

## **AN ANALYSIS OF HOW DEVELOPMENTS IN THE PACKAGING INDUSTRY WILL INFLUENCE THE DIMENSIONS OF FREIGHT CARRIERS**

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## **Abstract**

To what extent will trends in the packaging industry determine or influence the future dimensions of freight carriers? In this study we have identified these trends and studied the possible impact on the sizes of the truck of the future. It was part of a dissertation for the MSc programme in Logistics and Supply Chain management of the University of Westminster. This dissertation has been carried out within the context of the HTAS-EMS research project, in which amongst others MAN, University of Technology Eindhoven, TNO and HAN University of Applied Sciences cooperate to determine the requirements for the truck of the future. In this part of the project research was carried out to find out a possible influence of packaging on the requirement of Logistic Service Providers for the next generation of trucks.

## **Introduction**

Throughout the world, freight flows keep on increasing. In 2001 the European Commission's predicted in its white paper on transport that:

- Freight activity will grow by 55% between 2000 and 2020;
- The need for efficiency and sustainability of the growing transport sector will increase.

Our assumption is that the predicted 55% growth in freight transport, the increasing need for efficiency, and the expected requirements for sustainable transport, all will require a modular concept of transport with vehicles being rearranged and adapted to future standards. This modular concept is referred to as the European Modular System (EMS). Modular vehicles will result in higher transport efficiency with fewer vehicles required to transport more goods. In order to develop a new concept for the truck of the future, several universities and business have joined forces, supported by the Dutch Innovation project High Tech Automotive Systems (HTAS). In this HTAS-EMS we develop the technical modular outlines for the truck of the future. Starting point is what will be the requirements on the truck of the future for the European market. Improving the efficiency and sustainability of the transport sector can be achieved by allowing a larger transport capacity per unit and the adoption of modular systems, according to the HTAS EMS project team (2010).

This project builds on a group of six companies - MAN, DAF, Krone, LAG, D-Tec and Wabco - and three universities - HAN University of Applied Sciences, Eindhoven University of Technology and TNO Industry and Technology. The project develops in three main phases:

1. A definition of the future prospects for modular road vehicles. The goal of the first phase is to make an inventory of the requirements put forward by the various stakeholders.

2. Setting performance and safety assurance requirements for road vehicles. The goal of the second phase is to develop methods and tools to analyze the performance of advanced articulated vehicle concepts.
3. The design and analysis of future EMS vehicles. The goal of the third phase is to perform a detailed technical analysis of the vehicle concepts as developed in phase 1.

This article relates to the first phase of the project, collecting the requirements mainly from logistics operators. The assumption in this study was that the link between the future logistics requirements and the sizes of the trucks will be mediated by packaging. That was the reason to focus the logistics part of this project on an analysis of the future demands of the various stakeholders on packaging.

The main question we address to in this paper is:

*'What are the developments in the packaging industry and how will they influence the dimensions of freight carriers?'*

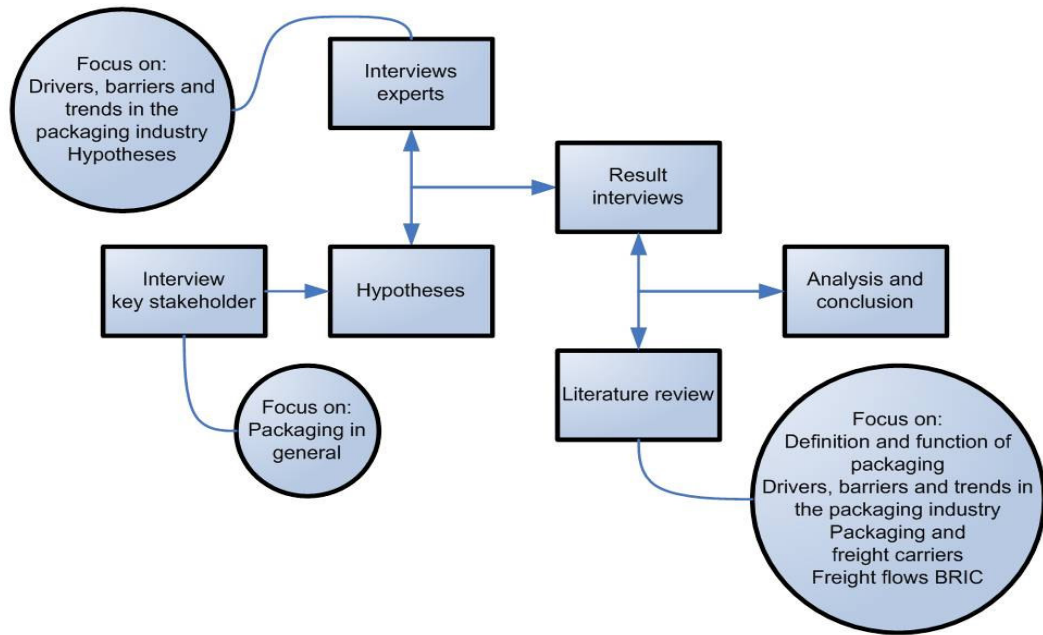
The answer to this question may help us to define the requirements, that we will translate into the characteristics of lorries and trailers in the future.

## **Methodology**

Our research is based on extended study of literature, and in-depth interviews with business and research experts and logistic service providers (LSPs). On the basis of desk research a theoretical framework for this project has been developed.

Field research was carried out using a semi-structured interview technique, so the qualitative research was comparable. The interviews were held with six business and research experts in packaging and three logistic service providers (LSPs) with European wide activities. Because of reasons due to anonymity, in this paper the interviewed stakeholders will be referred to as: 1, 2, 3, 4, 5 and 6. One of them is the key stakeholder. The findings from the theoretical part of this study have been matched with the information of the key stakeholder. On this basis hypothesis have been formulated and have been tested in the interviews with business and research experts.

Figure 1: Research model



### Packaging - theoretical Framework

Packaging can be defined as: '*... a means of ensuring safe and efficient delivery of the goods in sound condition to the ultimate consumer, supplemented by efficient reuse of the packaging or recovery and/or disposal of the packaging material, at minimum costs*' (Gustafsson et al., 2009, p. 70).

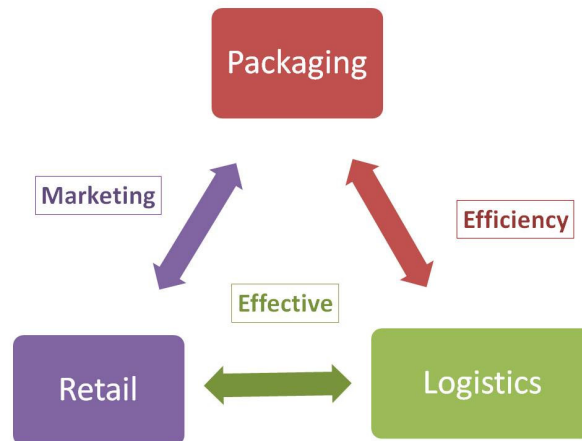
Packaging closely relates to a future product development, making it crucial to know what is happening in this particular logistics-related activity. Several macro driving forces might influence packaging in the next coming years (see Gustafsson et al., 2009, Olsmats, 2002 and Mühlbacher). A DESTEP analysis might include the following drivers:

Table 2: DESTEP analysis of possible drivers of packaging

Demographics	Smaller households, ageing and growing population
Economics	Greater disposable income, raw material costs, emerging markets and increasing trade
Social	Globalisation, culture, time pressures and life style
Technological	Technology advancement, supply chain know how, production structure, information technology and biotechnology
Ecological	Health awareness and environmental awareness
Political	Laws and regulations

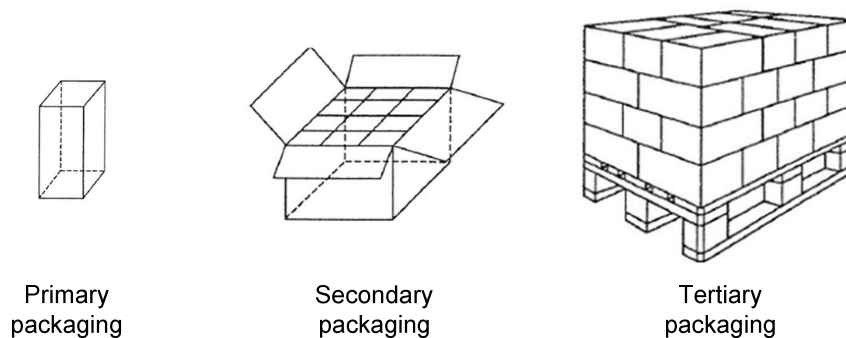
Besides such macro driving forces, packaging will be determined by forces on meso and micro level. In business practice, mainly production, retail and logistics industry will develop the main drivers in close interaction. On an operational level, marketing and logistics efficiency will be more decisive for packaging that just the product itself. In the end this will result in specific trade off's as shown in figure 2.

Figure 2: Trade off's



Marketing trade off's related to packaging will be made between the producer and retail industry, in order to fulfill the requirements for their clients (B2B and B2C). Efficiency trade off's will play an important role to use logistic resources – transport, warehousing – as adequate as possible, in order to realize cost reduction. Effectiveness trade off's will be made to deliver products at the right time, on the right place and the required quantity and quality. In real business life, these trade off's are made simultaneously in a changing and dynamic environment. In packaging, in general, three layers are recognized (Figure 3). To our study, the 3<sup>rd</sup> tier of packaging is most relevant.

Figure 3: Primary, secondary and tertiary packaging



Primary packaging

Secondary packaging

Tertiary packaging

## **Standardization**

Packaging is exposed to various contradictory requirements, more than any other component used in logistics (Olsnats, 2002). Of course, within the designing process of packaging, all relevant demands must be taken into account, including manufacturing, marketing and product design requirements. Any logistics company will be keen on improved efficiency, in pursuit of their aim to decrease material handling costs (Ballou, 2005). As the packaging configuration will have a major influence on the effectiveness of logistic services (Bowersox et al., 2007), many companies design a packaging that perfectly fits to standard pallets (Mühlbacher et al., 2006). Moreover, packaging standardization as a precondition for logistics efficiency is often initiated by retailers (Mühlbacher et al., 2006; Bowersox et al., 2007) who have become powerful players of the supply chain nowadays (Koopmans, 2001). Thus, in their aim of optimizing routine activities, retailers push their suppliers towards delivering goods packed according to the particular general standards.

From a pure logistics perspective there are several ways to increase standardization. One of the possible solutions is a so called modular system. This way of secondary packaging will influence the primary packaging of the product, but only in terms of volume.

However, in reality, a full worldwide packaging standardization seems to be hardly possible. The obvious constraint is the differences between the requirements of numerous markets and various customer expectations (Mühlbacher et al., 2006). Moreover, from a marketing perspective, packaging standardization is seen as a synonym to low sales (Koopmans, 2001) being a barrier for a product's uniqueness.

Thus, in the coming decades the influence of the consumer tastes and requirements, is going to be far more significant than the ordinary rules of the packaging industry (Sjöström, 2000). Nevertheless, whatever the packaging standards are going to be, industry and trade should adapt their products and services to new life styles and manners of the consumers. If companies are not willing to adapt their products to consumer wishes, consumers will look for products from other suppliers who are willing to change products and product requirements, and understand consumer needs.

## **Freight Carriers**

### *Pallet*

A pallet is a portable wooden platform used for transport or storage (Ballou, 2005, Gustafsson et al., 2009). The concept of the pallet is of key importance for standardization, as it increases the number

of handled materials in weight and volume per hour. Moreover, a pallet size should be made compatible with the existing system inside and outside the firm (Ballou, 2005). This will result in a minimal amount of movement needed, and in decreasing amount of materials handling. Although normally pallets are sized differently, in Europe four fixed dimensions are used (Gustafsson et al., 2009) with the Euro pallet as the main standard (Koopmans, 2001). In the US, the block pallet is the main standard. The dimensions of pallets are leading in packaging design (Ballou, 2005). The packaging should be designed to make it perfectly fit onto a pallet, resulting in the minimum wasted space.

*Table 3: Pallet sizes in Europe*

Name	Width (in cm)	Length (in cm)
Euro pallet	80	120
UK / block pallet	100	120
Half size pallet	60	80
Quarter size pallet	60	40

### *Container*

The best practical example of load unitization is the container (Ballou, 2005). A huge advantage of a container is that it can be used for the transport of goods by different modalities without unloading and loading the goods (ten Klooster et al., 2008; Ballou, 2005). It is seen as door to door equipment. The standardization of containers' dimensions has been very important in the global growth of container usage (Ballou, 2005).

The development of containers is playing a major role in international marketing in accomplishing the protection function of packaging (Mühlbacher et al., 2006). Containers provide the opportunity to retain a relatively low weight of the package. Besides that, the container protects the cargo from climate influences, damage during transport and theft. The dimensions of containers are not based on the modular system which exists for packaging and pallets (ten Klooster et al., 2008). Adjustments to these dimensions will have a huge impact on the existing infrastructure for containers. However,

nowadays the dimensions of new containers are more over based on the modular system for Euro pallets.

## **Results**

After carrying out desk research (study of literature and relevant articles) and interviews with key stakeholders, hypotheses have been developed. In a next step, these hypotheses have been tested in interviews with experts. We present both hypotheses and results at the same time.

*Hypothesis 1: Marketing has an enormous impact on dimensions in the packaging industry*

*Result:* All questioned specialists *totally agreed* with the view that in most production companies marketing is playing the most important role in defining the dimensions of packaging. Person 1 noted that in most cases marketing dictates how a product should be packed. The respondent had already had an experience with clients which the marketing view had a negative influence on the logistic manageability. Thus, according to person 1 logistics has almost no influence on the product development itself. Person 2 stated that there is a clear distinction between B2B and B2C products. For B2C packaging marketing is more important than logistics, and for B2B packaging logistics is more important than marketing.

*Hypothesis 2: Freight carriers are playing a negligible role in defining dimensions of packaging*

*Result:* Persons 3 and 4 *agree* on the given hypothesis. Moreover they think that there is a lot of sub-optimization in the process of product and packaging design. They also believe that communication within the supply chain can favor the handling speed. Person 1 supports an opposing view and thinks that freight carriers play an important role in defining the dimensions of packaging in the food industry. Retailers are interested in buying products which are set to the dimensions of the modular system. Persons 2 and 5 also do *not agree* on this hypothesis and assert that pallets are indeed used as the starting point in defining dimensions, especially with Fast Moving Consumer Goods (FMCG). The secondary packaging of FMCG is mostly set to Euro pallet sizes.

*Hypothesis 3: The modular system is not used enough in the packaging industry*

*Result:* All the respondents are convinced that a modular system should be used much more than at present. Person 1 says that the modular approach for secondary packaging is a real way to save money. According to person 2 although standardization is a big challenge nowadays it will increase in the future. So far, the pallet is clearly leading in this industry.



*Hypothesis 4: In the packaging industry there is a lack of standardization*

*Result:* Persons 1, 2, 3 and 4 *support* the mentioned hypothesis and prove it by the idea that marketing is a great obstacle for making standards as it chases the diverse customers' wishes. Nevertheless they believe that packaging industry is willing to standardize in the near future. Observing 20% versus 80% of standard and non-standard packaging in many warehouses, person 5 agrees with the given hypothesis and believes that during the following decade the percentage ratio will become diametrically opposite.

*Hypothesis 5: There is not a particular development to point out in the packaging industry*

*Result:* Persons 1, 2 and 4 think that *sustainability* in the way of using less material, more environmentally friendly material and reusable material is the main development in the packaging industry. They also add such innovations as continuous cost efficiency improvement. Nevertheless, persons 3 and 5 *support* the idea that there is not a particular development to point out in the packaging industry that they are aware of. They state it is a fragmented business with high competition and rivalry. They are not as proactive as they could be and are not reacting enough to their customer wishes.

*Hypothesis 6: The impact of developments in the packaging industry on freight carriers is small*

*Result:* Persons 1, 2, 3 and 4 *agree* with the hypothesis and think that the dimensions of secondary packaging are based on the dimensions of freight carriers as pallets. Person 1 states that the transport and loading units are set for years, and fixed. Containers and Euro pallets are fixed in size and these sizes will not be adjusted in the coming decades. Person 5 asserts that the entire layout of warehouses, trucks and other equipment is based on the sizes of a Euro pallet.

*Hypothesis 7: Packaging influences freight carriers, not the other way around*

*Result:* Persons 3, 4 and 5 do *not agree* with the hypothesis and think that freight carriers dictate the rules for packaging and pallets creators. The standardization of loading and transport units has existed for years. So far, the pallet leads the supply chain game as packaging dimensions will always be based on the sizes of a pallet itself. Thus if person 4 would develop a product nowadays, he would adapt it to the standards of the loading and transport units. Also person 2 makes a distinction between B2B and B2C packaging: he says that the B2B freight carriers influence packaging which is the other way round in B2C environment.

## **Analysis**

### *Drivers*

Most interviewed experts believe that the driving force in the packaging industry is not from logistics but instead is from marketing. Some believe that efficiency and sustainability are achievable, thanks to the existing infrastructure which is based on the Euro pallet as a key driver. The Euro pallet is leading in Europe, some do believe also in defining the dimensions of secondary packaging and freight carriers, this would imply that the dimensions of the Euro pallet will not change soon.

### *Barriers*

The interests of the packaging and logistics industry are totally different. Some believe that the investments which are needed to change the standard dimensions of pallets are a huge barrier. The investments which were made in the past are so high that it is not realistic to change them. Getting economies of scale is a barrier in the packaging industry as well. Packaging in essence is developed by an individual company for an individual product. This is true for each given product. So it will be difficult to get economies of scale out of a diversity of products made by the same company. Also legislation might be considered as barriers in the packaging industry, although new European legislation last many years before implementation.

### *Trends*

Some experts believe that sustainability will become more and more important in the future, because the packaging dimensions will adjust to the modular system in order to fit better on standard pallets and roll containers. They also expect more use of carton instead of wood for packaging goals in future. But it seems that sustainability only becomes relevant when it is lowering costs.

Overall, the results of the interview can be summarized as follows: A barrier in the interaction between logistics and marketing is the fact of chasing totally different goals. Marketing is about selling the product, making it special and interesting to buy, whilst logistics is about eliminating waste, standardization and efficiency. Moreover, the experts distinguish B2C marketing packaging which is playing an important role in defining dimensions, and B2B marketing where the main driver is efficiency. For the packaging industry it is different to cope with the contrary requirements mentioned above.

Sustainability is the most important trend in the packaging industry for the future. However it only will be interesting for business when it actually decreases supply chain costs.

Although freight carriers play a negligible role in defining the dimensions of primary packaging, their position becomes more significant when it comes to secondary and tertiary packaging. Pallets are leading in defining these dimensions. In the retail industry and FMCG industry, the pallet is seen as the starting point for the other dimensions in the supply chain. In general, the experts see a bright future for a modular system in packaging, putting the main stress on the dimensions of secondary packaging. Concluding, no level of packaging (primary, secondary and tertiary) does influence the freight carriers. However, in case a product has an unusual size, the dimensions of the involved freight carriers will be based on the packaging sizes of the product. In such a situation a pallet will be specially made for the extraordinary size of the product.

Standardization in packaging is limited, due to marketing reasons. To a certain extent, standards and marketing are diametrically opposite in their meaning. According to the forecasts of the specialists questioned, industry can expect that during the next 20 years nearly 80% of all packaging will be standardized and based on the modular system. The respondents stressed the necessity of transparent and direct communication between members of the supply chain.

In general, the Euro pallet is leading in the EU in defining the dimensions of secondary and tertiary packaging. Many retailers have contributed to this trend by requiring their suppliers to deliver the goods on Euro pallets, or in packages which are set to the modular system based on the dimensions of Euro pallets. This is especially true in the FMCG sector and will be more common in other industries in the future. In the America's, the block pallet is leading. Given the predicted large role of the BRIC countries in the global economy of the future, and given the fact that they did not have yet chosen between the Euro pallet or the block pallet, the big question is what these countries are going to decide. Will they adopt the Euro pallet as a standard in the future, or the block pallet – or will they choose another option? We will address this question in our next research step.

## **Conclusion**

1. The main drivers in the packaging industry are efficiency and sustainability. The impact of the efficiency issues is expected to grow with the course of time.
2. The main barrier in the packaging industry is the tension between logistics and marketing. In case packaging has a high marketing potential, it involves high logistics costs to store and transport it through the supply chain. At the same time, the lower the marketing potential of a product, the lower logistics costs are possible.
3. An important trend in the packaging industry is standardization. The company's drive for efficiency – and related to that sustainability – asks for standardization, but marketing will

restrict an overall standardization. From a marketing perspective, standardization neglects the particular nature of a product.

4. In order to increase standardization, efficiency and sustainability, a modular system could be of help. For Europe, a modular system must be based on the dimensions of a Euro pallet, and then translates to secondary packaging. In general, the Euro pallet is leading in defining the dimensions of secondary and tertiary packaging, while marketing dictates the dimension rules for primary packaging.
5. Overall, the future developments in the packaging industry will not influence the dimensions of pallets and container. It will be the other way around: the pallet and container will influence packaging. Because, the infrastructure in and outside warehouses is based on the dimensions of these freight carriers. A policy to change these dimensions would involve incredibly high investments with a small grow prospect of profitability. In Europe, the Euro pallet will be leading in defining dimensions for both packaging and other freight carriers for the next coming decades.
6. The Euro pallet is and will be dominant in Europe. The block pallet is dominant in the USA. They are hard to combine. What future choice will be made by the BRIC countries? Will it be the Euro pallet system, the block pallet system or a new standard? That is the question!

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