challenge of implementing this change is the focus of the case studies below.

Methodology

The implementation of system-wide change can take many forms. Here, the two cases of the United Kingdom and Sweden are considered. These are contrasting cases and have been deliberately chosen for this reason. The United Kingdom case is an example of a 'dominant designer' (see Lee et al 1995, Koehurst et al 1999), who through their market position and leadership is able to construct and press change on their own supply partners and then on the wider system. The Swedish case is more collaborative and reflective, involving a sequence of industry-wide learning and missions before decisions are finalized and change implemented.

The methodology in the United Kingdom case is that of participant research. One of the authors was actively engaged in driving change in logistics, initially in Tesco and in a system wide advisory role. He has spent the last seven years developing a more reflective and academic stance ion his previous activities. The case is developed from personal knowledge and involvement, reflection and confirmatory interviews with key other participants. A similar pattern of case development was followed in Sweden, but here the lead researcher also had access to written documentation, prepared as the business project developed.

Case: United Kingdom - Implementing the Second Generation Tray in Tesco's Supply Chain

It has been argued that Tesco's retail transformation demanded a concurrent logistics transformation (e.g. Sparks 1986, Smith and Sparks 1993, 2004a, b, Smith 1998). Within this, issues of packaging logistics were important, particularly given impending European Union legislation. Three phases in the change to a full plastic tray system can be identified.

Phase I: The first phase from 1990 to 1992 involved the Board decision to proceed with a new approach for disposing of secondary packaging by the retail stores. This involved the setting up of specialised recycling service units that would recycle plastic and cardboard and clean the proposed increasing volume of plastic trays, so that the suppliers could reuse them. This strategy repositioned the impending EU legislation on recycling from a threat into a business opportunity. The Board's decision was based on an assessment of the costs and benefits. There were the costs of change and implementation that were set against the penalties being imposed by the EU legislation. The benefits were to be found throughout the business, retail, commercial, logistics, suppliers and the environment. Retail were able to work more productively in store using the plastic tray for displaying products, especially fruit and vegetables. Commercial prioritised which product groups would benefit from lower costs in using the plastic tray rather than corrugated secondary packaging. Logistics improved their handling and stacking using the plastic tray. Suppliers paid less by using the plastic tray. The environmental benefits contributed to the reputation of Tesco as a company acting as a good citizen.

The second generation plastic tray has a footprint of 600 by 400 mm as well as a half tray footprint of 300 by 400 mm. They fit both the Euro pallet and the UK pallet. They have different heights to suit different types of products, which together with a folding and adjustable handle improve the space efficiency. An inefficient use of space was one of the criticisms made of the first generation plastic tray system compared to the use of corrugated secondary packaging, which is designed to fit closely to its products. There was considerable development effort at the design stage to find workable solutions, which would retain the benefits of rapid handling and product protection that are strong features of the plastic tray system, but with minimal loss of space efficiency. The adjustable bale arm was the chosen design solution, which was made possible with the improvements in plastic materials.

The second generation 600 by 400 mm plastic tray was designed as a modular system that would work efficiently with other equipment in the handling and transport process along the supply chain from supplier to store. Whilst they fit both the Euro and the UK pallet dimensions, a further part of the modular system design development at that time was a dolly. This is a plastic base on wheels that stacks 50 trays in two columns of 25 with a clip at the top designed to hold them in place. The use of dollies provided productivity benefits in retail store handling, warehouse handling and transport cube efficiency. At the retail store and in the warehouse assembly dollies are very popular as they are easy to move around and when empty, stack on each other, which again uses less space. The transport cube is more efficient as a standard length 13m trailer will hold 60 dollies compared to 45 roll cages.

The design development of this entire second generation plastic tray and dolly system provided supply chain, logistics and retail productivity and utilisation efficiencies. These were an essential part of the transformation from the earlier more static storage to the modern dynamic, fast

moving and tailored volumes of products that resulted in no stock being held in the supply chain, except what was in transit between suppliers, distribution and stores.

Phase II: The implementation phase from 1992 to 1994 was intense. A national network of recycling service units needed to be located next to the composite distribution centres which handled the fresh food product range. All the cardboard and plastic which used to be disposed of locally through the store waste compactors, as well as the plastic trays, was going to be collected from the stores by the composite delivery vehicles on their return journeys. Suppliers would then be able to collect the trays they needed after their deliveries to the distribution centre. It was decided to give the contract for the operation of these recycling service units to one contractor as part of the Tesco strategy to benefit from applying best practice throughout the network. There was a standard design for all the recycling service units. This design needed to balance the capacity and space for the operation in order to keep the costs of the land and building as low as possible. One of the influences on the amount of space required was the empty nesting ratio (empty interstackability) of the plastic tray. The first generation tray had a ratio of 2:1. The target for the second generation tray was 4:1. This was not an easy task at the time but the tray manufacturer did eventually succeed. The commercial division had the task of prioritising which product groups should go into plastic trays and then instilling the new disciplines with those suppliers.

At this time Tesco had already implemented key changes to its infrastructure for information technology, supply chain and temperature controlled logistics (Sparks 1986, Smith and Sparks 1993). This placed it in a very good position to develop a national strategy of recycling service units alongside each of its multi-temperature composite distribution centres. These handled the most volatile and sensitive food products, which were the very products that it was logical to transfer into the plastic tray system. This transformation in retail supply was an evolution from storage to rapid handling by all the parties along the chain. Logistics became focused on movement rather than holding stock. This faster pace of logistics was a powerful driving force. Some of the conflict in change management during this transition arose because the old way of doing logistics for storage did not meet the need for faster handling and the very rapid movement of the goods from the supplier to the retail store. However suppliers who had earlier experiences of successful change by Tesco were more able to give their credibility to this development in the recycling strategy.

Phase III: From 1995 to 1997 there was a phase of growing the number of products using plastic trays to reach an annual volume of 100 million. The unit cost of a plastic tray trip was linked to the total volume going through the recycling service unit network. The first product group had been fresh fruit and vegetables as there was a high cost to the secondary packaging of good quality corrugated cardboard. The next product group was fresh meat and poultry that had by that time been reorganised into a centralised factory production system with the fully prepared meat and poultry going directly into the plastic trays and quickly through the logistics supply chain to the retail store, with no stock being held in the composite distribution centres. The production quantity was determined by the anticipated retail sales with no buffer stock in the supply chain. The plastic trays fully protected the product during its handling and assembly into store orders in distribution. The next set of product groups were lighter in weight with a lower corrugated cost and needed a lower cost for the use of the plastic tray to be economical. This was now possible

as the volume moved through to a higher level justifying a reduction. The commercial, retail, supply chain and logistics cost benefits were evaluated to prioritise the selection of the next product group (specialist bakery products, such as croissants and pastries).
A valuable part of the implementation with the suppliers of these products was a supplier day held at a recycling service unit. A small group of suppliers and representatives from commercial, technical, supply chain, logistics and retail worked together to agree the optimum configuration of products in a tray and discuss the implications of the change. These events were highly successful in gaining the positive involvement of the suppliers in this change process. This had big implications for their production and packaging methods.

During this phase there was also a broader assessment of the feedback from the suppliers about the implications for the whole industry servicing the retailers. Manufacturers said that they understood the application and benefits of the plastic trays but pointed out that there were different sizes and specifications from different retailers. This puts demands of complexity into their production and distribution processes. The manufacturers asked the retailers to act together and agree a common standard. The outcome of this review was a consensus on a single design which all the retailers would use. This eliminated the cost of complication for the suppliers if each retailer had continued to insist on using their own distinct design.

The key themes that come thorough in the Tesco study derive from the 'dominant designer' paradigm. Tesco's power meant that they were able to take control of the process and to drive both the outcome and the speed of the implementation. By being further advanced than other retailers in this process, first-mover advantages allowed them to dominate the industry solution as well. There are disadvantages in this, but system efficiency overall was enhanced by the rapid process of change.

Case: Sweden - The Development of Multi-Party Nationwide Pool System in Sweden
During 1992-1999, a group of logistics specialists within the Swedish food supply chains took part in a development process, which included much learning and new thinking. The process contained eight separate missions (Table I). After several years of discussions, tests, investigations and new tests, the suppliers and the retailers within the Swedish business sector for food and commodities formed a jointly owned non-profit company in 1997, which started its physical operations in 2000. This company, Svenska Retursystem AB (www.retursystem.se), now has the mission to introduce returnable transport packaging into the Swedish food supply chains. The product range includes a family of nestable and interstackable plastic trays and plastic pallets in two sizes. This pool system is unique, since it is the only open, business-wide and national pool system in operation in the world.

Working Group 1, 1992-1994: In 1992, this process started when the first working group was formed. The members of this group represented a wide spectrum of actors in the Swedish food supply chain: growers, manufacturers, transporters, wholesalers and retailers. The chairman was a senior retailing logistics expert, well known and respected for his deep knowledge of the business sector.

The most important initial issue was to make sure that all group members were equally aware of the potential of the pool concept. The overall objective was to create a packaging system with

lower supply chain total cost. Additional objectives were increased product quality due to less transport damage, improved ergonomics, less time-consuming in-store handling as well as waste reduction. This first mission also included the task of selling the vision to governmental agencies in order to obtain the necessary financing of the upcoming development process. At an early stage it was concluded by the working group members that government agencies could be suitable project sponsors, as the group thought that a government-sponsored process would have a higher credibility and authorisation than if the actors themselves had sponsored the project.

The working group members therefore undertook a study visit to Austria, where the Kisten-Pool system was visited. At an early stage, after the trip to Austria, and as soon as the group had convinced itself of the potentials of a national pool system, it was decided to plan and perform a large-scale pilot test. The purpose of this test was not to try out different tray and pallet designs, but to test and evaluate the pool *system* from logistical, economical, ergonomical and environmental perspectives. This was the second mission, and the most cost- and time consuming part of this phase of the process. During the pilot test phase, the working group decided to start looking at the design of an administrative concept for the pool system, but this mission was postponed, and taken up again in 1998, as the eighth and last mission.

At this stage, the first working group looked at both trays and pallets. The need for a new type of returnable pallet was one of the main triggers for several of the working group members to join the process. For this reason, the working group decided in 1993 to design a material neutral functional standard for half pallets (800 x 600 mm footprint), to become a European standard. This mission was completed by the end of 1994.

The fifth and final mission of the first working group was started in early 1994, as a new sponsor, the Swedish Board of Agriculture, entered the scene. Sweden was soon going to become a member of the European Union, and the agricultural sector was facing a totally new market situation, where the open European market was identified as both a threat and an opportunity. The Board asked for a concept design of a pool system for returnable trays for vegetables.

After the large-scale pilot tests, the working group agreed on a number of system and product requirements. On the system level it was decided that the actors wanted an open-loop pool system, open for all suppliers, wholesalers and retailers to become accepted as pool system members. All members of the working were clear on the need for a neutral pool system solution that would not interfere with normal commercial competition. The pool system design would be deposit-based in order to achieve a high circulation speed and reduce loss of trays, already mentioned as two of the key parameters for pool system total economy. There was also full unity behind the conclusion that no one desired a third-party operator to run the pool system solution. The reason for this was that all actors wanted to keep full control on system cost and future development issues. Finally, the search for a suitable technology for the cleaning of used crates was identified as a high-priority system requirement. This had been identified during the study visit to Austria, where the cleaning of used trays was still an unsolved issue in 1992.

It was concluded at an early stage that both trays and pallets would follow the European pallet standard and its modules. The trays were designed with stack/nest functions based on 180º rotation. This was considered as the optimal way of reducing the space requirements for the

return handling and transport of empty trays. Other design solutions for space reduction of empty trays was turned down e.g. no foldable/collapsible or bale-arm stack/nest tray due to the bad quality of existing trays (e.g. hinges) and hygiene (difficulties in cleaning).

The first working group ended at the beginning of 1995, when the logistics manager at the largest retailer in Sweden stopped the vegetable growers from taking an initiative in starting and driving the development of a packaging pool.

Working Group 2, 1995-1999: Two new working groups, one for trays and one for pallets, were formed during 1995 as a result of a common initiative by the suppliers and the retailers. When Working Group 2 was formed in 1995, new group members were invited into the process. Knowledge continuity was secured, as three of the members from the first working group became members of the second group. The study visit strategy in Mission 1 was repeated.

Working Group 2 accomplished three missions. The first mission was the most time-consuming and effort-demanding of all eight missions (Table I). The working group was asked by the suppliers and the retailers to develop a specification of requirements on a business-wide, returnable tray, followed by a tender process (1995-1998). The second mission was to perform an environmental evaluation of a plastic tray (1996-1997). The third mission (how to design an administrative concept for the pool system and establish a member-owned pool company, 1998-1999) was taken up from the first working group.

The mission of developing a specification of requirements and undertaking a tender process has been selected here for further description and analysis, as it provides the basis for understanding how multi-party co-operation concerning change management, learning, reaching consensus and decision making, has been managed in this process.

In 1995-1996, two conflicting parties were identified. The suppliers of meat and cured meats, poultry and delicatessen stood against the suppliers of fruits and vegetables. These two parties continued to fight for their own interests throughout the process. The two groups could not agree upon various issues. Should the trays should be ventilated/drained or closed? Should handles be perforated or non-perforated? Another hot topic, repeatedly being put on the agenda, was the debate on tray height dimensions. Even the colour to be chosen for the trays caused conflicting views. To move forward, the working group identified two questions to be carefully considered when deciding on tray properties. Which of the two groups had the most urgent need/use of a common tray? Which of these two groups had the larger volume?

Nonetheless, certain decisions were iterated repeatedly or deliberately postponed. The decision-making was based on a negotiation- and majority-based consensus decision strategy. This was time-consuming. The definition of tray heights is one example of this. At a working group meeting during a study trip to Finland in August 1996, it was decided to start a project to test how the most frequent products would fit into different tray heights. First, a test protocol was compiled. During October 1996, a large number of test packing operations took place all over Sweden. More than 200 different frequent products were included in the test. In order to achieve a unified height on loaded pallets, as well as acceptable fill rates, the following three heights were proposed and decided upon in November: 110, 140 and 165 mm.

However, in May 1997, one group member came back from a trade fair in Brussels, where he had seen a new type of tray with interesting properties. This was the second generation bale-arm tray developed by Tesco. The empty nesting space reduction capacity was an impressive 75 % (to be compared with the 50-55 % offered by the 180º rotation stack/nest trays). This parameter, *empty tray space reduction*, had not been in focus earlier in the development process, since the working group had decided on the 180º rotation stack/nest tray concept, for quality and hygienic reasons. The Tesco tray gained support from the retailers' point of view, thanks to its space reduction features. Now the process entered into what is described as *"the U-turn"* by four of the group members. Or as another member described it: *"it went from evolution to revolution"*.

The second half of 1997 and 1998 were turbulent times, as the retailers argued for the Tesco tray, while the meat industry together with other suppliers fought for their positions, which had been formally agreed upon in the working group's specification of requirements for a returnable tray. In May 1999, the pool system company was finally provided with the investment capital required for concluding contracts concerning pallets and trays. The Tesco tray supplier was selected as supplier to the pool system. During 2000, the first trays were introduced in the market. It can be noted that the heights of the trays in operation today are somewhat different than what was decided after the large packing test in 1996: 106, 167 and 199 mm.

The key themes that come through in the Swedish case are focused on the idea that a commonly shred vision and objective is best implemented by a consensual decision-making process. From this stem a number of procedural avenues that attempt to take the entire market structure along with the decisions. The problems with this are that it may not be possible to move forward quickly and decisions may be postponed or endlessly debated in order to attempt to get consensus. The decisions that are made may become less viable as the time for implementation or discussion expands and so they may have to be revisited. Ass groups change their composition and minds, or as technology moves forward, so the process slows down further. By focusing on what was know, rather than what was desired, the stage was set in Sweden for the dramatic "U-turn".

Conclusions

Table II provides a summary of the contrasts between both cases and from this identifies some of the 'lessons'. No criticism is intended by this contrast. Organisations and individuals found themselves in a set of situations and circumstances and acted in the ways they felt appropriate. The 'lessons' are drawn to raise (self-)awareness of the potential issues for tackling change in such circumstances. It is important to note that in both countries the reusable plastic tray systems continue to expand.

The most obvious difference between the two cases in the pace of development, being very much more rapid in the UK. This pace stems from the direction given to the process by Tesco and in particular its high Board level interest. This was added to by the involvement of a multi-functional team to the process, stemming from internal and external (supplier) involvement. In Sweden the process was more passive and less directive and organisations, whilst perhaps having greater group dynamics, tended to revert to their own organisational requirements. There may also have been some 'groupthink' in Sweden due to the dominance of logisticians and the lack of

contributors from 'commercial' and other areas of the businesses involved. Perhaps surprisingly this pace was not adversely affected in the UK by an unwillingness to accept the current technological situation. Technological solutions were demanded to 'fix' problems, yet this did not seem to delay the process. In Sweden by contrast, initial acceptance of supposed limits to technology, closed off debate and choice, but did not speed up the process. In essence the pace of the solution was determined by a clear dominant force having the power and vision to seek rapid solutions. This vision extended to the supply chain as a whole as opposed to simply being company-specific solutions. The process in the UK was opportunity-driven rather than problem-oriented as in Sweden.

Packaging logistics takes a supply chain approach to the development of packaging, seeking efficiency and effectiveness across supply chains by the co-ordinated development of packaging activities and solutions. This is admirable, but there are major issues of implementation as these cases here show. There is need for further research to be undertaken in this area to understand not only the advantages and disadvantages of certain changes in this area, but also the best way to implement such changes. Imposition by a dominant designer is one way forward, but if that forces other competitors to incur extra costs to adapt to the dominant design then it could be seen as undesirable in the long term. Similarly, whilst consensus is admirable, if it takes too long to achieve, then inefficient supply chains are being maintained unnecessarily.

The contribution of this paper lies mainly in opening up this area for further research. The very limited previous research in detail on aspects of packaging logistics is somewhat surprising given the importance of the subject in both practical and academic terms. Practically it is clear that companies around the world are struggling with implementing similar solutions and there are implications and lessons for companies and supply chains to be drawn from the cases. In an academic sense, much is often written about the importance of integration in supply chains, and much for example has been written about ECR, but often the details of the actual physical activity needed to move products is ignored. Packaging by its nature has integrative functions and a better understanding of how packaging logistics works and how integration can be best achieved may produce revised conceptualisations of logistics changes and challenges. Much could be gained by contrasting the detailed implementation of such packaging logistics developments with the current conceptual descriptions of supply chain behaviours. A variety of approaches could be utilised in this regard. We hope that through these contrasting situations, we have begun to open up the subject for further work.

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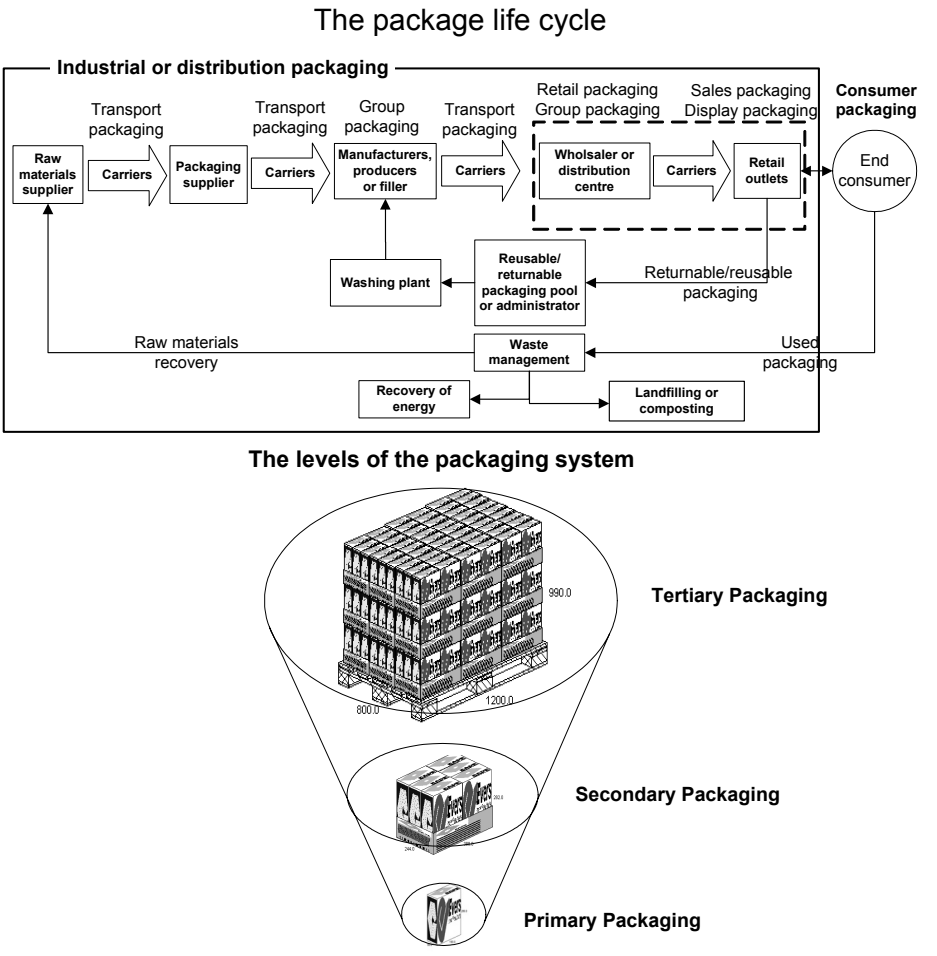
Table I: The Swedish Missions

	Working Group I
1	Identification of potential of pool concept and securing government support
2	Large scale pilot test
3	Administrative system developments for pool system (postponed to mission 8)
4	Design of material neutral functional standard for half pallets
5	Concept design of a pool system for returnable trays for vegetables
	Working Group II
6	Specification of requirements for a business-wide returnable tray (tender process)
7	Environmental evaluation of a plastic tray
8	Administrative system developments for pool system and establishment of a member owned pool company

Table II: Issues from the Case Studies

	UK Case	**Swedish Case**
Pace of Development	Rapid development period, 2 years	Slower development period, 8 years
Top Management Approach	Driven by Tesco Board as business priority	Management support from companies, but essentially passive
Importance of Logistics	Board level priority	Not on the agenda at board level
Functional Approach	Logistics and supply chain orientation so multi-functional teams introduced	Some multi-functional components but mainly separate identities maintained
Awareness of Technology	Technological improvements demanded to 'fix' problems	Acceptance of current technological state
Group Dynamics	Imposition by Tesco, but some dynamic 'following' – industry as a whole came into line later	Good working group and study tour dynamics. Involving and learning together encouraged interactions. Wider discussions ensued.

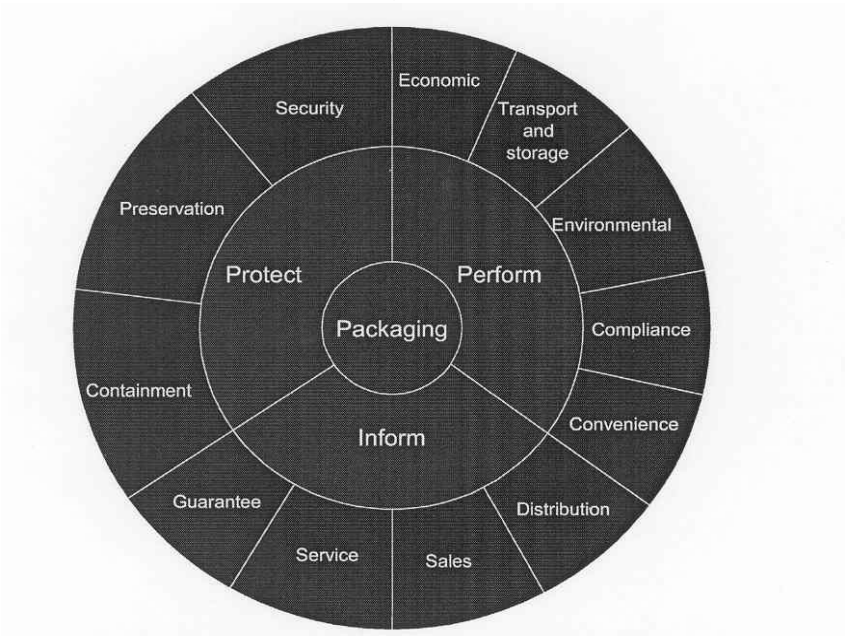
Figure 1: Different packaging terms used and the levels of the packaging system.



Source: (Saghir 2004)

Figure 2: The Purposes of Packaging

Drivers Influencing Packaging	
Ageing population	Consumer tastes – fashion and culture
Smaller households	Technology advancements
Greater disposable income	Competition
Time pressures	Raw material costs
Health awareness	Supply chain performance
Environmental awareness	Globalisation



Benefits delivered by Packaging	
Consumer choice	Convenience
Tailored portion sizes	Product protection (waste minimisation)
Packaging minimisation (reduced packaging per functionality)	

Source: Pira/University of Brighton (2004)

Appended Paper Three

Packaging logistics and retailers' profitability: an IKEA case study

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Packaging logistics and retailers' profitability: an IKEA case study

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Packaging logistics and retailers' profitability: an IKEA case study

Abstract

Many businesses still put too much focus on manufacturing, marketing and sales without considering the inter-linkages amongst these elements. This paper shows the importance of including packaging logistics and supply chain management in strategic planning. By integrating these aspects, retailers and suppliers may reduce costs, environmental impact and increase profits. A case study at IKEA is used in the paper to demonstrate the issues. The importance of cooperation across the supply chain is identified as a key factor. Another conclusion is that even minor changes may result in big benefits since the scale of operation is so large.

Introduction

It is quite natural, even in today's business environment, to believe that it is only retailing and manufacturing that matter in a successful business plan. The emphasis is often on whether the product can be produced and then sold. How the product actually makes the journey from producer to consumer is of increasing concern, though attention still lags behind producing and selling. This goes hand in hand with a belief that what goes on 'behind the scenes' does not really matter to the success of a business – and certainly does not justify major business resource or thought from the top of the company.

Many believe that it is quite sufficient to let logistics proceed at a lower level of management attention, or better still, simply outsource the activity to a third party or business partner with no further management time spent on its control or development. Such views are misguided in that the logistics and supply functions represent real opportunities to enhance business and supply chain performance. The problems of supplying often volatile consumer demands are substantial, and the costs of getting it wrong can be considerable, both in the short and the long term.

The purpose of this paper is to highlight the need for retailers to increase their top management attention on supply chain performance. When top managers focus on applying packaging logistics experience and knowledge the result is higher profit margins and lower costs as well as reduced environmental impact from transport.

This paper aims to explore how small changes in products may influence production, packaging and distribution and in the end provide great benefits to the business. In particular it illustrates the need to understand product and packaging development as well as understanding production and supply chain properties. To meet this aim, the paper is

structured into four sections. First, we provide an introduction to the topic of packaging logistics and retailing supply chains. Secondly, a brief methodological section is provided. Thirdly, the case and the consequences are presented. Finally, lessons are drawn.

Packaging logistics in interaction with product and packaging development

First, a brief introduction to packaging logistics. There is an initial distinction to be drawn amongst primary, secondary and tertiary packaging. Primary packages hold the basic product and are brought home from the shop by the end consumer. Secondary packages, or transport packages, are designed to contain several primary packages. A secondary package could be taken home by the end consumer or be used by retailers as an aid when loading shelves in the store. The third level of packaging, tertiary packages, comes into use when a number of primary or secondary packages are assembled as for example on a pallet. The Figure 1 considers the package life cycle as a whole.

As might be anticipated from Figure 1, there are different purposes and functions of packaging depending on the type and role of the packaging involved and its place in the distribution channel. Figure 2 attempts to provide a guide to the most important functions of packaging at different levels. The main levels of protection, performance and information are subdivided into further functions. Figure 2 also summarises the drivers influencing packaging and the benefits deriving from packaging. It is clear that many elements of the performance component and of the benefits have a direct impact on logistics and supply chains.

Packaging is often developed *after* the design of the product (Jönson 1999) and according to Hine (1995) separately from other design activities even if the packaging literature stresses that product and packaging are two integrated items that would benefit from joint development (Esse, 1989; Paine 1991; Kooijman, 1995; ten Klooster, 2002). Bramklev (2003) has shown that the integration of product and packaging is preferred in many cases.
It is a recognized need to integrate packaging considerations into the product development process (e.g. Bjärnemo et al. 2000; Johnsson 1998; Paine 1981; Shina 1991) in order to improve the logistics activity, the performance of the product and the packaging.

But this is still an area in its infancy and very little research has been conducted (Johnsson 1998; Saghir 2002). Today the product is complemented with packaging, i.e. another product, to fulfil the demands of the later phases in the product life cycle. Klevås (2004) has in her work shown the close connection between the product, the packaging and the logistics activity. In a case study at IKEA she has shown that the integration of packaging in *both* the product development team *and* in the logistics function is more successful because of the input of a supply chain overview (Klevås, 2004).

Within one of the largest retailing sectors – food retailing – large actors have already understood the need for change and the need for new packaging systems to meet demands throughout the supply chain. E g, Tesco's retail transformation demanded a concurrent logistics transformation (Sparks 1986; Smith and Sparks 1993, 2004; Smith 1998). For such retailers, much of their product flows are transformed from being based on stock holding to rapid movement and no stocks. Such strategic changes put new demands on the efficiency and effectiveness of packaging concepts.

In such transformations, certain system properties are brought into focus, e g handling costs both in the distribution centres and on the retail shop floor. There is a growing awareness

among companies that efforts can be taken to enhance both efficiency and effectiveness by applying a broader sense of thinking, from a packaging logistics perspective.

In addition to the demands arising from the product characteristics, packaging has other logistics dimensions. In all supply systems there are issues of unitisation, inter-stackability and other requirements to achieve best possible transport economy. Better packaging logistics will also minimise handling costs and provide more secure loads, with less damage to the product. Packaging also has to consider the environment. Existing packaging solutions can create added transport requirements and unnecessary packaging waste.

Packaging logistics takes a supply chain approach to the development of packaging, seeking efficiency and effectiveness across supply chains by the co-ordinated development of packaging activities and solutions. However, identifying changes that need to be made in supply chains to make them more efficient is one thing. Actually carrying through and implementing such changes is more problematic, with many opportunities for delays or errors.

Methodology

The implementation of system-wide changes is often difficult, especially where actors with different interests are involved in the supply chain. It is of interest to illustrate the potential benefits when such changes are actually put in place along the whole supply chain. We have therefore selected a case study where the main player controls the whole supply chain so as to demonstrate the beneficial results when full cooperation within the supply chain is attained.

According to Eisenhardt (1989) the *case study* is a research strategy focusing on understanding the dynamics present within a single setting. Both Yin (2003) and Eisenhardt (1989) remark that the case study is a strategy that typically combines data collection methods such as archives, interviews, questionnaires, and observations. The evidence may be qualitative, quantitative or both. It may be used for many purposes, but one of them is the building of theory, which in turn might be utilised for building a general product development procedure model (Eisenhardt, 1989).

Since IKEA is a retailer which is capable of grasping the total supply chain, with full control from raw material sourcing to the end-consumer, a case from that company has been chosen to illustrate the implications and the complexity of packaging logistics transformation projects. This case study is based on personal interviews with key people involved in the project, combined with observations at certain locations across the supply chain.

IKEA: the tea candle case

IKEA was founded in 1943. It has been recognized as one of the world's best retailers in terms of sales volume, growth, number of stores and number of countries (Arnold 2002). The company has also been recognized as viewing packaging and logistics as important factors for success (Bowersox et al. 2002; Johnsson 1998).

At IKEA stores the customers select their products directly from the stock that is displayed in the store or immediately receive it from the store warehouse and take it home, where they carry out the final assembly operation. IKEA has total control over the supply chain from the supplier to the end-customer. IKEA does most of the product development in-house, but does not own the manufacturing facilities. Today, there are more than 200 IKEA stores in 31 countries and the range of products is almost the same in every country. The main market is

Europe (82 %), followed by North America (15 %) and Asia (3 %). In the beginning IKEA primarily worked with furniture, but now the availability of accessories and ancillary products are just as important. This broadened product range has resulted in a number of different packaging solutions, where IKEA had to leave their original "flat package, home assembly" concept. The case described here is a widely appreciated product, with such a large volume of sales, so even minor changes in the packaging will result in considerable influence on product profitability.

The amount of manually loaded goods has increased as IKEA has entered the global market. Distribution and the packaging solution have from the beginning been set for the European distribution on Euro pallets. This has become a limiting factor as the market has become more global. Unloading times and product damages have increased and the capacity fill rate for the containers became unsatisfactory. So during 1996 and 1997, IKEA decided that the packaging issues had to be addressed. A packaging support function was set up in 1999, called the Packaging Concept. (Klevås 2004). The idea was that the packaging technicians should be located closer to the products and the product development process. This meant that new systems were developed to fulfil IKEA's different needs.

Klevås (2004) has described the present organisation the following way

> Packaging Concept's main task is to create the overall packaging concept at IKEA. Packaging Concept is a part of the Distribution Service competence function, where logistical tasks at a strategic level are performed. The reason for putting Packaging Concept into the Distribution Service was for it to be close to the supply chain perspective, from the packaging line at the supplier to the end-customers in the stores.

There has been a continuous search in IKEA to reduce the amount of empty space in packaging and vehicles. In 2002 it was found that GLIMMA (the IKEA product name containing a package with tea candles) had more air than any other package. As the GLIMMA product was a massive sale success, it was obvious that a change in packaging would be very beneficial.

The original consumer package held 100 candles in a plastic bag. The bags were packed in large cardboard containers placed on full-size pallets (1200x800 mm), offering a display function, see Figure 3. (Photo of old product packaging concept). The plastic bag was difficult to handle and expose. The floor space utilisation and display functions were not good.

In November 2002 a project was initiated, where two members of staff members were selected and given the mission to investigate the potential for improvement in the product, packaging and distribution. The staff chosen had received internal IKEA education and reported directly to the managing director of the IKEA packaging department. This director has an MSc in mechanical engineering and logistics, working with universities to develop the packaging aspects. They formed a team together with the product development people and the suppliers of the candles. The objective was to make the space wasting bags more effective in all parts of the supply chain from supplier to store.

In February 2003 they had identified a solution for the total supply chain which was expected to fulfil all the technical properties of the tea candles. In July 2003, four pallets of the prototype solution arrived from the supplier in China.

Since the management responsible for this product range accepted the prototype solution, a next step was taken in August 2003, when IKEA started to work together with a German company that develops and produces machines for the candle industry. Test tools both for the tea candle and for the candle cup were manufactured during the autumn. The old consumer package did not need any sophisticated packaging machinery, but the new solution required new machinery to sort the candle as seen in Figure 4. Another machine, which would pack the tea candles, was discussed during the autumn. In the beginning of 2004, the production of that machine was started. The re-designed product and package was tested in April and accepted. In August 2004, the first 100-pack was delivered from the new machine. In September, production could start at full capacity. The new packaging solution can be seen in Figure 4 and Figure 5.

A European pallet in the new German system holds today 360 packs, each holding 100 tea candles, instead of the original 252 packs of 100 candles on the pallet. That reduced the number of Euro-pallets used from 59,524 to 41,667 pallets. This reduction lowered the number of trucks needed for the distribution from warehouse to store by 200 trucks each year. It resulted also in lower costs and less environmental impact. It actually produced 21 % less CO2 emissions from fossil fuel used in the vehicle journeys each year. The new packaging solution also required less packaging materials in bags and cardboard boxes. These savings meant that it was possible to increase the profit margin, as the price for 100 tea candles is the same as before.

Time has also been saved in the store. The new production and packaging solution result in easier handling, faster unpacking and better display opportunities. As one pallet takes five minutes to unpack in the store, IKEA calculates with a saving of 186 working days each year in the stores. See figures 6 and 7.

The new solution also promotes the commercial requirements better than before, as less cardboard is visible and less floor space is required per 100-pack. This results in more available space for other products to be displayed and sold in the stores.

One detail concerning the product design is also worth mentioning. When sorting and packing the tea candles in the new concept, there was a risk of damage to the candle wicks. Misplaced wicks could also influence the packing line efficiency. The wicks were shortened in order to reduce the risk for this occurrence. For this reason the candle casting tools had to be adjusted to allow a hollow profile around the wick. The change can be seen in Figure 4. The wick was shortened by 2 mm. The burn time of the candle was, however, not changed. This change made it possible to reduce also the transport needed to get the wicks to the production line each year by the equivalent of a round trip from Stockholm to Madrid.

Discussion and conclusions

There are challenges that arise from an increased global reach. This case demonstrates the effectiveness of the retail power to influence the whole supply chain with an improved channel method of operating. The attention to detail laid the foundations for an agreement of a revised packaging design with all the supply chain parties from the manufacturer to the store. The improvement in transport space utilisation provided not only a lower cost but also a benefit to the environment by less journeys made with a reduction in carbon dioxide and other emissions.

These points reinforce some of the central propositions that the author team consider critical to successful packaging design. The perspective taken is an end-to-end assessment for all the parties along the whole length of the supply chain. There is benefit in having the review team report to a senior director and in positioning that team within distribution, a part of the supply chain than can otherwise be ignored. There is a considerable advantage to be achieved in working to gain retail, manufacturing as well as supply chain benefits in order to obtain the approval for the costs of implementing the necessary changes at the manufacturer.

This case shows the importance of forming a task force team to take action after having been provided with a clear mission and management support. Kanter (1984) points out that all change processes are based on three basic requirements: first the availability of facts and information, second that enough resources are provided for the change project and third, the management support, not only in terms of economic resources but also a commitment to the vision and the objectives of the project. In addition to this, the authors would include a fourth basic requirement. Before succeeding in getting support for new solutions, much effort must be put on *gaining acceptance* for the new visions and ideas (from both top management *and* the grass-root level) and across the supply chain.

This immediately raises issues of power in the supply chains as ideas about acceptance are inevitably bound up in questions of power. Who has the power in the supply chain? Is it one single dominant company (as IKEA in the case described here) or an alliance of companies within the supply chain? This aspect is important to take into consideration when performing an analysis concerning the preconditions before starting a change process within a supply chain. From the authors' experience it is our conviction that it is often about seeking ways of communication with all parts of the supply chain, in order to create a meeting of minds where good operational ideas can be exchanged and then used in the creation of a full list of requirements for any new packaging logistics system.

For too many, for too long, logistics and supply chain management have been an afterthought. It is time for all retailers to reconsider their supply chain concepts and investigate the potentials of improvement in terms of profitability, customer service and resource management. It must be noted that even minor changes may result in big benefits since the scale of operation is so large. In the IKEA case, this is illustrated in the candle wick protection issue.

More research is needed in order to identify and describe the opportunities and obstacles within supply chain and packaging logistics change processes. The potentials are obvious which would be a strong signal to top managers within retailing to start looking at what is really going on behind the scenes.

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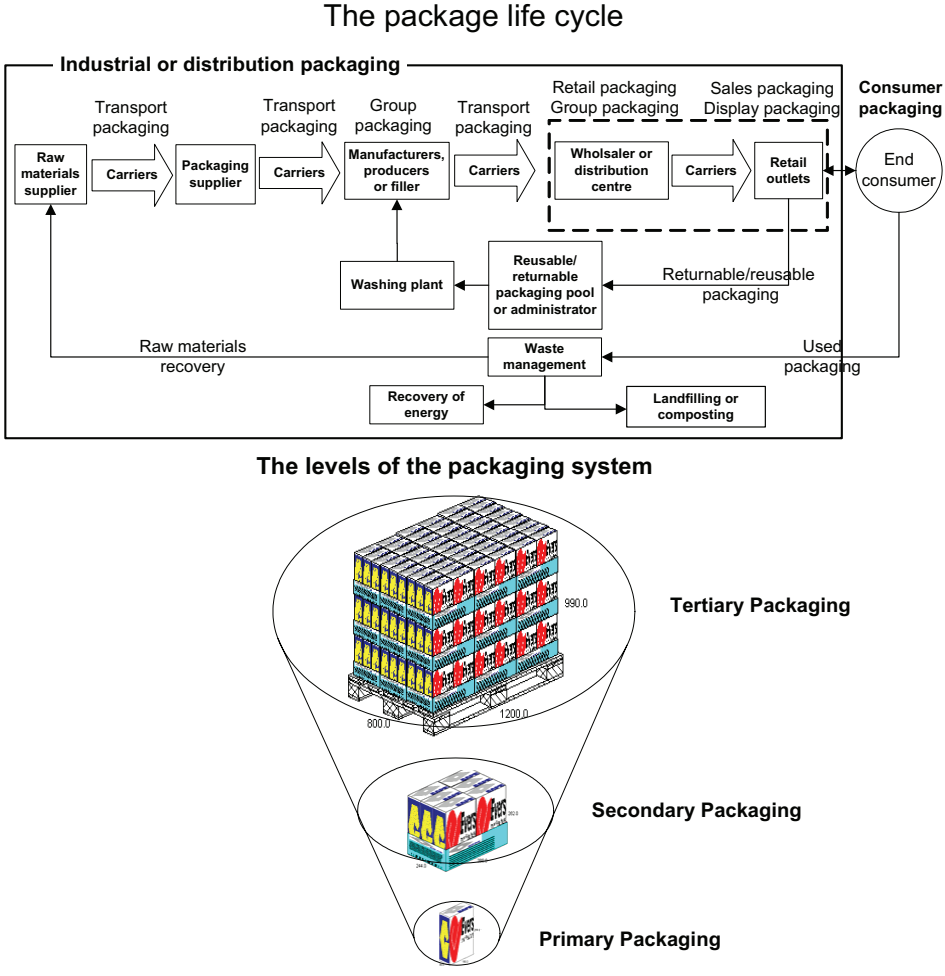
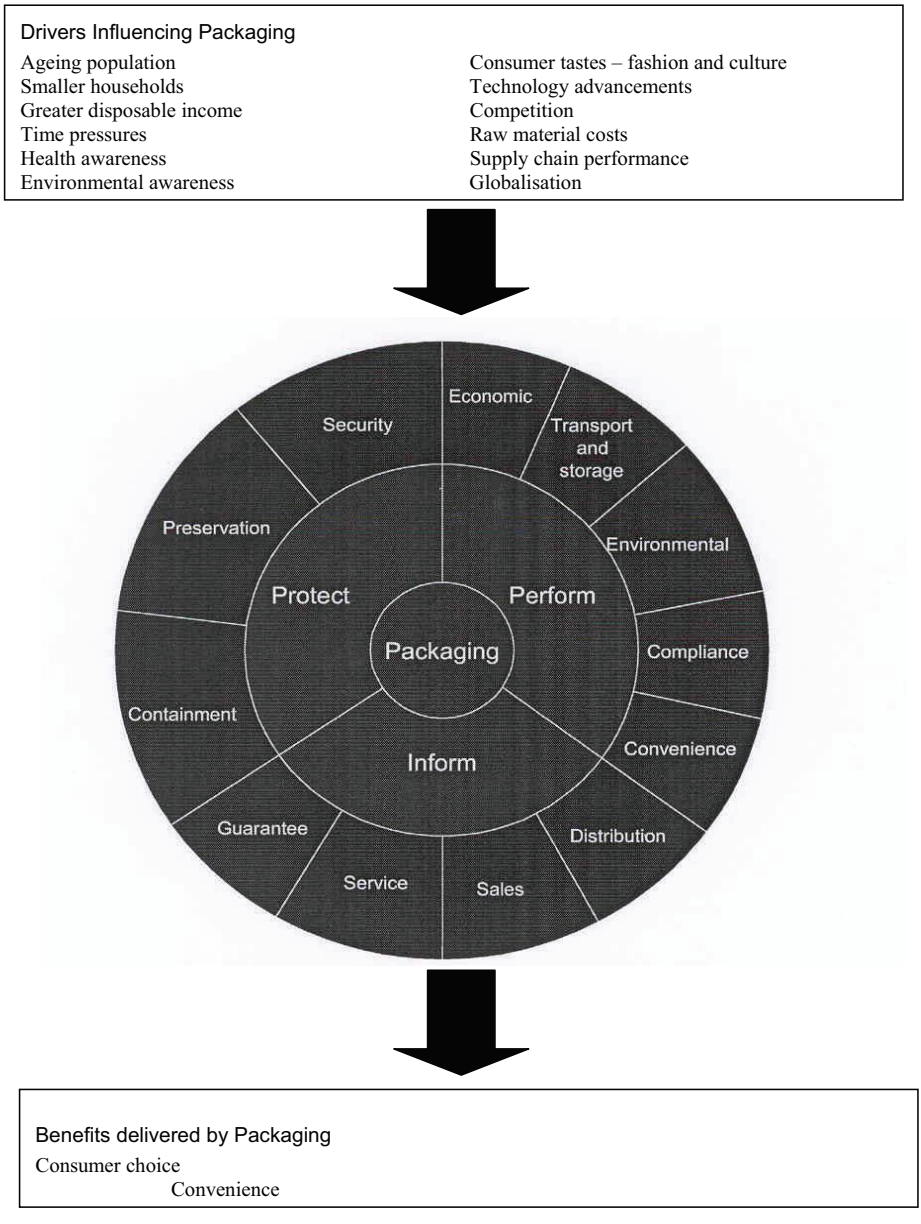
Figure 1: Different packaging terms used and the levels of the packaging system.



Source: (Saghir 2004)

Figure 2: The Purposes of Packaging



Source: Pira/University of Brighton (2004)

Figure 3: Photo of old product packaging and display concept

Figure 4: New packaging solution to the left, old plastic bag to the right. NB the new hollow profile on the candles, designed to protect the candlewick during handling and transport.

Figure 5: The old packaging solution on pallet

Figure 6: New packaging solution on shop floor, requiring less floor space.

Figure 7: The new packaging solution on pallet