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# Unveiling the Concept of Packaging Logistics

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## ABSTRACT

An increasingly competitive environment, technological advancements and globalisation are a few of the factors placing higher demands on today's company activities, e.g. development, production and distribution processes. Company activities have hereby become a complex system, even more so if one company is seen as part of a network of companies. The aim of this article is to present and elaborate on an approach that deals with these matters in an integrated manner – packaging logistics, where the logistics systems are studied from a packaging perspective. This is carried out through putting package definitions and logistics definitions into a model framework based on Porter's value chain and Christopher's network theory. Rather than studying packaging and logistics separately, the integrated concept of packaging logistics will give a more complete perspective in problem solving and research. The contribution of this article is to theorise and introduce suggestions to define the subject of packaging logistics.

*Keywords: Packaging, logistics, packaging logistics, definitions, concept*

# **1. INTRODUCTION**

The world of today is changing and technological advancement and globalisation are a few of the factors placing higher demands on today's company activities. The company environment is getting more complex, and companies are creating networks where the movement of goods and people is increasing (EEA, 1999), which leads to a more complex operative company environment.

Logistics is growing more important in this complex environment and packaging has been identified as an important part of logistics. Björn (1990) argues that the cost of the package is about 5-10 percent of the logistics cost and that a package can influence about 65 percent of the total logistics cost. Lancioni and Chandran (1990) argue that the package itself accounts for about 8 percent of the logistics cost and, in international logistics, about 15-20 percent, which is in line with Björn's (1990) statement. Since the package exerts such a strong influence on the cost and on the total performance of the logistical chain, the importance of the package can easily be identified.

The aims of this paper is to describe our view of the subject of logistics and packaging and the interaction between, them called packaging logistics. By using definitions of packaging and logistics and describing how they interact with companies internal and external environment the paper will show how the integrated view of Packaging Logistics can create added value.

## **1.1. Definitions**

A definition is a demarcation or an explanation of the meaning or use of a word/phrase (NE, 1990). The definition is made to create a single word/phrase for a bundle of activities/functions that would otherwise require a long description. Both logistics and packaging have been defined by many different sources, thus creating both differences and similarities. To explore the activities involved in both packaging and logistics, an introductory discussion of the range of the different definitions of packaging and logistics is put forward.

### **1.1.1. Package definitions**

The primary function of a package is to serve as an interface and a barrier between the product inside the package and the surrounding distribution environment (Jönson, 2000). The surrounding environment can be divided into the three categories of physical, ambient and human environment. In the physical environment packages are exposed to damage through shocks, vibrations and other physical treatments, while in the ambient environment gases and humidity are some of the factors causing potential package or product deterioration. The interactions between people and packages take place in the human environment, where issues of information, package functions, legislation and

regulations are important. The demands placed on a package vary depending on the product inside and the surrounding environment. The above-mentioned packaging activities are to some extent included in today's packaging definitions. One broad definition of packaging divided into three levels has been put forward by the UK Institute of Packaging.

The three levels of the packaging definition provided by the UK Institute of Packaging are as follows (Robertson, 1993 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 and efficient delivery to the ultimate consumer in sound condition at minimum cost”*

*“Packaging is a techno-economic function aimed at minimizing costs of delivery while maximizing sales (and hence profit)”*

Paine (1983) states that packaging contains, protects and preserves as well as informs, and from a broader perspective it also creates and sells convenience. Bram et al (1983) use these functions in their packaging definition in the following way:

*“Packaging is the enclosure of products, items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or other container form to perform one or more of the following functions: containment; protection and/or preservation; communications; and utility or performance. If the device or container performs one or more of these functions it is considered a package.”*

Another package definition used by Packforsk (2000), and translated from Swedish, also integrates the above-mentioned elements of packaging into the supply chain.

*“Packaging: All products, independent of material, that are produced in order to contain, protect, handle, deliver and present goods, from raw material to final product and from producer to user and consumer”*

One of the definitions of the UK Institute of Packaging, based on Paine (1981), was developed by Bjärnemo et al (2000) as follows:

*“Packaging is a means of ensuring safe and efficient delivery of the goods to the ultimate consumer followed by an efficient reuse of the packaging or recovery and/or disposal of packaging material at minimum cost.”*

As seen in the latter definition, the elements of packaging also hold functions of ensuring deliveries and recycling. This reasoning has also been developed in Jönson (1995), where the basic package values *protect, collect, distribute* and *inform* are described. Furthermore the role of packaging in terms of accounting for less waste, less damaged goods, less waste of resources, safe products and safe working environment, is discussed, which, in turn, gives an added value. Consequently, if correctly designed, the package will *save*, as in the statement of Ruben Rausing, the founder of Tetra Pak: “a package should save more than it costs”.

Further value can be added to a product and to the actors throughout the value chain by using the future potential of packaging. One example is active or intelligent package functions. Active packaging interacts with the packed product in changing the condition of the product over time, while intelligent packaging monitors to provide information about product quality (Ahevenainen, 2000).

Statements such as “more than the package” made by Tetra Pak and “thinking outside the box” by SCA indicate that packaging companies of today regard the package as a tool to create values beyond the basic components of containing, protecting and preserving, and informing.

### 1.1.2. Logistics definitions

The word “logistics” is derived from the Greek word *logistike*, which means practical mathematics (NE, 1990). Logistics in the sense of physical distribution first appeared in the academic literature in the early 1900s but it was only during WWII that logistics developed and got more attention. After WWII, logistics was transferred into industry and developed as industrial logistics or business logistics. The basic requirements in the logistics system have often been described in terms of the seven R’s: *the right product, the right quantity, the right quality, the right way, at the right time, at the right cost and to the right customer* (Persson et al, 1996). Some of the existing definitions of logistics are presented below. Two early definitions come from Magee and Bowersox, both with the focus on the physical flow.

Magee (1968) defines logistics as:

*“The art of managing the flow of material and products from source to user. The logistic system includes the total flow of material, from the acquisition of raw material to the delivery of finished products to ultimate user.”*

A later logistics definition is put forward by Bowersox (1978) as:

*“The process of strategically managing the movements and storage of materials, parts and finished inventory from suppliers, between enterprise facilities to customers.”*

As mentioned above, WWII had a great impact on the development of logistics. In the military sector, NATO and the US Air Force use one common definition of logistics. The definition is much more detailed but still only focuses on the physical flow.

Compendium of Authenticated Systems and Logistics Terms (1981) defines logistics as:

*“the science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, logistics pertains to those aspects of military operations which deal with (a) design and development, acquisition, storage, movement, distribution, maintenance, evaluation, and disposition of material; (b) movement, evacuation, and hospitalization of personnel; (c) acquisition or construction, maintenance, operation, disposition of facilities; and (d) acquisition or furnishing of services.”*

A more modern definition of logistics is that of the Council of Logistics Management (CLM, 2001), which is an organisation for developing the field of logistics and the people working within logistics:

*“Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers’ requirements.”*

The definitions above, except the one provided by CLM, only take the physical flow into consideration. The definitions put forward are derived from both military and civilian sources. The military definitions are more detailed and do not take cost into consideration. The only definition that fully embraces physical distribution, cost and information flow is that of CLM.

As opposed to the academic world, logistics companies view logistics as a solution. The following example of a slogan comes from Schenker:

*“A worthwhile logistics concept should reduce lead times and improve information flows in our customer's business processes. It should contribute to overall company efficiency and quality performance. It should simplify and reduce administration. It should make a difference to our customer's customer. A good logistics concept makes our customer more competitive while reducing costs.”*

This could be an indication of how companies in the field work with logistics. Unlike academics, practitioners find it important to have a wider perspective than logistics definitions generally have. Here it could be pointed out how interactions between packaging and logistics require further study in order to formalise this broader view.

### **1.1.3. Interactions of packaging and logistics definitions**

In view of the different logistics definitions it can be concluded that the impact of packages on the logistics system is neglected. However, in most packaging definitions the package is considered an integrated part of the logistics system. This has been recognised in previous research, where researchers and institutes have made attempts to integrate the two disciplines into one definition of “packaging logistics”.

The Swedish institute Packforsk (2000) suggests the following definition (translated from Swedish):

*“Packaging logistics is an approach which aims at developing packages and packaging systems in order to support the logistical process and to meet customer/user demands.”*

Another packaging logistics definition is found in Logistik (2000) (translated from Swedish):

*“Packaging logistics is an approach which aims at developing packages and packaging systems in order to support the logistical goals of creating product benefits in terms of time, space, shape, and user friendliness towards the customer.”*

In these definitions packaging logistics is regarded as a discipline where packages and packaging systems are developed to fit into existing logistics systems. However, an integrated development of packaging systems and logistics systems would further enhance the area of packaging logistics.

In the context of product development, Björnemo et al (1999) describe packaging logistics as follows:

*“The interaction and relations between the logistical system and the packaging system that “add on” values to the combined, overall, system – the Enterprise”*

The first two definitions of packaging logistics both state that the packages are integrated in the logistics system. The last definition, by Björnemo (1999), suggests that there is an interaction between the two systems of logistics and packaging. The forthcoming analysis is aimed at exploring the role of packaging in order to show that packaging interacts with the logistical system rather than being integrated into it.

## **2. ANALYSING DEFINITIONS FROM A COMPANY PERSPECTIVE**

If there is an interaction between packaging and logistics, the definitions of the subjects could be a good starting point. In order to establish that there is an interaction between packaging and logistics, we have to know what firms do. A common way of describing of the company environment is to divide the company into several functions, e.g. finance, production and marketing. Another perspective is activity-based. One example is activity-based costing, which provides the possibility of dividing costs by activity over the activities performed in a company is given. In view of the definitions put forward above, such an activity-based perspective creates an opportunity to explore what companies do according to packaging and logistics definitions. The activity-based perspective thereby creates support in exploring what firms do. Given this, the activities included in packaging and logistics definitions can be divided into the activities performed in the company.

The framework put forward below is used in order to differentiate between activities performed in the company’s internal and external environment and to distinguish what company activities are included in the definitions of packaging and logistics.

### **2.1. The Porter Value Chain**

Porter (1985) addresses the interplay between the types of competitive advantage (cost and differentiation) and the scope of a firm’s activities. Porter’s Value Chain Model provides a systematic way of examining all the activities a firm performs and how they interact. The model could be described as a framework illustrating what companies do in their internal environment. The value chain activities represent a general model of all activities performed in any business, be it supplier (downstream value), retailer and customer (upstream value) or the company in between.

According to Porter (1985), every firm is a collection of activities that are performed to design, produce, market, deliver and support its product. All these activities can, according to Porter (1985), be represented in terms of a value chain. (see Figure 2.1) The value chain displays total value and consists of value activities and margin. Value activities are the

physically and technologically distinct activities performed by a firm. These are the building blocks by which a firm creates a product valuable to its buyers. Margin is the difference between total value and the collective cost of performing the value activities. Every value activity employs purchased inputs, human resources and some form of technology to perform its function. Each value activity also uses and creates information.

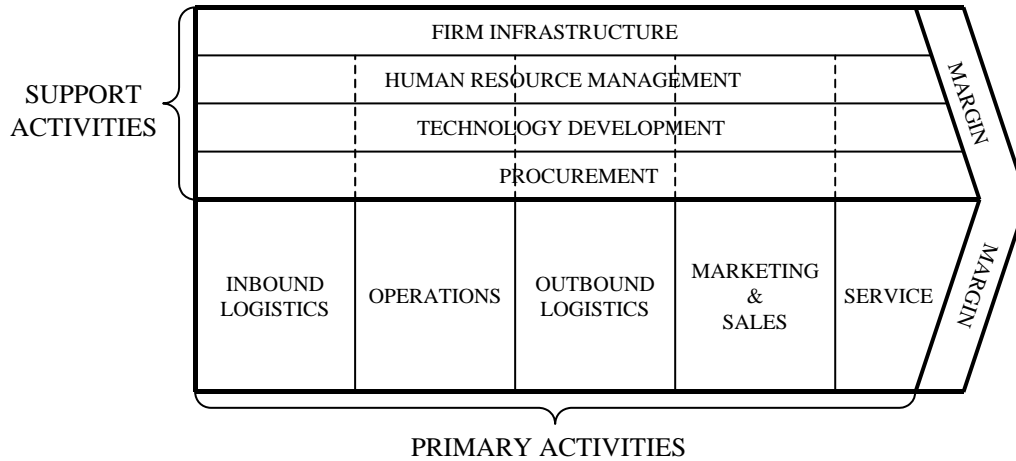


Figure 2.1: The Porter Value Chain (Source: adapted from Porter, (1985))

Value activities can be divided into two broad types, primary activities and support activities. Primary activities are the activities involved in the physical creation of the product and its sale and transfer to buyers as well as after-sale assistance. Support activities support the primary activities and each other by providing purchased inputs, technology, human resources and various firm-wide functions. The dotted lines reflect the fact that procurement, technology development and human resource management can be associated with specific primary activities in addition to supporting the entire chain.

### 2.1.1. Primary activities

In any firm, primary activities can be divided into five generic categories. Each category is divisible into a number of distinct activities that depend on the particular industry and firm strategy (Porter, 1985):

- *Inbound logistics.* Activities associated with receiving, storing and disseminating inputs to the product, such as material handling, warehousing, inventory control, vehicle scheduling and returns to suppliers.
- *Operations.* Activities associated with transforming inputs into the final product form, such as machining, packaging<sup>1</sup>, assembly, equipment maintenance, testing, printing and faculty operations.

<sup>1</sup> This definition of packaging only includes the packing of goods.



- *Outbound logistics.* Activities associated with collecting, storing and physically distributing the product to buyers, such as finished goods warehousing, material handling, delivery vehicle operation, order processing and scheduling.
- *Marketing and sales.* Activities associated with providing a means by which buyers can purchase the product and inducing them to do so, such as advertising, promotion, sales force, quoting, channel selection, channel relations and pricing.
- *Service.* Activities associated with providing service to enhance or maintain the value of the product, such as installation, repair, training, parts supply and product adjustment.

All these categories of primary activities will be present to some degree in any firm, according to Porter (1985).

### **2.1.2. Support activities**

Support activities involved in competing in any industry can be divided into four generic categories (Porter, 1985):

- *Procurement* refers to the function of purchasing inputs used in the firm's value chain, not to the purchased inputs themselves. Procurement tends to spread throughout the firm. Although a given procurement activity can normally be associated with the specific activity or activities which it supports, a purchasing department often serves many value activities and purchasing policies apply firm-wide.
- *Technology development* is embodied in every value activity, be it know-how, procedures or technology embodied in process equipment. Most of the value activities use technology that combines a number of different sub-technologies involving different scientific disciplines. Technology development consists of a range of activities that can be broadly grouped into efforts to improve the product and the process. Technology development that is related to the product and its features supports the entire chain, while other technology development is associated with specific primary and support activities.
- *Human resource management* consists of activities involved in recruiting, hiring, training, developing and compensating all types of personnel. Human resource management supports individual primary and support activities as well as the entire value chain.
- *Firm infrastructure* consists of a number of activities including general management, planning, finance, accounting, quality management, legal and governmental affairs. Unlike other support activities, infrastructure usually supports the entire chain but not individual activities.

The primary and supporting activities suggested by Porter (1985) provide an explanation of the internal environment of the company. However, since companies operate in both an

internal and external environment these should be represented when exploring packaging and logistics definitions are explored from the perspective of what companies do. Christopher is one researcher who has extended the Value Chain to include the external environment.

## 2.2. The Christopher Supply Network

In connection with the above discussion of the Porter Value Chain and when the impacts of globalisation on distribution and packaging are considered, the Value Chain is somewhat narrow. for the purpose of analysing the definitions of packaging and logistics. Internationalisation and globalisation have brought about an increased external activity of distribution and package activities. It would not be sufficient to discuss the definitions solely in terms of the value chain, since it only describes the internal environment of a company. The external company environment can be described in terms of the network theory presented by Christopher (1998) as an extension of the Porter Value Chain. Christopher (1998) has found that the Value Chain should be adjusted to today’s conditions and has made an extension of the model.

According to Christopher (1998), organisations in today’s competitive environment are dependent on their relationships with other companies. Together companies constitute a supply chain, ranging from the raw material to the finished product in the hands of the end consumer. The single company is often described as part of this supply chain, with one supplier and one customer. To widen this perspective and to represent reality better Christopher (1998) has suggested that the supply chain should be described as follows (see Figure 2.2):

*“The supply chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.”*

Aitken (in Christopher, 1998) suggests the following definition of a supply network:

*“A network of connected and interdependent organizations mutually and co-operatively working together to control, manage and improve the flow of materials and information from suppliers to end users.”*

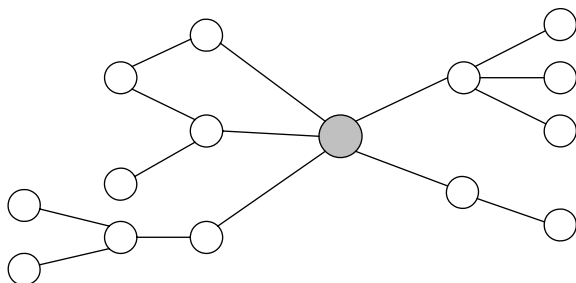


Figure 2.2: The Christopher supply chain – a network (Source: Christopher M. (1998))

As mentioned before, Porter claims that several value chains create upstream value. Christopher’s extension of this statement is the supply chain network of upstream and downstream linkages. Thus, if the Value Chain constitutes the internal environment of a

company, the external environment is represented by the supply network, constituting the framework within which companies operate.

### 2.3. The supporting framework

The activities described by the Porter Value Chain are integral parts of the company environment. Porter mainly uses the Value Chain in his analysis of company strategies, i.e. the configuration of activities and their internal relations. However, in this paper the framework will be used to facilitate an understanding of activities and their possible interactions. The well-defined activities in Porter's model are here used in order to illustrate the packaging and logistics flow in the value system.

In order to have a framework more likely to represent today's company environment, however, the external environment has to be added to the Porter framework. Christopher represents the integrated system of value chains and activities in a company environment. Christopher's extension makes it possible to describe the external environment, where logistics is applied and packages are transported.

The analysis is based on the information on what companies do contained in the packaging and logistics definitions. The analysis will be performed by searching for activities within the definitions based on the activities defined in the Porter Value Chain (see elaboration of Porter). In order to include the external environment, the company environment will be viewed as several value chains in a network (see Figure 2.3). This combined framework should enable us to illustrate the activities contained in package and logistics definitions.

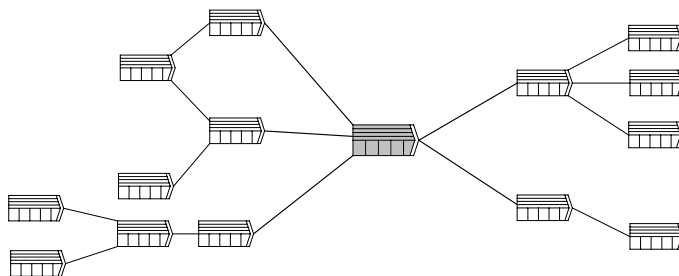


Figure 2.3: An illustration of the company environment – the combined Porter and Christopher framework (Note: an extension of Porter and Christopher)

## 3. AN ANALYSIS OF SUITABLE DEFINITIONS

The definitions within packaging and logistics presented before show the wide range of perspectives in the two fields. In order to analyse the activities in the definitions, one definition from each subject has been chosen to represent the modern view of packaging and logistics. They are also frequently used and accepted within the business sector and in the academic sphere.

### 3.1. Packaging

The packaging definition chosen is the one made by the UK Institute of Packaging (Robertson, 1993 and Paine, 1983). It is a thorough description of what packaging involves:

*"Packaging is a coordinated system of preparing goods for transport, distribution, storage, retailing and end-use"*

*"Packaging is a means of ensuring safe and efficient delivery to ultimate consumer in sound condition at minimum cost"*

*"Packaging is a techno-economic function aimed at minimizing costs of delivery while maximising sales (and hence profit)"*

According to the framework described a number of activities can be found within this definition. Figure 3.1 shows what activities in the Porter and Christopher framework are included in our interpretation of the definition.

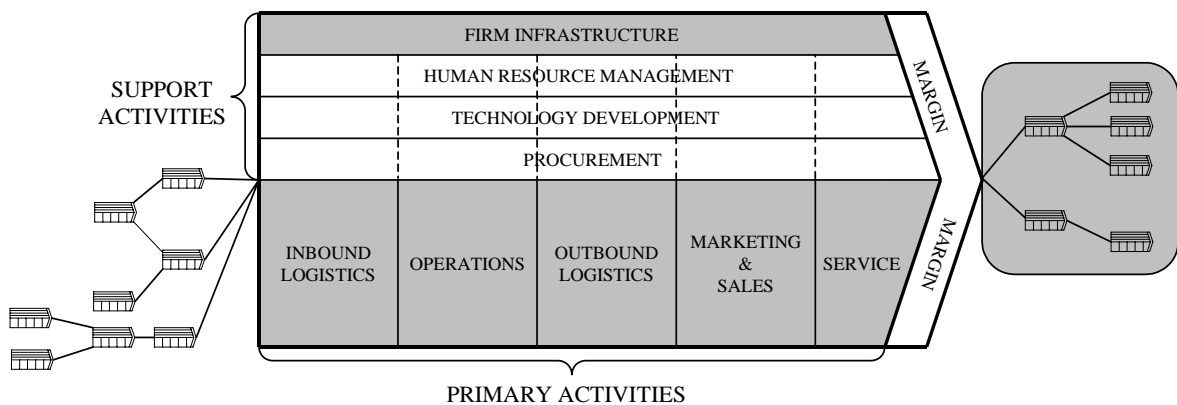


Figure 3.1: Porter and Christopher activities in the packaging definition.

In our interpretation, the following primary activities are represented in the packaging definition:

- *Inbound logistics.* This is represented in the definition by the use of activities such as transport and storage.
- *Operations.* Preparing goods is interpreted as representing the activity of operations.
- *Outbound logistics.* This is represented in the packaging definition by the activities of transport, distribution and safe and efficient delivery to ultimate consumer.
- *Marketing and sales.* Marketing and sales is represented by the activity of retailing. Retailing can be interpreted to include marketing and sales activities such as channel selection, channel relations and providing the means by which purchasers can buy the product.

- *Service*. The final primary activity is service, represented in the framework by the activity of end-use. The interpretation of end-use should be read as an activity existing if we are talking about the service of machinery. However, in a company using fast-moving goods, the activity of customer service vanishes in the definition. Service also includes activities such as ensuring sound condition and safe delivery.

In our interpretation, the following support activities is represented in the packaging definition:

- *Infrastructure*. The description of packaging as "ensuring safe and efficient delivery...in sound condition" is here interpreted as a part of the infrastructure activity. The use of packaging as a "techno-economic function" also includes the infrastructure activity.

In our interpretation, the following upstream and downstream network is represented in the packaging definition:

- *Upstream value*. Retailing can (besides Marketing & Sales) be interpreted to represent the upstream value created in the activity of a retailer and not the company in the middle. Further end-use also represents the up-stream value.

Our concluding remark is that packaging is fully represented in the primary activities. It now remains to be seen to what extent the definition of logistics is represented in the framework.

## 3.2. Logistics

The CLM definition was chosen as a good representative of a modern, generally accepted description of logistics activities within both the business sector and the academic sphere. It reads as follows:

*"the process of planning, implementing and controlling the efficient, cost-effective, flow and storage of raw materials; in process inventory, finished goods and related information from point of origin to point of consumption for the purpose of conforming to customer requirements"*

The logistics definition is activity-intense in its description of logistics as a subject. Figure 3.2 shows what activities in the Porter and Christopher framework are included in our interpretation of the definition.

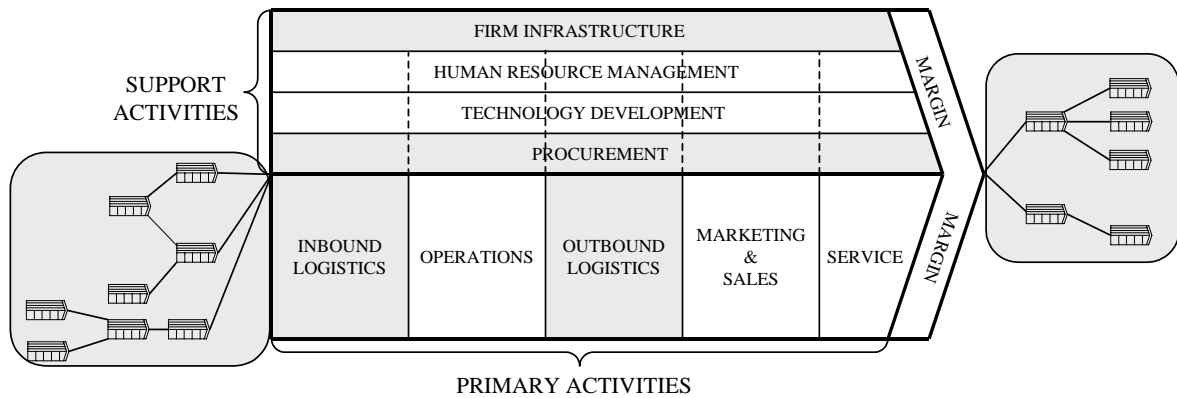


Figure 3.2: Porter and Christopher activities in the logistics definition.

In our interpretation, the following primary activities are represented in the logistics definition:

- *Inbound logistics.* Inbound logistics is represented by the statement in the CLM logistics definition that flow, storage and process inventory are interesting activities within logistics. Flow is interpreted as internal and external movement. Process inventory is interpreted as disseminating products as, according to Porter (1985), inbound logistics includes such activities.
- *Outbound logistics.* Outbound logistics is represented by activities such as finished goods and processing of related information. As related information is a very wide description of information used and produced, it has been interpreted as e.g. order-scheduling, the activity of ordering and financing.

In our interpretation, the following support activities are represented in the logistics definition:

- *Procurement,* which includes the activity of handling related information.
- *Firm infrastructure,* which is represented by activities such as handling related information and meeting all customer demands.

In our interpretation, the following upstream and downstream network are represented in the logistics definition:

- *Upstream value.* Christopher's framework is represented by origin to consumption. Consequently this includes both upstream and downstream value.
- *Downstream value.* See above, upstream value.

Our concluding remark is that logistics is not fully represented in the primary activities. However it is fully represented in upstream and downstream value, which illustrates the core of logistics, i.e. movement between and within value chains.

### 3.3. Summary of activities represented in the framework – an illustration

Figure 3.3 illustrates the final combined framework of logistics and packaging activities represented in today’s general packaging and logistics definitions.

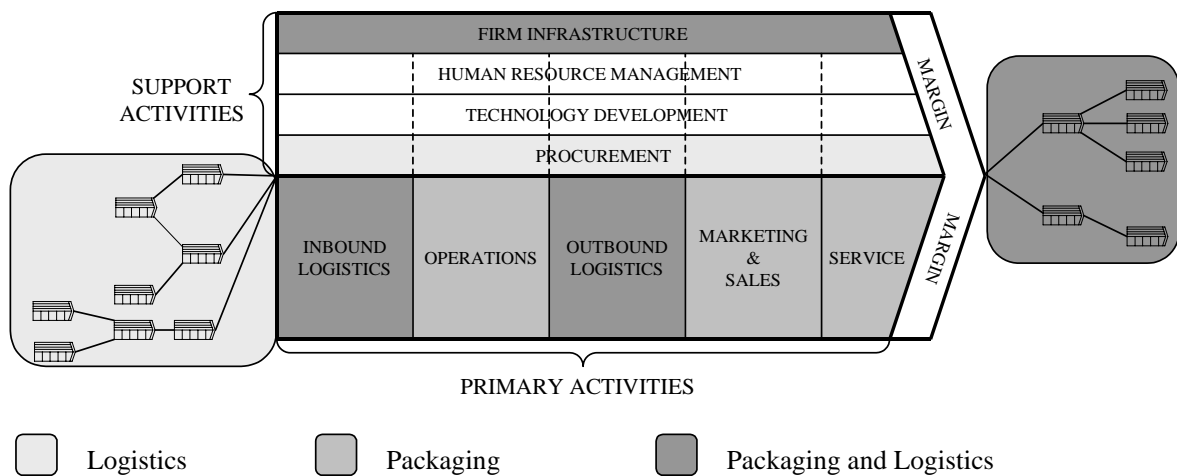


Figure 3.3: The combined packaging and logistics definitions interpretation.

All primary activities are represented as well as a full downstream and upstream value. Human resource management and technology development are not represented among the support activities in the framework.

## 4. DISCUSSION

The illustration of packaging and logistics in the framework in Figure 3.3 shows that both a broader and deeper perspective could be achieved in combining packaging and logistics. The broader perspective becomes apparent since packaging and logistics include all of the primary activities. Furthermore, packaging and logistics together include both upstream and downstream values and two of the support activities, firm infrastructure and procurement. The deeper perspective is pointed out by representation of both packaging and logistics definitions in the same activity. Such activities are inbound and outbound logistics, firm infrastructure and upstream value. The final illustration in Figure 3.3 shows a wider and deeper spectrum of activities than packaging and logistics separately.

The activities represented in both packaging and logistics are “doubled marked” in Figure 3.3. Through the interaction between packaging and logistics in the same activity an in-

depth knowledge can be viewed and benefited from. In these interactions of packaging and logistics two perspectives are combined in depth. Similar interactions could be found in the width. One can conclude that primary, support, up- and down-stream activities interact with both packaging and logistics, as illustrated in Figure 3.3. This final illustration could therefore be said to present an introductory elaboration on the interactions between packaging and logistics, in a complex environment.

The ability to exploit the complex environment of the interactions between packaging and logistics could be the core of packaging logistics in the framework in Figure 3.3. If the package is assigned the central role in research, a new integrated approach to research is adopted when studying interactions between the package and the product inside or the surrounding environment. However, if the two areas of packaging and logistics are combined, as in the illustration in Figure 3.3, new perspectives and other results can be found as compared to undertaking logistics and packaging research separately.

## 5. CONCLUSIONS

By viewing packaging and logistics in a both deeper and wider perspective the understanding of the two and their interrelation in and between the activity/activities in which they operate will increase. If a number of these relations are to be viewed at the same time, i.e. packaging and logistics dependence and influence on each other's performance, they have to be viewed upon as a complex system. In viewing this as a complex system, optimisation of the whole system can be achieved. The expected result from this is to get both the packaging and the logistics system to collectively perform at their best throughout the presented framework. A suggestion for further research is to explore the relations in such a complex packaging logistics system, in order to achieve both better understanding of the processes in the company environment and to help companies perform better throughout the framework presented.

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