The core role of packages in a logistics networks

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Abstract

The flow of goods and information supporting this flow of goods may be viewed as the "hard core" within logistics. Within this core the package plays an important role as facilitating the provision of goods to end-users. Packages are based on empirical findings found to be of importance in relation to their physical roles in containing materials and other packages and in providing utility. The importance of the package is however underlined by its communicative purpose as an information carrier and as an information source. In addition the importance of the package is shown to transcend the borders of logistics. Packages also play a vital role within marketing. This is especially evident when considering the role of the package as an information resource. Within logistics packages are primarily of importance in relation to goods. When goods are packed, it is packages, not materials or products that are evident to logisticians both as a physical entity and as an information resource even though actors may in their practical terminology be communicating about materials or products. A network approach is combined with Alderson's understanding of the provision of goods as a transvection to construct empirical findings regarding the distribution of four perishable foods products to discuss and analyse the role of packaging in physical distribution.

Keywords: Package, Physical distribution, Goods, Information, Logistics Network

1. Introduction

Packages are evident to consumers as well as marketing and logistics professionals as a key resource when distributing products. However, in physical distribution it is the product or goods that seem evoked while the package play seemingly a more obscure role. A detailed investigation based on empirical findings is provided aiming to exhibit the importance of the package mainly as a logistics resource meaning a resource used to facilitate the distribution of goods to an end-user.

Packaging is the field that is mainly concerned with packages. Packaging is as a field according to Johnsson (1998) mainly technically oriented focusing on package form characteristics and concerned with technical aspects of the package. Technicality regards package form and how this form is related to a degree of functionality when packages interplay with different facilities and actors carrying out logistics activities in a supply chain. Packages are in relation to their use still regarded as a rather unstudied area of research within logistics. According to Johnsson (1998) a greater understanding of how packaging is integrated into a logistics system is called for. This represents the role of packages in relation to goods in providing products to end-users. Jahre and Hatteland (2004) show in a case study how packaging represents an integrated system with packages having various roles that are more or less adapted to a network context consisting of different logistics resources. Packaging also represents a logistics management issue as well as a technical issue and Johnsson (1998 p. 7) states that: “Without a package that supports a logistics system and without a logistics system that supports the package it will be difficult to create an efficient logistics system.” Twede and Parsons (1997 p.21) state that: ”…once one thinks in terms of what a package must do – rather than what it is made from – new package ideas begin to emerge.”

The package is here treated as the focal unit of analysis in this study. It represents here a given form and therefore packaging design issues are not covered. This is an observed package form carrying products to an end-user and represents focusing on the aspect of the package as a moveable logistics materials containment facility. Packages are logistics resources primarily when they are used in relation to goods, and it is this use of packages to contain other packages or other forms of materials in a network of logistics resources and actors (within logistics commonly denoted as a supply chain) that has provided the basis for an area of study within logistics that has become coined as “packaging logistics” (Twede and Parsons 1997, Johansson et al 1997, Johansson 1998).

Packaging logistics may be considered a sub-field within logistics and shares facets of interplay with the more technically oriented field of packaging. This study aims to contribute within this area of logistics. The range of different approaches to studying logistics issues includes managerial, actor-based and operations management approaches (Gammelgaard 2004) and efforts are being made to develop logistics as an academic field include contributions by Stock (1995), Harland (1996), Lambert et al (1998b), Arlbjørn and Halldorsson (2002), Gadde et al (2002), and Mentzer et al (2004). The CSCMP (Counsel of Supply Chain Management professionals, prev. Counsel of Logistics Management) definition of “logistics management” reads as follows:

“Logistics management is that part of the Supply Chain Management process 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” (www.cscmp.org)

This definition shows that a flow of goods is a key aspect of logistics, as is a supporting flow of information. Packages are used to distribute goods and not services. This study is accordingly concerned with the physical distribution aspect of logistics. When Arlbjørn and Halldorsson (2002) state regarding logistics as an academic field, that “…the hard core may be formulated as follows: directed toward the flow of materials, information and services, along the vertical and horizontal value chain (or supply chain) that seeks to coordinate the flows and is based on; system thinking (a holistic view), where; the unit of analysis essentially is the flow,” these authors are seeking much in line with the CSCMP logistics definition to find

what entity is of greatest importance, or what is the key function within logistics. They land through their study on a view of logistics where the flows are of greatest importance and are therefore viewed as the "core" of logistics. In relation to physical distribution it is the flow of physical objects, materials, destined for an end-use that is of importance, and this entity is commonly denoted within logistics as "goods".

The importance of packages within physical distribution has been accounted for in relation to the flow of goods by Ballou (1987) who states that "…it is the package that must be dealt with, and the product itself may be of secondary concern…" because "…it is the package that has the shape, volume, and weight, whereas the product inside may not have the same characteristics." Ballou, however does not investigate in greater detail how the package may be viewed as having logistical importance. However, this statement exhibits an understanding that products may be viewed as mainly related to the transfer of title (see also Rosenbloom 1995), a marketing aspect of distribution, while the package is a facilitator that must be accounted for when carrying out logistics activities.

The search for the role of the package and importance of this resource in relation to logistics is based on empirical findings from the distribution of food products to retailers in Norway. The next step is to describe the analytical framework used to reach an improved understanding of the importance of the package in relation to logistics. This framework is described in parts 2 and 3 covering the package, activities using the package, and the use of a network approach to understand the overall setting of the use of the package. Part 4 provides methodological considerations related to this study, part 5 presents the empirical findings using four product examples including a brief analysis of each example, and in part 6 this paper is concluded.

2 Packages

2.1 Using Packages for different Purposes

Packaging is concerned mainly with the form aspect of packages and this use of packages for distributing goods is the logistics aspect of a package. However, packages have an aspect related to customers also. Lambert et al. (1998:330) state that: "Packaging serves two basic functions: marketing and logistics." In relation to logistics a package is a specific material form that organizes, protects and identifies goods. In an economy where mass produced products need to be distributed a package is a facilitating resource that is used that is used to contain and provide utility helping to move goods from an original location their destination (Twede and Parsons 1997). The transformation of location and form of goods in a materials flow is a logistics role of packaging. In relation to marketing, packages help inform and influence professional customers and consumers, helping to promote the product and thus support the transaction of title of the goods. Paine (1981:215) states that a "good" package form including the materials used, shape and print promotes the product increasing its sales, while poor packages provide the end-user with damaged products. Logistics provides the availability of the product to the user. The provision of goods is a basic requirement to be able to market products. The different aspects of the package, its form (packaging), its role in the physical distribution of goods (logistics), and to transfer title of a product (marketing), may therefore be viewed as interdependent.

2.2 The Physical Properties of a Package

The field of packaging is mainly concerned with the form of packaging and this form is of importance regarding its use. Some aspects of package form are regarding its physical dimensions and the type of material used (Coyle et al 1996). The physical dimension refers to the size and shape of the package. Packages and goods may be represented by varieties of forms e.g. cardboard boxes, and crates that are loaded onto T-pack form plastic-wrapped pallets containing a variety of different packaged products and materials. According to Jahre and Hatteland (2004), the form of the material contained in the package influences how packages are combined with other packages and logistics facilities such as storage rooms and handling equipment. An important issue is the degree of fitness through use of standardised package sizes and shapes and between different logistics facilities when used in relation to logistics activities. The following are regarded by Dowlatshahi (1996) as key factors influencing package design: 1) physical properties (form of the package), 2) dynamic

limitations (e.g. acceleration, vibration etc.), 3) environmental limitations (e.g. temperature, pressure, humidity etc.), and 4) hazardous effects (e.g. radiation, explosives, personnel safety etc.). These are factors mainly accounted for in package design, but are important since the form of a package also influences how it is used.

The form of packages can be classified according to different levels based on Johansson et al (1997:12) and EAN (European Article Numbering) standards (www.ean.no) as:

- Consumer packages ("C-pack"-level): Individually wrapped products, includes also multi-pack solutions. Consumer packaging is viewed here as part of a product.
- Distribution packages ("D-pack"-level): Secondary or multi-unit packages. Crates, cartons that may be displayed in stores, containing either unpackaged or consumer packaged products. This form of packaging may be handled manually. Contains usually C-level packages.
- Transport packages ("T-pack"-level): Tertiary packages such as containers, large crates, pallets (including goods on pallets), storage tanks for liquids. Contains secondary packaged or unpackaged products.

In addition unpacked and packed goods are contained in various types of transport and storage facilities including large transport containers that hold packages of different levels. D-pack and T-pack levels usually contain C-packed products. However this is not a necessity. Some products are packed directly into T-pack or D-pack levels of packaging. The borderline between these packaging levels is also in some cases unclear as when consumer packaging may also serve the role of a D-pack, such as is the case when video television sets are displayed in stores in cartons. In other cases C-packs may be placed directly into a T-pack container. These are only a few examples how packages at varying levels may be combined into units of packaging. When lower level packages are combined at a higher level of packaging this becomes a new unit of packaging with a unique identity. When packages become perceived as goods in a materials flow, the use of packages is primarily related to one of these levels. At a retailer the receiving of good is mainly at a D-pack level, while goods sold are registered at a C-pack level. A transport firm mainly counts pallets of goods, a form of D-pack when loading and unloading a container, while during transport it is the T-level container that is managed and operated.

2.3 Using Packages

When packages "become" goods during distribution this involves a focus on the use of packages. Physically speaking, goods usually consist of combinations of materials and packages. In the flow of goods packages are given a purpose. This purpose is primarily logistical, aiming towards the placement of a product in the hands of an end user. As a result of this placement in the materials flow, packages are transformed from an original state at the point-of-origin to its state at the point-of-consumption (see logistics definition CSCMP, www.cscmp.org). Between is original state and its placement at the location of an end user, an important characteristic of goods is that they are transformed. The key variables in this transformation are according to Alserson (1957) form, time and location. The form of goods is accordingly a variable involving complex combinations of packages and materials. In addition a unit of goods is combined with other logistics facilities and organisational resources used to operate the flow. In addition, within the materials flow, the form of goods may be described in relation to when it has been identified with a specific form, and where it has been identified.

Packages and materials interplay as goods in the materials flow, and this interplay may be described principally as a "Pandoras box", with materials at the core, followed by the C-level, the D-pack, T-pack and finally the facility containing the goods. The description as a Pandora's box is not completely appropriate, since the D-pack, T-pack and goods containment facilities contain often more than one unit of packaging at a lower level:

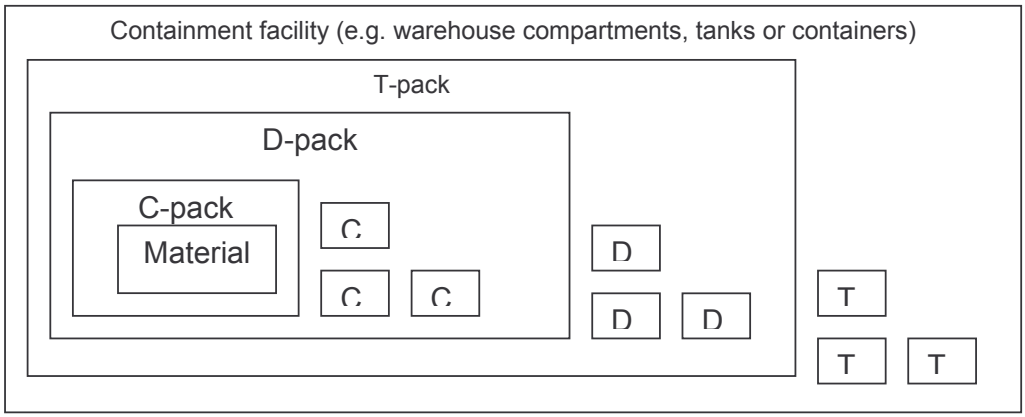

Fig. 1 Goods as materials at the core covered by layers of packaging

Essentially fig. 1 shows that goods are a variable that may in a more precise manner be characterised using the levels of packaging as shown in the figure. This basic understanding of the interface between the package and a material or product is important since it shows how layers of packaging literally cover each other. This combining also helps determine the basic form features of a product consisting of a consumer-level package containing a more or less produced form of material. When packages are placed inside each other it is most often the outer level of packaging that is identified, and the unit of packaging that is managed and operated in the materials flow. The next phase is to consider more closely the activities that make are the basis for understanding the package as a logistics resource.

2.4 The Facets of Using a Package

Packages may be viewed as having different facets, physical and informational, that interplay with other resources. On the physical side packages interplay with materials, packed or unpacked, that is contained within a package. This combining of packages and materials make up a unit of goods that is the entity that must be accounted for and identified in order to sort goods at e.g. terminals to carry out logistics activities of transport, storage or materials handling.

Packages and the materials contained in packages interplay in an "intimate" manner. According to Paine (1982:20), "the functions of any packaging will be dependent on the item to be contained and the method by which it is to be transported from the manufacturer to the consumer". Usually a material that is packed in consumer packaging is denoted as a product. The two vital interfaces of the package resource accordingly is the material or possibly a manufactured product a package contains, which is another resource it is combined with, and the materials flow, that is understood as an *activity* structure involving facilities and human resources that delivers a product to its user. The main functions of packaging are according to Twede and Parsons (1997) 1) containment, 2) utility and 3) communication. Containment represents an interplay with mainly other physical resources such as other goods, handling equipment and storage facilities. Utility is on the other hand related to logistics activities in a supply chain. This understanding is shown in the figure below:

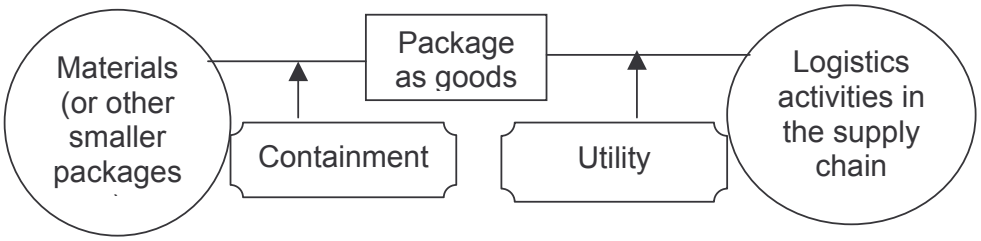

Fig. 2 The roles of the package providing containment and utility

In addition to containment and utility, packages also have a vital function in relation to communicating information (Twede and Parsons 1997). The basis for being able to communicate about packages in their role as goods is based on the interdependency of the roles of the package as an containment facility and as a facility used to carry out logistics activities as shown in fig. 2. Communication about packaged goods is based on that the goods has a form and the package contributes to being able to describe the form of goods. In addition, packaged goods are used in relation to logistics activities.

The communicative function of packages is related both to the goods themselves, the physical entity in distribution, and with an information system. The two main logistical and communicative functions of a package are accordingly described as (see Johansson et. al. 1997):

- An information carrier: information attached to the package itself, label, tag (such as RFID) or other document forms that are attached to the package.
- As an information source: information concerning the package registered in other media forms than the package, through documents either in an electronic or paper form.

The function of the package as an information carrier is based on the physical presence of information on the package and is information embedded in the flow of goods. The function of the package as an information source is based on identifying the package or goods and relating this with information content in an information system regarding time, location and product form related to units of packaging including potentially product form characteristics.

The material flow of goods cannot operate without information being provided where information about the goods is one part of the information content. Actors may perceive a package in its physical form, or as information. One role of packages is related to the flow of goods, and the other is related to the “information flow”. Communication is provided through print or writing directly on the package, labels and tags that are attached to the package, represent also a part of the physical role of the package. This is the communicative role of packaging as an information carrier and is a technical role related to identifying goods and therefore being able to transform the physical properties of goods by assigning these goods to logistics activities. In addition units of goods consisting of combinations of packages are an informational content that is created and transformed mirroring the characteristics of packages and goods in the materials flow. This is the communicative function of the packaging as an information source. This function of packages is vital since this function provides information that is the basis for operating and managing the materials flow.

3 Packages and the Flow of Goods

Possibly the most distinctive attribute of physical distribution is that goods represent a variable. Goods change features in relation to place, time and form through the operating and management of the distribution channel (Alderson 1965). Therefore goods transformation and the logistics activities contributing to the transformation of goods need to be accounted for. In relation to the package this involves considering how the containment of goods changes due transformation in package form, and how activities, involving package utility in using the package to transform goods.

3.1 Logistics Activities that Transform Goods

The basic objective of logistics is concerned with the provision of goods to an end user and four main activities are involved in this provision of goods. They may be classified as materials handling, transport, storage and production. Starting with materials handling, this logistics activity plays a central role in transforming goods and is a logistics activity that may be described in its simplest form as “the movement of materials when not actually being processed” (Paine 1981:153). According to Stock and Lambert (2001:22) materials handling is “…concerned with every aspect of the movement or flow of raw materials, in-process

inventory, and finished goods within a plant or a warehouse." Arnold (1998:248) states that: "Materials handling is the short-distance movement that takes place in or around a building such as a plant or distribution centre". Materials handling is an activity that takes place at a specific logistical facility, most commonly in or near a warehouse, terminal or production facility. This involves receiving goods, identifying goods, dispatching goods for storage, holding goods, picking goods, preparing and for outbound transport, and loading for outbound transport (see: Arnold 1998:305). At a warehouse the borderline between materials handling and storage is fuzzy, since some forms of short-term storage may be regarded as materials handling. Materials handling includes short idle phases where goods or individual packages are not moved.

When a specific phase of production, transport or storage has been completed, the provided products need to be handled. This often includes repackaging the products, or assorting the goods into new groups of packages. Following this handling, the goods are moved to a location of the following activity which may be either production, storage, or transport. Materials handling is pictured as a central logistics activity since this is the activity which goods are assigned through to transform a product in relation to a future time, location and product form state. This coordinating role of materials handling in relation to other goods transforming activities view is described in the following figure:

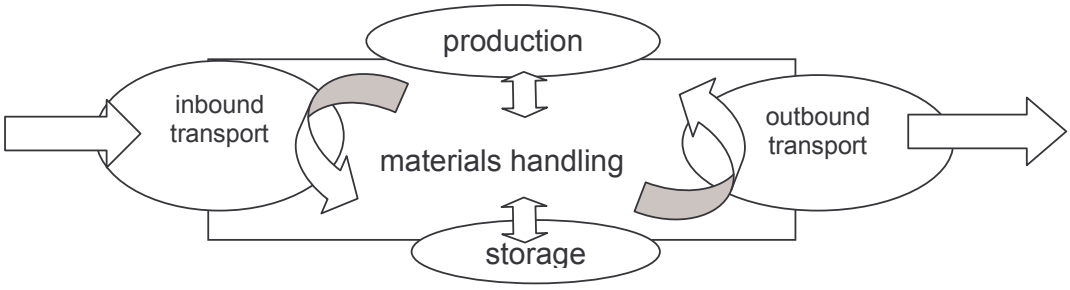

Fig. 3 Materials handling as a coordinating activity in the materials flow.

Materials handling and the related activities of transport, storage and production are activities that in a physical manner transform goods in an intentional manner. The main understanding derived from fig 3 is that different types of interrelated activities need to be coordinated in relation to a same unit of goods.

3.2 How Goods are Transformed

The transformation of goods takes place in a setting that is termed in the CSCMP logistics management definition as a flow of goods. This flow of materials or goods has a range of characteristics that may be accounted for. Here a focus is placed on how the basic structure of the flow of goods is related to the transformation of goods. The following case examples presented in part 5 are structured in accordance with a transvection understanding of the structure of physical distribution. A transvection is a term created by Alderson(1965) and represents the action of placing a product in the hands of the end user. According to Alderson (1965:92), taking the perspective of the end-user of a product, "…the transvection comprises of all prior action necessary to produce this final result, going all the way back to the conglomerate resources." The transvection concept allows for a "…piecemeal analysis" (Alderson 1965:94) of the materials movement and storage in the logistics network. This is a basis for a more detailed study of the materials flow including the idle periods of storage and the informational flow. "Sorting" and "transformation" represent the key concepts of a transvection. Sorting is a decision-making event of choosing how to carry out mainly logistical activities and leads to an assignment of goods to another logistics actor. According to Alderson (1965:94): "Different facilities are required for fabrication, shipment, storage and credit. Thus, there has to be an intervening assignment to the appropriate facilities". Transformations are according to Alderson (1965) changes of a product in a combination of time, location and form characteristics. Alderson expresses that "…two transformations cannot appear successively without an intervening sort. Information is provided and used in relation to a sort. To move materials downstream, customers must select products and

communicate order information. The selection is communicated in a specific volume of packaging units combined with time and location information. However, the movement of goods may also be assigned based on forecast information. Based on order or forecast information suppliers assign goods towards the end-user. Sorts lead to that logistics activities involving materials handling, transport, storage and production, transforming the goods are carried out sequentially so that they eventually reach an end-user.

At a sort, individual packages or goods are assigned onwards to a destination downstream in the materials flow and sorts involve the use of information. However how information is provided and used at sorts between the different actors managing and operating a materials flow is not accounted for in detail within a transvection. The transvection is mainly a here applied as a research tool that is used to design the research process and construct cases concerning physical distribution in a manner as shown in figure 4 below:

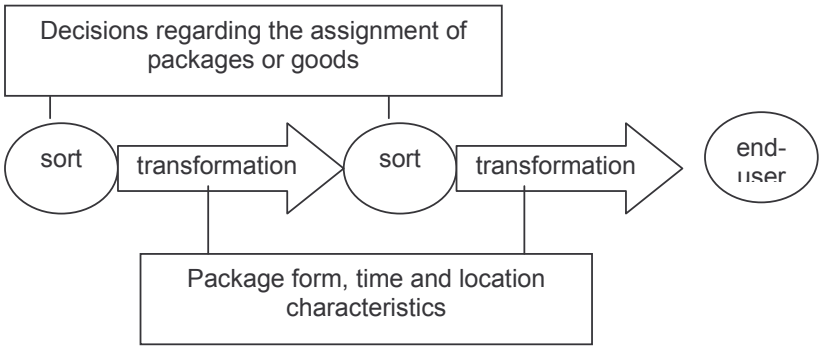

Fig. 4 Sequentially ordered sorts and transformations in a transvection

The empirical findings presented in part 5 exhibit the distribution of four different food products form a point of origin to a Norwegian retailer. This description is based on research conducted in line with the transvection, starting with the time and form characteristics of the product at the retailer location. Therefore the transvection plays a “back-stage” role as a research tool helping to create and structure empirical descriptions that follow a traditional downstream flow of goods.

3.3 Interdependencies and Physical Distribution

Thompson (1967) has created a framework for analysing interdependencies within and between organisations. Organisational interdependencies may be sequential, pooled or reciprocal according to Thompson (1967). The flow of goods is a sequential interdependency where goods in a distribution process are transformed step by step, one sort depending on the following. However, this accounts form only a limited aspect of the distribution of products. Håkanson and Persson (2004) and Dubois, Hulthén and Pedersen (2004) both site using Thompson’s framework, that all three forms of organisational dependencies sited by Thompson (1967) should be accounted form when describing and analysing the nature of physical distribution. The main characteristic of a flow of goods based on a transvection understanding is that goods, since they are physical objects are always identifiable by actors at a specific location. In addition, since goods are always location specific in relation to time, the transformation of goods must be sequential.

Alderson (1965) describes how goods in a basic manner differs form information related to it and states that while goods is bound to a single location information has a character that it may be at two places at the same time. The transvection accounts primarily for the physical aspect of the flow of goods, however, there is an informational aspect of this flow also which is in the CSCMP logistics management definition termed as an “information flow”. In relation to the transvection information is provided to actors at the sort. However how this information is given and evident at a sort is not accounted for in the basic description of a transvection. An additional approach is however needed in order to be able in a more precise manner study how information is provided and new information is created in relation to sorts accounting for more complex interdependencies related to information exchange. This includes how

information carried on goods and information about packaged goods interplay mainly in relation to sorts. Information may in such an approach be viewed as exchanged between different actors involved in different sorts and also include actors not directly involved in operating the materials flow. In information exchange, basically speaking, a third resource or actor may be involved (pooled interdependence), and information exchange may in a communicative process be reciprocal since information is often communicated in a back and forth manner.

3.4 The Logistics Network

The logistics network is here applied as the context of both the flow of goods and the more complex flow of information. This information flow is viewed as dependent on the flow of goods and influencing it. A network structure is chosen since this provides a setting that is applicable in describing an "information flow". A network basically consists of entities that are linked by a specific type of relation and this structure may be understood by finding the ties between these entities (Aldrich 1979:281). Focusing on its structure, a network can be described as a set of inter-related entities in what may be pictured in the form of a net. Threads that represent relationships connect different nodes. A network has according to Aldrich (1979:18) no common or definitive business objective and no definite borders of the entity. It is a metaphor that is well adapted to carry out explorative studies. The logistics network is a research tool and accordingly also a loosely defined area within which empirical evidence is collected. A network is in this manner different from a system with defined borders and a binding overall function. The "information system" is accordingly viewed as a system within the network. Systems may, accordingly, be described as part of a network context influencing how system dynamics and their structure.

Simchi et.al (2000) apply logistics networks as a basic term to describe the configuration of networks. These authors also discuss switching out the commonly used "supply chain" term with a "logistics network" term to describe and analyse physical distribution issues. Logistics networks, according to Simchi et.al. (2000:17), "…consist of suppliers, warehouses, distribution centres and retail outlets as well as raw materials, work-in-progress inventory, and finished products that flow between these facilities." According to these authors, an important issue is how these facilities and materials are related to each other representing what seems to be a mainly physical form of structure. The package is a physical resource, and interplays with facilities that also are physical in nature.

The logistics network is applied in this study to account for empirical findings regarding information about goods involving the role of the package as an information source. This aspect of the transformation of goods involves interdependencies involved in how packages and their contents are transformed in a flow of goods and also how this involves a transformation of information about the goods. The information exchange leading to an assignment of goods is more complex than the actual transformation of goods, and the logistics network is used to approach the context of how packages are transformed. The basic approach applied is influenced by the IMP Network Approach (Håkansson 1982, Axelsson and Easton 1992, Håkansson and Snehota 1995, Gadde and Håkansson 2001). The industrial network approach represents an inter-organisational form of research direction within business and management related studies and the approach has been applied to a range of research issues basically in the realm of what has been termed as "industrial marketing and purchasing" including issues concerning technological development (see e.g. Håkansson 1987, Holmen 2001, Håkansson and Waluszewski 2002), purchasing and supplier relationships (see e.g. Pedersen 1996, Torvatn 1996, Gadde and Håkansson 2001), distribution (see e.g. Kaplan 2002, Hulthen 2002) and most recently in relation to logistics (see Gadde et al 2002).

The IMP network approach is based on Cook and Emerson's (1978) definition of networks as "…sets of two or more connected exchange relations" (see also Håkansson & Waluzewski 2002:29). According to the IMP Network Approach, firms interacting in a network are interrelated through three layers of substance that are characterised as 1) activity links, 2) resource ties and 3) actor bonds. This is what within the IMP group is commonly termed as the "ARA-model". The model is based on an assumption of interacting actors using combinations of resources carry out activities. Resources are viewed as heterogeneous,

therefore resources may be combined in different ways, and this also represents a doorway for seeking innovative solutions to business problems. Interdependency is accordingly a basic feature of how actors, resources and activities interact or interplay. Logistics actors need to communicate with each other and develop bonds in order to keep the information system functioning that provides the necessary information at sorts that is viewed as vital in order to manage and operate the materials flow. This is a key issue within or aim of supply chain management regarding inter-organisational integration in relation to logistics activities. The role of the IMP network approach involving the A-R-A model in this study is as a research tool that is used to account for the more precise nature of the logistics network.

A logistics network is applied here as a network of interacting activities, resources and actors where logistics represents the functional focus. Within the physical distribution aspect of logistics a focus is paced on the role of the package as the focal resource object in this network. In the logistics network information is exchanged between actors responsible for sorts in accordance with the transvection understanding. This exchange in a network context of interdependent and interplaying actors, resources and activities represents the basis for the assignment of goods to logistics activities. The nature of the flow of information in relation to the flow of goods in the following manner is shown in fig. 5 as an excerpt from the logistics network:

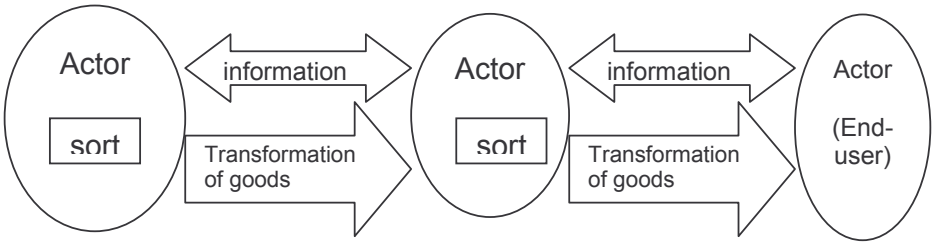

Fig. 5 Excerpt from a logistics network. The exchange of information between actors in relation to sorts of a transvection. Double-headed arrow indicates information exchange in the context of a business relationship.

The package is in this view the focal resource of this study. Packages are embedded in a complex network context of interplay between actors, resources and activities. When approaching the issue regarding the importance of a package in logistics network this accounted for primarily by describing and analyzing this embedded nature of the package in the logistics network. This as a network with unfixed boundaries and an overall purpose. The logistics network is bounded by the information and material flows with an overall purpose of physical distribution of goods.

4 Some Methodological Considerations

The empirical evidence has been collected in relation to an ongoing doctoral work involving a four cases study concerning the distribution of fresh food products to Norwegian retailers. This study is focused on the issue regarding the role of package as an information resource when distributing products. This represents the basis for the product examples given in the following part 5. The studied products are Norwegian seasonal Corona strawberries, bananas from Costa Rica, low fat milk packed in 1-litre Pure-Pak cartons, and fresh white fish filet packed in trays covered by plastic foil. Each product case is constructed in the thesis in accordance with the framework. Based on these four cases narrative examples exhibiting different aspects of the role of the package as a logistics resource is provided, one related to each product case.

The reason to choose the specific products and informants were based on convenience sampling. The doctoral work is a part of the NETLOG project at the Norwegian school of Management BI, involving 6 companies financing this project and the main informants were found mainly among two these companies. These were a dairy producer and a fresh fruits and vegetables wholesaler. Both of these are actors with dominant market shares in their

respective markets. The chosen products are all perishable food products, meaning that time is an important common aspect to them. All the studied products may be denoted as fast moving consumer goods, relatively low priced products that may be included into “everyday household” consumption patterns. This allows a focus on issues regarding problems related to distributing these relatively similar products while accounting for other differences for reasons of comparison. The aspects on which the products differ include how the products are distributed including transport distance, the type of packaging used, the information systems and actors involved and regarding variation in supply also including the volume in the supply chain. The strawberry product was first chosen based on that the fruits and vegetables wholesaler wished to study this product. The initial study of strawberries was conducted purely as a NETLOG-related case, and later this case together with interview transcripts were used in the thesis. The three additional cases were chosen based on the mentioned differences in product and distribution attributes enabling qualitative comparative analysis on the mentioned variables.

The research design used to collect data and construct the cases has been explorative and iterative. An iterative or abductive research design, influenced by what is termed as “systematic combining” (Dubois and Gadde 2002) is applied in this study meaning basically that there is no fixed sequencing between the development of the theoretical and empirical realms. The research design was emergent based on a constant interplay between theory and empirical findings. The empirical and theoretical realms develop in a back and forth manner, or in some events simultaneously. Gradually theory is developed based on empirical evidence and theory, hand-in-hand so to speak. In some cases formulations that may resemble a “hypothesis” or simply explicit “hunches” based on empirical data that may steer the ongoing research process.

Roughly altogether 60 semi-structured interviews represent the basis for the cases presented in this study. Also new issues became evident during the interview session to the researcher. Starting in the chosen focal firm data was collected by finding a “focal actor” for each of the four products. Data was mainly collected for each of the product “sub-cases” with a group of interviews related to each other carried out in the frame of a few weeks. Based on this type of initial interview in relation to the focal informants. Interviews have been open-ended and one interview usually influenced who would be the next person to be interviewed and the contents of the following interview. This applied research design may be termed as a form of “snowballing”. In some cases respondents had to be interviewed twice since the now topics had emerged since a previous interview. An interview guide was created for each interview, but these were often relatively similar in their basic structure. In almost all interviews the respondent brought up issues. A unique interview guide was created for each interview that was adapted to the stage of the research process and based on the development stage of the frame of reference and the pool of previous empirical findings. This guide was based on the prior empirical findings and formulated based on what was expected that that specific informant had knowledge about. Each interview guide contained a list of loosely formulated topics of the interview, and the exact question was formulated orally during the interview. All interviews commenced with that the informant was asked to provide a presentation of their role and background in their firm and their logistics network. Thereafter more focused topics were covered in relation to predefined topics of that specific interview. Initial interviews in a product case usually carried out with an informant that had an overall product responsibility regarding its distribution. These interviews covered relatively “overall aspects” regarding the distribution of a product. Thereafter interviews were done with other informants (most often suggested by the initial informant) with more specialised competence regarding specific issues. Each interview was taped and transcribed. Trustworthiness to the data collected was developed as informants often gave overlapping descriptions of the same phenomenon. In additions, since informants often were interviewed regarding observable facilities and how actors used these, observations were also used in a complimentary manner to mainly compliment and also verify informant data.

The basis for being able to apply the data from the described PhD research to the theme of this paper concerning the core role of the package is that in this research process the package and information were treated in a simultaneous manner as the focal unit analysis.

Therefore a rich database was created regarding the physical properties of the package in a logistics network in addition to the informational aspects. In this study information from transcripts has been reinterpreted accounting for the physical package as a goods providing facility. In this study the different functions of the package as a containment, utility providing and communicative resource are understood in an "egalitarian" manner since all these roles are important in relation to and contribute to understanding the nature of the importance of packages in physical distribution.

5 Empirical Findings: Packages and the Distribution of Perishable Foods

The four different product examples are not considered to provide a complete overview of how these goods are distributed and the role of packaging in this respect. Rather, four examples concerning each of the four products focusing on a specific characteristics of this product are bought up. These examples may therefore be viewed as narratives or stories exhibiting a plot related to the importance packages in a logistics network. Based on the meanings provided in these examples a short analysis is provided. Each product example analysis focuses on a focal set of issues and is therefore does not represent an attempt to make a complete to provide a more complete analysis of different aspects of using the package to distribute goods. In 5.1 the issue placed in focus is that Corona strawberries is a high-volume seasonal product that demands additional organisational resources, and that this product also is extremely perishable. 5.2 places focus Low –fat milk and the role of production in relation to the package, 5.3 is concerned with the role of the package in the unitisation and apportionment of Costa Rican bananas, and finally 5.4 is about how a new and low volume consumer packed fresh fish filet product is combined with other units of goods in the materials flow.

5.1 Seasonal Strawberries

Starting with Corona strawberries the chosen feature to be investigated more closely are features regarding time and vital aspects of how this influences using packaging. Time is judged as an important feature in the transformation of Corona strawberries mainly due to two different reasons. First, strawberries are a seasonal and high-volume product. This means that organisational resources need to be made available in order to distribute strawberries in addition to managing and operating the other products that then the fruits and vegetables wholesaler ordinarily distributes. Creating an additional organisational resource, a "strawberry team", solves this problem. Second, the supply of strawberries is complex. The studied strawberry species has a very short lifetime of about 24 hours from harvest to sales. Also a variable amount of strawberries are supplied every day of the season at the same time. In the materials flow Corona strawberries are packed into plastic reusable distribution crates containing 12 baskets containing 500 grams of strawberries. The distribution crates are stacked onto EURO pallets for handling and short-term storage. In addition to that plastic baskets, IFCO crates, pallets and handling and containment facilities neatly are adapted to each other due to standard measurements this influences also how goods are informed about.

Upon delivery from the farmer, the aim is to limit the use of time through its activities, thereby reducing the decay of the product. Time provides an absolute limit in the durability of the product and thus contributes in providing a measure of how many Corona strawberries need to be sold. To be able to coordinate supply with demand, information from producers regarding the daily harvest of strawberries measured in a number of pallets using SMS and fax regarding the daily harvest, must be coordinated with orders received from the distribution centres also measured in pallets. This is done by the "strawberry team", with two persons receiving the variable supply volume information and coordinating transport from the farms, and the two others "pushing" the supply out to the market through tits distribution centre customers. These four members of the seasonally functioning strawberry team use an EXCEL spreadsheet to coordinate the daily supply of Corona strawberries with demand. In addition to that supply fluctuates from day to day, order volume fluctuates based on the day of the week and weather conditions. Mondays are "quietest" while demand picks up towards the weekend. Orders are faxed from retailers to the distribution centres together with orders for other fruits and vegetables products. The distribution centre loads these accumulated orders

from the preceding day into an EDI system that is accessible to the strawberry team. When supply and demand, measured in pallets divisible into crates of Corona strawberries has been fixed using price as the main coordinating tool, delivery from the farms to the distribution centres must be coordinated with truck capacity. The strawberry team uses an EDI system that is internal within the wholesaler organisation to coordinate transport. If additional trucks are needed a transport company is contacted by phone by the fruits and vegetables wholesaler's logistics department based information regarding supplies in the EDI system. In addition, the distribution centres must take into account that they too have a limited storage capacity, although this does not pose a problem in practice since volumes of other products is reduced in the summer season.

- ***Analysis***

This example shows how informational aspects of a package are crucial when describing how packaged goods are distributed. It is the communicative roles of the package that therefore comes into focus in order to manage and operate the flow of goods in relation to logistics aims of goods provision. In the case of Corona strawberries the volume of goods are both measured using a same standard, namely units IFCO crates and of pallets, and each pallet contains a certain number of IFCO crates. The activity of the strawberry team is focal in the distribution of Corona strawberries in its logistics network. The strawberry team coordinates supply with demand information concerning the provision of goods including the handling of goods in relation to transport and materials handling activities. When time is limited, as in this case information regarding supply, demand and logistics facility capacities must be coordinated. The time frame for delivery is limited, the daily volume in the season is large and the distribution of Corona strawberries is different form distributing other products of the wholesaler, distribution varies in volume from day to day in a short season. This combined complexity and seasonality are reasons why information received by the strawberry team is manually handled, and this activity must be supported by comprehensible information about the goods. The use of units of the same type of packaging to communicate both orders and supply and in relation to assigning goods to transport and materials handling influences accordingly the efficiency of activities transforming the goods through easing sorting activities and providing comprehensible information about goods. This involves the use of a range of different documents created and used by different actors. Therefore, this example shows how packages may serve an important coordinating function since packages represent an information content that is standardised. Packages thus represent in practice a form of "language" understood by the different actors operating the materials flow of Corona strawberries in relation to different activities. When time is short efficient communication that limits the distortion of information is of increasing importance, and the package is in this respect a resource facilitating the correct informing about goods based on a common conceptions of the package among logistics network actors.

5.2 Low-fat Milk

The feature focused upon regarding Low-fat milk is that it has basically two different forms in the materials flow that are also characterised by how it is contained. Low fat milk must be contained in some manner in order to be distributed due to its liquid form. In its first raw-milk state before being produced at the dairy, milk is stored in a variety of tanks, at the farm, on a truck and in silo tanks at the dairy. Milk from various farms is collected into trucks, and these following different pick-up routes deliver this raw material to the dairy. When produced the studied Low-fat milk is packed into e.g. 1-litere PURE PAK drinking cartons. These cartons may then be placed on plastic trays containing 10 1-litre cartons each that fit into roll-rack containers containing 160 1-litre cartons. The milk cartons may also be directly placed into the roll-rack containers without using the trays. The roll-rack is a relatively small manually handled grid-like container on wheels and with a brake. It measures 42 cm in width, 67 cm. in depth and 124,5 cm. in height.

The daily provision of raw milk to the dairy is based on information that is set on a long-term basis. These plans include which farms deliver to the dairy and the annual production quota of each farm. Delivery of raw-milk is measured in litres, and the tanks of raw-milk help identify the location of this volume. During production at the dairy, the material form is transformed and the information about the goods is now measured in different units of packaging. The studied carton of low-fat milk is a well-established product, and the daily ordered volume

varies very little from day to day, or from week to week. Information in the form of orders measured in either units of plastic trays or roll-rack containers is received in the morning is coordinated with production information so that production is adjusted to meet orders. The actual daily production of low fat milk therefore exactly matches orders. This exchange of information with retailers provides the destination of the goods, and this earmarking of goods transforms the information about the goods by more precisely combining of a volume of low fat milk measured in units of packaging with an intended destination. While raw milk is registered as the fluid contents in tanks, cartons of produced low fat milk is informed about in units of packaging, mainly as a standard number of milk cartons in either trays or roll-rack containers.

- ***Analysis***

When a product undergoes production and is packed, the way goods are informed about changes. After being packed, the package plays an important role in informing, that is to describe vital aspects of a product form. This regards most importantly its volume features and this aspect involves the function of packaging as an information source. It also shows how a product, in this case 1-litre cartons of low-fat milk, is characterised by including its consumer level packaging. Since milk is a liquid product, it must be contained, and therefore even in its raw milk state, milk is characterised by its containing facility, the storage tanks. However, these facilities inform about the material in a different manner. When milk has undergone production and is packed in consumer packaging, this helps more precisely inform about the product to consumers involving its function as an information carrier. When raw-milk is contained in tanks, the volume in these tanks is a variable amount that needs to be informed about. In addition the need to control heightens the need to register goods and take samples of the goods in its different forms. In the event of tracing the source of a product discrepancy of a packed low-fat milk carton, this may involve having to trace the source of the discrepancy through production and back to its raw-milk state. This involves therefore a complex process of going through the different states of the milk including how it has been contained since the registers of how the milk has been produced, stored and transported is informed about including how it has been contained in packaging or in tanks. This example therefore shows how production in this case in a radical manner changes how a materials are contained, and that this transformation of the product, including its packaging also changes how the goods are informed about. The increasing use of various types of packaging therefore also increases the complexity of information exchange about goods in a logistics network. Therefore, the way a material is packed also influences how a product (consumer packed material) and goods in general are informed about to actors in a logistics network. Since the characteristics of packages are standard in form this represents a common knowledge base of actors in a logistics network, helping to exchange of information concerning the features of goods.

5.3 Bananas

This example places focus on how packages unitise and assort materials and therefore help inform about volumes of goods. An important characteristic regarding the studied bananas is that they are not C-packed and are harvested in an un-ripe condition. Therefore the banana peel has a role of assorting this product. The studied banana product is packed only in distribution-level packages, and the international fruits supplier distributes bananas in 15 different forms of boxes that are all made from corrugated carton. When distributed in a specific box each packaging type containing the same type of Cavendish (the main commercial species) bananas has a unique EAN product code. The bananas distributed to Norway are packed in clusters that are placed into a see-through plastic bag at the banana plantation in the tropics, and placed into a box measuring 50 cm. in length, 40 cm. in width and 24 cm. high. The box is printed with the fruits company logo in bright colours and includes information about product type, Cavendish bananas Class 1 and the minimum weight of the contents. Each of these boxes is specified to carry 18,4 kilos, and this weight norm is printed on the box. Usually each box contains somewhat more bananas than the specified norm in a number of clusters of 4-7 fingers, with no more than one cluster containing 3 fingers in each box. A cluster of about 5 fingers is regarded as optimal quality and clusters are cut seeking to meet this norm upon packing. The wholesaler in Norway orders all its bananas in this type of box. This is also the most common type accounting for over 80% of the volume supplied by the international fruits company. The bananas remain in their box from when they are packed

until they are unpacked at the retail location. Banana boxes are placed onto ISO standard "fruit" pallets. These measure 120 cm in length and 100 cm. in width. 6 boxes are placed on each level of the pallet. 48 boxes are stacked onto one pallet weighing 980 kg, of which the bananas weigh 878 kg making bananas a relatively heavy fruits and vegetables product. The boxes are then strapped onto the palled using strapping wire. At the Norwegian wholesaler, the banana product manager plays a central role in coordinating how bananas are supplied to the Norwegian market. The banana box has holes in its side since this allows for ventilation. This is especially important when the banana is in the ripening facility. To carry out production at this facility the temperature is regulated and ethylene gas is inserted into the containment rooms without unpacking the boxes.

- ***Analysis***

The role of unitisation and assortment of goods is to communicate materials volume information between the actors. Unitisation of goods helps verify an anticipated volume of bananas that need to be ordered and supplied. The interesting feature is that communications leading to an order are measured in pallets of the standard banana box even prior to harvesting the banana. The banana box therefore, since it represents a unit of the goods, also is an efficient way to communicate the volume of the goods. Since the banana boxes have standard measurements, also when they are palletised, this makes stowing the goods in various containment facilities, such as the banana ship, in truck compartments or at the banana ripening facility in Norway, easier to plan and organise. This displays how the informational role of the package is vital in informing about goods both in relation to ordering and to carry out logistics activities or production. The ripening of bananas is a production activity that takes place without unpacking the bananas. It is first when bananas arrive at a retailer facility that they are unpacked. Here clusters of bananas are usually placed on a store display shelf. It is then the consumer who apportions the goods. Since the studied bananas do not have consumer packaging the product needs to be weighed at the cash register, a manual and more time consuming process at the supermarket cash register. This hinders the use of more automatic identification of the goods at the consumer pack level since labelling these unpacked goods does not help to identify the volume of these goods. Therefore the lack of consumer packaging used to contain bananas, and that it is banana fingers that assort the product, limits the possibility to register a standard volume of these goods at the retailer. Therefore packaging through its function of unitisation and apportionment serve a vital role of identifying a relatively precise volume of goods. Identification of packaged goods also provides the basis for automatic goods identification using labels at all locations in a materials flow and in relation to all levels of packaging through labelling (or potentially the use of electronic tags, "RFID").

5.4 Packaged Fish Filets

This example focuses on a new packaged fish filet product that is still distributed in a low volume and within a short time-frame. It is a fresh fish product with a best-before date that expires a week from it was fished at sea. Therefore a distinguishing feature regarding the distribution of this product is that a low volume of products is transformed using facilities provided by a range of different companies. On the fishing vessel when fish are used from a trawler are delivered to the same production facility on land. The fish filet products demands the freshest raw material and then only within a specific size range of the fish. Therefore fish when caught at sea and packed into fish crates with ice. The raw material must then be sorted and the crates labelled using colour-codes in order to identify the date of the catch. At the production facility fish raw materials of different species are used to produce a range of different consumer packed products for the Norwegian market, and products packed in distribution packages for export. The studied fish product represents only a few percent of the value of this supplier's production.

The studied product uses an innovative form of consumer packaging that reduces the oxygen content in the consumer packaging to delay product decay. This packaging equipment at the filet factory in Northern Norway has its own production line that due the novelty of product features, Since the weekly produced volume is low this equipment lies idle 5 days of the week, and on the two production days it is used only for a certain number of hours. The product is packed into C-packs that measure 19 cm in length, 14 cm in breadth and are 5 cm high. This is an open black coloured plastic cup-like holder that is covered with a see-through

thick plastic film, and a label is attached onto the film. This label is pasted onto the film, includes a colour picture of a prepared fish product, and uses black coloured text on top of a combination of white and light-blue background. The C-pack label contains a mixture of printed information created prior to the production and information that is stamped on during the production. The printed information on the label contains product information regarding type of product, EAN numerical and bar code, brand name and other necessary information regarding product contents. The label also informs about a product quality guarantee that allows the consumer to receive money back if the product does not meet expectations. The label includes instruction to the consumer regarding how to prepare the product in a basic manner. Also a more "fancy" and detailed recipe using the product as the main ingredient is provided on the package. The stamped-on information is located in specific spaces on the label. This information contains the lot number, the best before date, and a code indicating the time and location of production. The lot number represents a batch of fish that is fished on a specific fishing vessel on a specific date and this also can be used to identify the location where the fish was caught.

The consumer-packed fish filets are then packed into plastic reusable meat containers. These measure 40 cm in width and 60 cm in length and 4 of the meat containers are adapted to fit on a EURO pallet. A meat container may contain up to 3 layers of consumer packaged fish filets with 5 packages in each layer. Each plastic meat container carries a transport label with an EAN bar and numerical product code indicating the contents of the container. On the pallet a transport label with an EAN SSCC bar and numerical code is attached containing information indicating the destination of the goods.

Transport from the fish producer to the market in Southern Norway is carried out twise weekly in refrigerated trucks that travel daily on this route. Each truck has four different compartments allowing for differentiated temperatures adapted to the different goods that are carried. When loading the labels are on the meat containers are scanned, and this is also done when unloading the vehicle. Here the same dairies that distribute the low-fat milk product also distribute this fish filet product. Upon arrival at the dairies, the goods label on each container is scanned and the goods are then placed in a designated place at the terminal for picking later the same day for delivery to retailers. Since a small volume of these products are ordered by each retailer, picking lists specify the goods measured in units of consumer-level packaging, and the location of this goods in the terminal is identified through the label on the meat container.

- ***Analysis***

When a small volume of goods is distributed with a great degree of pressure regarding timely delivery as in this case, the focal goods need to be combined with other goods in order to efficiently deliver this product. This combining of different products is evident in the whole of this flow of goods. The example shows that since the product places specific demands to the nature of raw materials, these types of fish raw materials delivered form the trawlers need to be identified and placed into specific packages that are discernable from boxes with other materials by using labelling at the fish factory. When packed the material is discernable due to its distinct consumer packaging. However this specific goods is combined with other goods, and the distribution packaging may be used to carry many other types of products, especially meat products. Therefore the containers need to be labelled. Also, since the goods are grouped with other goods with different destinations labelling is essential in order to identify the goods and secure that they are delivered to the correct destination. At the consumer level the label helps to inform the consumer about the origins of the product, its best before date and may also help influence the consumer into purchasing the product. In a logistics network where goods are combined with other goods, products with other products, goods and products need to be identified. When goods are handled together with other goods it is not sufficient only to contain the goods in packaging to be able to identify a unique shipment. The goods need to be precisely identified using labelling or newer forms of RFID tagging which links the specific goods in an accurate manner to an information system at sorts. This is the basis for assigning the intended goods to the appropriate activities. This example exhibits accordingly the importance of communicative role of the package as information carrier in identifying units of goods and distinguishing a specific unit of goods from other goods at sorts in a logistics network.

6 Conclusions

Two characteristics of how a package is important in relation to logistics are accounted for. The first is through the containment function of packaging. Here the form of packaging influences the degree of utility in relation to logistics activities carried out in order to operate the flow of goods. For instance when bananas are packed in boxes that help not only to protect the material but also are adapted to use in containment facilities during storage and transport and regarding production at the ripening facility. Packages represent accordingly the physical object that has various facets of interplay with other handling, storage and transport equipment and also with information system facilities. Packages facilitate accordingly in an important and "central" manner the physical distribution of goods through containment of materials and utility in interplay with other logistics facilities and goods since this is the object that facilitates the transformation pf location of the goods. It is possible to say that this form of transformation related to place is most important in relation to logistics aims.

The second aspect of importance regarding the role of packages in a logistics network may in addition be underpinned by placing focus on the communicative function of packaging. This function is evident when the package interplays with an information system or directly with actors cooperating in a logistics network. The package is both an information carrier and an information source. It communicates directly to actors through printed text on the package or labels, or through being informed about and identified through an information system.

When goods are packed logistics practitioners commonly term the goods they distribute as "products". However, the visible feature of this type of packaged goods is transport and distribution-level packages and not its "product" or material content. The package is an integral part of both products and goods with consumer packaging interlinked with products and distribution-level and transport-level packaging to goods. Within physical distribution, when actors in the logistics network communicate about "products" this may involve to some degree a marketing potential, especially in the case of consumer-level packaging. However, the logistician is mainly concerned with distribution. Therefore it is "goods" that is the key term in the CSCMP logistics management definition and not products. Goods consist of packages and materials, and it is these forms of objects that are evident and therefore most important to a logistician. Therefore, when logistics actors speak about "products", it is actually goods they are informing about even though the name or wording may be the same. The package then represents part of the information content of goods since packages are used together with materials to describe the goods. Packages are therefore a vital piece in describing the features of goods and it is only this "piece" that is evident to actors handling the goods when they are packed in transport and distribution packaging. Then the products must be identified through labels or tags with documents. This understanding may be related to the view proposed by Ballou (1987), that it is the package and not the product that is of prime concern within logistics. This discussion regards physical aspect of packages when combined into units of goods represents the basic importance of packages in relation to logistics.

Packages represent units of goods. The form or size of the package represents a specific measurement of the materials it contains. Through unitisation standard sized packages facilitate correct and perceivable information content that is less prone to distortion, packages contribute to the quality of information used to inform about goods. Information content is communicated based on the unitisation of distribution and transport packages and through the apportionment of consumer packages (or products). This information is used to coordinate different logistics facilities and logistics activities. In addition information provided in this manner through packaging may be used for marketing purposes like promoting products in a self-service store environment, or helping to define information content of products when negotiating product orders. This involves the marketing role of packages as described by Lambert et al. (1998). The marketing role of packages is mainly related to informing consumers about products through texts on consumer packages and informing in a business-to-business environment about the temporal states of goods regarding when and how they may be delivered. Packages provide information about the form of products and

information about the possibility for delivery of the requested goods. Within marketing it is the transfer of title regarding products and the ordering of services and that is more in focus (Rosenbloom 1995).

At sorts actors depend on information about goods that is combined with other types of information in order to assign goods to logistics activities. Since packages usually have a standardised form they also represent a source of potentially precise information content about goods that is comprehensible to logistics actors and therefore may be used as a tool to limit information distortion when communicating about goods. This coordination is based on that goods are supplied in accordance with forecasts or orders and that they thereby can be identified through comparing documents containing information about the destination of a unit of goods with the labels or tags on packages themselves. The communicative functions of the package as an information source as an information carrier are accordingly closely related and interplay. This interplay regards the importance of packages since it is the package both as an information content integrated in an information system and the package itself the needs to be related to each other in order to be able to supply goods, and this supply is vital in relation to a logistics function.

The package is one logistics resource of many logistics resources used in combination with each other. The package plays a central role in physical distribution both as a material object and as an information resource. The package is mainly a logistics facility since its core function may be understood as containing material facilitating the transformation of goods so that they reach the end-user. Packages have form that provides in relation to logistics activities a degree of utility, and the communicative function facilitates the operation and management of the transformation of the goods. Physical distribution within logistics is concerned with providing goods to an end user. When packages are used for this logistics purpose they become a vital part of goods. It is through this role as goods that packages primarily may be viewed as a core resource in the logistics network. This is because packages main use is to facilitate physical distribution. All functions of the package regarding containment, providing utility and communication partake in this understanding of the importance of the package in a logistics network. In accordance with the view of flows as the “hard core” within logistics proposed by Arlbjørn and Halldorssson (2002), packages play an important role involving both the flow of material goods and the flow of information.

This understanding of the importance of packages in a logistics network needs to be further studied and elaborated. Continuing research may be directed towards using a network approach also related to logistics. By combing logistics with networks, this may be interpreted as a form of systems approach common within logistics and supply chain research with more loosely defined borders and overall business function (Gammelgaard 2004). Studies may also use the transvection to structure cases describing the distribution of specific goods as has been done here to provide the basis for the empirical examples. More precisely studies may account for the interaction between actors, combining of resources and their use in relation to different logistics activities placing focus on packages in their role as goods. This should be especially of interest in relation to seeking innovative solutions to logistics problems and a better understanding of how packages, goods and information interplay in a logistics network. This involves both accounting for logistics and marketing issues concerning the package since both these functions are of importance in relation to the package as goods. Such a focus on the package as goods may prove especially fruitful since the rapidly developing information and communication technology involving new potential applications represents an area of study where new and unexplored ways to communicate information concerning both logistics and marketing functions may be discovered.

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