



Step 2  
Sustainability

*Online Course*

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# *UNIT 10* SUPPLY CHAIN AND LOGISTICS IN FOOTWEAR MANAGEMENT

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***How to Implement Sustainable Manufacturing in Footwear  
- New Occupational Profile and Training Opportunities -***

# *How to Implement Sustainable Manufacturing in Footwear - New Occupational Profile and Training Opportunities*

## **Credits**

### ***Title***

UNIT 10 - Supply chain and logistics in footwear management

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### 1. Introduction

A sustainable supply chain is increasingly recognized as one of the key ingredients of responsibility of individual companies to surrounding area. Correct and successful management of social, environmental, and economic impacts inside the supply chain is more and more important for individual companies, both in successful management of business as in successful acquisition of new markets and customers.

A sustainable supply chain means to manage those impacts and promote management of good practices in the entire life cycle of goods and services. The objective of such chain is to create and protect long-term environmental, social, and economic values for all parties involved in the production, sale, and implementation of individual services on the market.

There are many different reasons why individual companies start to introduce sustainable supply chains. The first and often the main reason is to ensure compliance with the laws and other regulations that which apply on the market where individual companies sell their products or provide services. The other reason for adopting such measures is that individual companies are trying to show themselves as socially, economically, and environmentally friendly companies. The main reason for this is the increasing awareness of companies which are trying to protect the environment as much as possible. Unfortunately, by doing so, companies too often exceed the bounds of reason. Therefore, in their fight for customers they are trying to show significantly better results than they actually should (e.g., Volkswagen 2015).

This paper is trying to show the main factors that affect the successful implementation of the sustainable supply chain of individual companies in the footwear industry. This includes both new as well as existing companies. It addresses the issue of the procurement, production, inventories, transportation, information flow as well as sustainable role of various sub-contractors, suppliers, customers, and service technicians. Since we are living in an era of rapid changes, on which most companies have no significant impact, flexibility is one of the key factors. In many cases, not only is the flexibility of individual company important, but so is the flexibility of the entire supply chain.

### 2. Supply chain

Supply chains encompass the companies and the business activities needed to design, make, deliver, and use a product or service. Businesses depend on their supply chains to provide them with what they need to survive and thrive. Every business fits into one or more supply chains and has a role to play in each of them.

The pace of change and the uncertainty about how markets will evolve has made it increasingly important for companies to be aware of the supply chains they participate in and to understand the roles that they play. Those companies that learn how to build and participate in strong supply chains will have a substantial competitive advantage in their markets.

#### 2.1. Definitions of supply chain and supply chain management

The term “supply chain management” arose in the late 1980’s and came into widespread use in the 1990’s. Prior to that time, businesses used terms such as “logistics” and “operations management” instead. Some definitions of a supply chain could be:

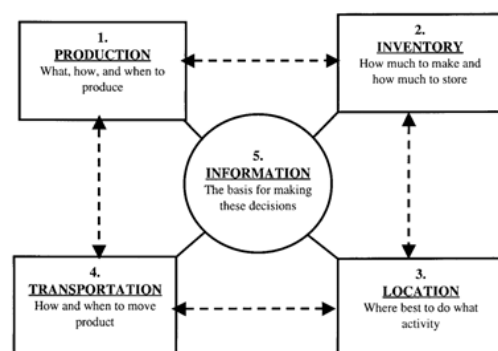
- A supply chain is the alignment of firms that bring products or services to market.
- A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturers and suppliers, but also transporters, warehouses, retailers, and customers themselves.
- A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers.

From this definition is possible to define also supply chain management as the things influence to the behaviour of the supply chain and get the results the company wants. Some definitions of supply chain management are:

- The systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.
- In other words the supply chain management is the coordination of production, inventory, location, and transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served.

There is a difference between the concept of supply chain management and the traditional concept of logistics. Logistics typically refers to activities that occur within the boundaries of a single organization and supply chains refer to networks of companies that work together and coordinate their actions to deliver a product to market. Also traditional logistics focuses its attention on activities such as procurement, distribution, maintenance, and inventory management. Supply chain management acknowledges all of traditional logistics and also includes activities such as marketing, new product development, finance, and customer service.

There is a basic pattern to the practice of supply chain management. Each supply chain has its own unique set of market demands and operating challenges and yet the issues remain essentially the same in every case. Companies in any supply chain must make decisions individually and collectively regarding their actions in five areas: production, inventory, location, transportation, and information (Figure 1). The sum of these decisions will define the capabilities and effectiveness of a company’s supply chain.



F1. The five major supply chain drivers

### 2.1.1. Production

Basic questions for production area are: What products does the market want? How much of which products should be produced and by when? This activity includes the creation of master production schedules that take into account plant capacities, workload balancing, quality control, and equipment maintenance.

Production refers to the capacity of a supply chain to make and store products. The facilities of production are factories and warehouses. The fundamental decision that managers face when making production decisions is how to resolve the trade-off between responsiveness and efficiency.

Factories can be built to accommodate one of two approaches to manufacturing:

- **Product focus** — a factory that takes a product focus performs the range of different operations required to make a given product line from fabrication of different product parts to assembly of these parts.
- **Functional focus** — a functional approach concentrates on performing just a few operations such as only making a select group of parts or only doing assembly. These functions can be applied to making many different kinds of products.

Companies need to decide which approach or what mix of these two approaches will give them the capability and expertise they need to best respond to customer demands. As with factories, warehouses too can be built to accommodate different approaches. There are three main approaches to use in warehousing:

- **Stock keeping unit storage**—in this traditional approach, all of a given type of product is stored together. This is an efficient and easy to understand way to store products.
- **Job lot storage**—in this approach, all the different products related to the needs of a certain type of customer or related to the needs of a particular job are stored together. This allows for an efficient picking and packing operation but usually requires more storage space than the traditional storage approach.

- **Crossdocking**— in this approach, product is not actually warehoused in the facility. Instead the facility is used to house a process where trucks from suppliers arrive and unload large quantities of different products. These large lots are then broken down into smaller lots. Smaller lots of different products are recombined according to the needs of the day and quickly loaded onto outbound trucks that deliver the products to their final destination.

### 2.1.2. Inventory

Basic questions for inventory area are: What inventory should be stocked at each stage in a supply chain? How much inventory should be held as raw materials, semi-finished, or finished goods? The primary purpose of inventory is to act as a buffer against uncertainty in the supply chain. However, holding inventory can be expensive, so what are the optimal inventory levels and reorder points? Inventory is spread throughout the supply chain and includes everything from raw material to work in process to finished goods that are held by the manufacturers, distributors, and retailers in a supply chain. The creation and storage of inventory is a cost and to achieve high levels of efficiency, the cost of inventory should be kept as low as possible.

There are three basic decisions to make regarding the creation and holding of inventory:

- **Cycle Inventory**—this is the amount of inventory needed to satisfy demand for the product in the period between purchases of the product.
- **Safety Inventory**—inventory that is held as a buffer against uncertainty. If demand forecasting could be done with perfect accuracy, then the only inventory that would be needed would be cycle inventory. But since every forecast has some degree of uncertainty in it, the companies cover that uncertainties to a greater or lesser degree by holding additional inventory in case demand is suddenly greater than anticipated.
- **Seasonal Inventory**—this is inventory that is built up in anticipation of predictable increases in demand that occur at certain times of the year. The alternative to building up seasonal inventory is to invest in flexible manufacturing facilities that can quickly change their rate of production of different products to respond to increases in demand.



### 2.1.3. Location

Basic questions for location area are: Where should facilities for production and inventory storage be located? Where are the most cost efficient locations for production and for storage of inventory? Should existing facilities be used or new ones built? Once these decisions are made they determine the possible paths available for product to flow through for delivery to the final consumer.

Location refers to the geographical siting of supply chain facilities. It also includes the decisions related to which activities should be performed in each facility. The responsiveness versus efficiency trade-off here is the decision whether to centralize activities in fewer locations to gain economies of scale and efficiency, or to decentralize activities in many locations close to customers and suppliers in order for operations to be more responsive.

When making location decisions, managers need to consider a range of factors that relate to a given location including the cost of facilities, the cost of labor, skills available in the workforce, infrastructure conditions, taxes and tariffs, and proximity to suppliers and customers.

### 2.1.4. Transportation

Basic questions for transport area are: How should inventory be moved from one supply chain location to another? Air freight and truck delivery are generally fast and reliable but they are expensive. Shipping by sea or rail is much less expensive but usually involves longer transit times and more uncertainty. This uncertainty must be compensated for by stocking higher levels of inventory. When is it better to use which mode of transportation?

This refers to the movement of everything from raw material to finished goods between different facilities in a supply chain. In transportation the trade-off between responsiveness and efficiency is manifested in the choice of transport mode.

There are six basic modes of transport that a company can choose from:

- Ship transport which is very cost efficient but also the slowest mode of transport.
- Rail transport which is also very cost efficient but can be also sometimes slow.
- Pipelines can be very efficient but are restricted to commodities that are liquids or gases.
- Trucks are a relatively quick and very flexible mode of transport and can go almost anywhere.
- Airplanes are a very fast mode of transport, very responsive and also very expensive, and
- Electronic transport, which is the fastest mode of transport and it is very flexible and cost efficient. However, it can only be used for movement of certain types of products such as electric, energy and products composed of data such as music, pictures, and text.

Given these different modes of transportation and the location of the facilities in a supply chain, managers need to design routes and networks for moving products.

### 2.1.5. Information

Basic questions for information area are: How much data should be collected and how much information should be shared? Timely and accurate information holds the promise of better coordination and better decision making. With good information, people can make effective decisions about what to produce and how much, about where to locate inventory and how best to transport it.

Information is the basis upon which to make decisions regarding the other four supply chain drivers. It is the connection between all of the activities and operations in a supply chain. To the extent that this connection is a strong one, (e.g., the data is accurate, timely, and complete), the companies in a supply chain will each be able to make good decisions for their own operations. This will also tend to maximize the profitability of the supply chain as a whole.

Information is used for two purposes in any supply chain:

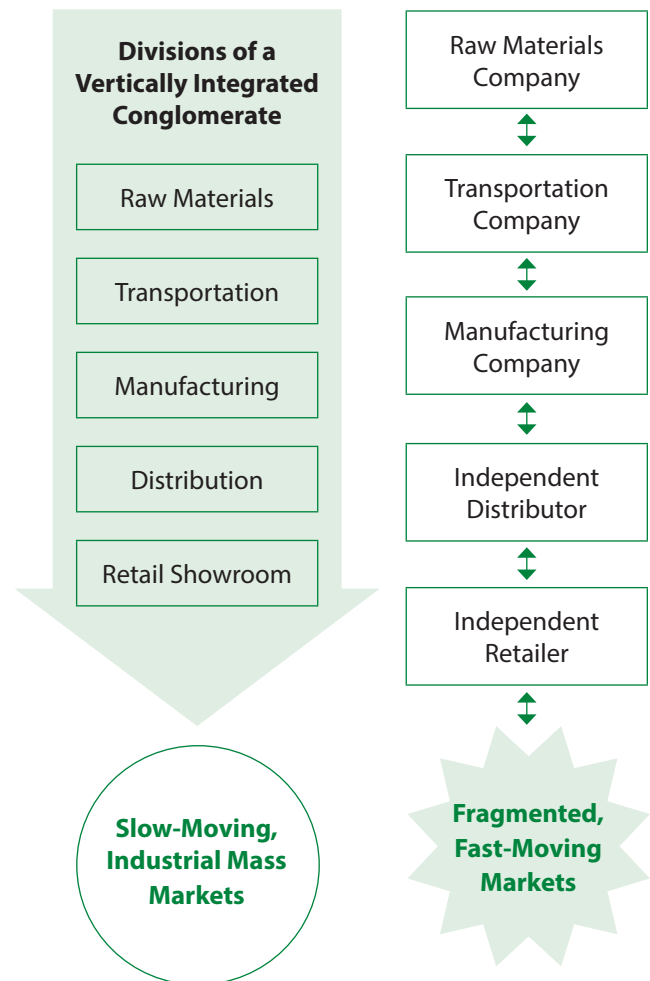
- Coordinating daily activities related to the functioning of the other four supply chain drivers (production, inventory, location, and transportation) and
- Forecasting and planning to anticipate and meet future demands.

### 2.2. The evolving structure of supply chain

The participants in a supply chain are continuously making decisions that affect how they manage the five supply chain drivers. Each organization tries to maximize its performance in dealing with these drivers through a combination of outsourcing, partnering, and in-house expertise. In the fast-moving markets of our present economy, a company usually will focus on what it considers to be its core competencies in supply chain management and outsource the rest.

This was not always the case though. In the slower moving mass markets of the industrial age it was common for successful companies to attempt to own much of their supply chain. That was known as vertical integration. The aim of vertical integration was to gain maximum efficiency through economies of scale (Figure 2).

Instead of vertical integration, companies now practice “virtual integration.” Companies find other companies who they can work with to perform the activities called for in their supply chains. How a company defines its core competencies and how it positions itself in the supply chain it serves is one of the most important decisions it can make.



F2. Old supply chain versus new – vertical versus virtual integration

### 2.3. Participants in the supply chain

In its simplest form, a supply chain is composed of a company, suppliers and customers of that company. Extended supply chains contain additional types of participants. There is a whole category of companies who are service providers to other companies in the supply chain (e.g., companies who supply services in logistics, finance, marketing, and information technology).

#### 2.3.1. Producers

Producers or manufacturers are organizations that make a product. This includes companies that are producers of raw materials and companies that are producers of finished goods.

Producers can create also products that are intangible items such as music, entertainment, software, or designs. A product can also be a service such as mowing a lawn, cleaning an office, performing surgery, or teaching a skill. In many instances the producers of tangible, industrial products are moving to areas of the world where labour is less costly.

#### 2.3.2. Distributors

Distributors are companies that take inventory in bulk from producers and deliver a bundle of related product lines to customers. Distributors are also known as wholesalers. They typically sell to other businesses and they sell products in larger quantities than an individual consumer would usually buy. For the customer, distributors fulfil the “time and place” function—they deliver products when and where the customer wants them.

A distributor is typically an organization that takes ownership of significant inventories of products that they buy from producers and sell to consumers. In addition to product promotion and sales, other functions the distributor performs are inventory management, warehouse operations, and product transportation as well as customer support and post-sales service.

#### 2.3.3. Retailers

Retailers stock inventory and sell in smaller quantities to the general public. This organization also closely tracks the preferences and demands of the customers that it sells to. It advertises to its customers and often uses some combination of price, product selection, service, and convenience as the primary draw to attract customers for the products it sells. Discount department stores attract customers using price and wide product selection.

#### 2.3.4. Customers

Customers or consumers are any organization that purchases and uses a product. A customer organization may purchase a product in order to incorporate it into another product that they in turn sell to other customers. Or a customer may be the final end user of a product who buys the product in order to consume it.

#### 2.3.5. Service providers

These are organizations that provide services to producers, distributors, retailers, and customers. Service providers have developed special expertise and skills that focus on a particular activity needed by a supply chain. Because of this, they are able to perform these services more effectively and at a better price than producers, distributors, retailers, or consumers could do on their own.

Some common service providers in any supply chain are providers of transportation services and warehousing services. Financial service providers deliver services such as making loans, doing credit analysis, and collecting on past due invoices. Some service providers deliver market research and advertising, while others provide product design, engineering services, legal services, and management advice. Still other service providers offer information technology and data collection services.

Supply chains are composed of repeating sets of participants that fall into one or more of these categories. Over time the needs of the supply chain as a whole remain fairly stable. What changes is the mix of participants in the supply chain and the roles that each participant plays.

### 2.4. Aligning the supply chain with business strategy

A company's supply chain is an integral part of its approach to the markets it serves. The supply chain needs to respond to market requirements and do so in a way that supports the company's business strategy. The business strategy a company employs starts with the needs of the customers that the company serves or will serve. Depending on the needs of its customers, a company's supply chain must deliver the appropriate mix of responsiveness and efficiency. A company whose supply chain allows it to more efficiently meet the needs of its customers will gain market share at the expense of other companies in that market and also will be more profitable.

There are three steps to use in aligning your supply chain with your business strategy.

#### 2.4.1. Understand the markets your company serves

Begin by asking questions about customers. What kind of customer does your company serve? What kind of customer does your customer sell to? What kind of supply chain is your company a part of? The answers to these questions will tell you what supply chains your company serves and whether your supply chain needs to emphasize responsiveness or efficiency. The following attributes can be defined as help to clarify requirements for the customers you serve. These attributes are:

- **The quantity of the product needed in each lot** — do customers want small amounts of products (e.g., drug store) or large quantities (e.g., discount warehouse)?
- **The response time that customers are willing to tolerate** — do customers buy on short notice and expect quick service (e.g., fast food restaurant) or is a longer lead time acceptable (e.g., custom made machinery)?
- **The variety of products needed** — are customers looking for a narrow and well-defined bundle of products (e.g., fashion boutique) or are they looking for a wide selection of different kinds of products (e.g., discount store)?

- **The service level required** — do customers expect all products to be available for immediate delivery (e.g., music shop) or will they accept partial deliveries of products and/or longer lead times (e.g., custom build new machine)?
- **The price of the product** — how much are customers willing to pay?
- **The desired rate of innovation in the product** — how fast are new products introduced and how long before existing products become obsolete (electronics, computers, mobiles, etc.)?

#### 2.4.2. Define core competencies of your company

The next step is to define the role that your company plays or wants to play in these supply chains. Is your company a producer, a distributor, a retailer, or a service provider? What does your company do to enable the supply chains that it is part of? What are the core competencies of your company? The answers to these questions tell you what roles in a supply chain will be the best fit for your company.

When you are serving multiple market segments, company will need to look for ways to leverage its core competencies. Parts of these supply chains may be unique to the market segment they serve while other parts can be combined to achieve economies of scale. For example, if footwear manufacturing is a core competency for a company, it can build a range of different articles in common production facilities. Then different inventory and transportation options can be used to deliver the products to customers in different market segments.

#### 2.4.3. Develop needed supply chain capabilities

Once you know what kind of markets company serves and the role your company will play in the supply chains of these markets, then you can take this last step, which is to develop the supply chain capabilities needed to support the roles your company plays. This development is guided by the decisions made about the five supply chain drivers. Each of these drivers can be developed and managed to emphasize responsiveness or efficiency depending on the business requirements.

- **Production** — this driver can be made very responsive by building factories that have a lot of excess capacity and that use flexible manufacturing techniques to produce a wide range of items. To be even more responsive, a company could do their production in many smaller plants that are close to major groups of customers so that delivery times would be shorter. Further efficiency could be gained by centralizing production in large central plants to get better economies of scale.
- **Inventory** — responsiveness here can be had by stocking high levels of inventory for a wide range of products. Additional responsiveness can be gained by stocking products at many locations so as to have the inventory close to customers and available to them immediately.
- **Location** — a location approach that emphasizes responsiveness would be one where a company opens up many locations to be physically close to its customer base.
- **Transportation** — responsiveness can be achieved by a transportation mode that is fast and flexible. Many companies that sell products through catalogues or over the Internet are able to provide high levels of responsiveness by using transportation to deliver their products, often within 24 hours.
- **Information** — the power of this driver grows stronger each year as the technology for collecting and sharing information becomes more widespread, easier to use, and less expensive. High levels of responsiveness can be achieved when companies collect and share accurate and timely data generated by the operations of the other four drivers. Companies in these supply chains from manufacturers, to distributors, to the big retail stores collect and share data about customer demand, production schedules, and inventory levels.



### 3. Logistics

The prevalent view is that the term logistics comes from the late 19th century: from French *logistique* (loger means to lodge). Others attribute a Greek origin to the word: λόγος, meaning reason or speech; λογιστικός, meaning accountant or responsible for counting.

The Oxford English Dictionary defines logistics as "the branch of military science relating to procuring, maintaining and transporting material, personnel and facilities." However, the New Oxford American Dictionary defines logistics as "the detailed coordination of a complex operation involving many people, facilities, or supplies," and the Oxford Dictionary on-line defines it as "the detailed organization and implementation of a complex operation. As such, logistics is commonly seen as a branch of engineering that creates "people systems" rather than "machine systems."

According to the Council of Logistics Management, logistics includes the integrated planning, control, realization, and monitoring of all internal and network-wide material, part, and product flow, including the necessary information flow, industrial and trading companies along the complete value-added chain (and product life cycle) for the purpose of conforming to customer requirements.

Logistics is the process of planning, implementing, and controlling the effective and efficient flow of goods and services from the point of origin to the point of consumption.

Academics and practitioners traditionally refer to the terms operations or production management when referring to physical transformations taking place in a single business location (factory, restaurant or even bank clerking) and reserve the term logistics for activities related to distribution, that is, moving products on the territory. Managing a distribution centre is seen, therefore, as pertaining to the realm of logistics since, while in theory the products made by a factory are ready for consumption they still need to be moved along the distribution network according to some logic, and the distribution centre aggregates and processes orders coming from different areas of the territory. That being said, from a modelling perspective, there are similarities between operations management and logistics, and companies sometimes use hybrid professionals, with for e.g., "director of operations" or

"logistics officer" working on similar problems. Furthermore, the term supply chain management originally refers to, among other issues, having a global vision in of both production and logistics from point of origin to point of production. All these terms may suffer from semantic change as a side effect of advertising.

#### 3.1. Development of the logistics

Logistics began to develop as part of military sciences few hundred years ago. In France under the reign of Louis XIV realized that the effectiveness of military organization depends not only on weapons, combat skills, and fighting spirit of soldiers, but also on the distribution of ammunition and food supply to them.

Military science extended the meaning of the term not only to the space accommodation of the army but also to supply the army with food, clothing, weapons, ammunition, storage organization, planning and implementation of operational programs, the preparation of transport, organization of transport routes, and transport itself.

As science the logistics in the economy has mostly developed during the period from 1950 to 1970 based on the experience they the USA had with supplying military allies all around the world. An expression has been created in the logistics: "to deliver goods to the customer in right quantity, to the right place, undamaged, fast, reliably and at suitable price". This motto is true for logistics even today.

The development of modern logistics business can be divided into 3 periods:

- **Before 1950** - dominates the market of salesman, profits are satisfactory.
- **From 1950 to 1970** - develops the market for customers (a lot of goods), started the competition between companies, which begin to look for "hidden reserves". Logistics as discipline enables the supply of goods at a lower cost.
- **After 1970** – the stagflation (stagnation and decline in purchasing power) and the oil crisis accelerate the further development of logistics activities. An integral logistics approach was formed, which gives importance also to the procurement and management of materials.

The amended marketing approaches are demanded with increasing adaptation to the specific needs and demands of consumers, which could be followed by increasing the flexibility of production organizations.

A comprehensive (integral) logistical approach is considered as the entire production process from the development of a new product to the final customer as a comprehensive material flow.

Management of logistics in a company means the strategic management of all the materials and information related to them:

- Flow of purchased materials in a company
- Production processes flow
- Product flow to the customers
- After sales logistics flow (services and reverse logistics)

The reasons for the comprehensive logistics approaches are:

- A shorter life cycle of products (e.g., quick changes of fashion, rapid development, displacing non-competitive products)
- Increasing product offerings on the market (e.g., adapting to the customer needs, wishes, and lifestyles)
- Changes in the balance of power (e.g., the power of strong retailers which determine what they will put on the market)
- A reduction in added value (e.g., greater material and distribution costs for producers)
- Reorganisation of production processes (e.g., specialization, areas where labour costs are cheaper)
- Development of information technology (e.g., revolution in the development of logistics control systems), and
- Increasing importance of exports (e.g., increasing value of the production and costs decrease)
- Logistics is therefore quite a young science. It was found that there exist huge savings that can give significant competitive advantages to positively oriented logistics organizations.

Nowadays, logistics has become a partial discipline of company economics, because of the following important factors:

- Changes in the world market - from market of vendors to the market of customers
- Increasing economic and social pressure on the industry, and
- Technologic changes in transportation, communications, and electronic data processing

Logistics today includes the physical flow of materials and information from the supplier, through the manufacturer and dealer to the final consumer and means spatial and storage changes.

### 3.2. The main objective of the logistics

The main objective of the logistics (5P's principle - Prior Planning Prevents Poor Performance) is to ensure the right goods, services, capital, and information in the right place at the right time, in the correct quantity and correct quality at the lowest cost and environmental impact, in accordance with the contract or agreement.

In the field of logistics the companies are primarily focused on the optimization of goods and information flows with the aim of lowering logistics costs. It is therefore not surprisingly that information technology (IT) and logistics are among the three fastest growing industries in the world.

### 3.3. Elements of logistics

The structuring elements of the logistics system, which is implemented in practice and is used by most authors, are:

- External transport
- Internal transport
- Storage
- Inventory
- Handling with goods
- Information, communication and control, and
- Personnel who are associated with the system

External transport, internal transport, storage, and handling of goods are parts of the basic logistics process, while inventories can also be the result of the logistics process of other business functions. Without proper and fast information, communications, controls, and properly trained staff we cannot take the necessary and correct decisions for undisturbed running of the logistics process.

The basic of the logistics is to ensuring optimal flow of goods throughout the logistics or the supply chain. The logistics chain covers all logistics processes within the company and also with suppliers and customers. In principle these processes are related to the supply, production, distribution and also the return of waste material.

More precisely, it covers:

- Purchasing processes
- Processes of storage and storage between stages
- Production processes
- Packaging processes
- Commissioning
- Delivery processes
- Transportation process, and
- Waste supply (reverse logistics) process

### 3.4. Logistics subsystems in a company

Logistics in manufacturing company is commonly divided into the following subsystems:

- Purchasing logistics
- Internal logistics
- Distribution logistics
- Reverse logistics

For purchasing, internal, distribution and partly for reverse logistics, the material flow runs from the supplier to the user, but for the other part of the reverse logistics it is typical that the material flow runs in the opposite direction as in the other logistical subsystems.

#### 3.4.1. Purchasing logistics

The task of the purchasing logistics is to supply the company with goods and services that are necessary for production or service implementation.

These tasks include:

- Identifying and defining purchasing requirements (quantitative, qualitative, and timely)
- Ordering from suppliers
- Transport organization
- Quality control in the production company or in own company
- Receiving of the goods, and
- Storage of goods in the entrance warehouse

The purchasing logistics cooperates closely with the purchase and production departments. They must know the market at the global, regional, and local level. It is necessary to decide what and where to purchase, how to coordinate all the logistics activities and what to produce at home and what to buy in the market (outsourcing). The important activities also include procurement policies and ensuring the quality of input materials and services.

The quality of input materials and services are provided with the appropriate quality management, which includes appropriate controls and other procedures.

Objectives of purchasing logistics are optimization of the procurement procedure and the incoming material flow. Its main areas are:

- Monitoring production needs for raw materials and others materials
- Monitoring and evaluating the reliability of suppliers
- Procurement policy (as a more economical inventory management, inventory turnover ratio, achieving optimal economic effects, etc.), and
- Providing all users in the company with the appropriate quantities and with the required quality of the material at the right time and at minimal costs

With growing specialization and division of labour in the modern economy, the importance of purchasing has significantly increased. Companies are aware that the purchase has a much greater impact on company profit than sales, so they are trying to lower the cost of the purchasing to minimum to increase their competitiveness.

Purchase today means a strategic business area of each company primarily due to constant change of external and internal factors. The external factors may include: pressure on prices and margins, loss of market share, the high volatility of prices on the market, etc. Meanwhile internal factors are: method of management, the level of quality concepts accepted by the company, level of data processing in the field of material flows, etc.

The impact of the purchasing to improve the competitive position of the company can be direct (e.g., savings on purchase prices) or indirect:

- Standardization of materials (e.g., standardisation of the primary and/or secondary packaging)
- A decrease of material in stocks (e.g., correct timing of deliveries, just in time, inventories at suppliers)
- New innovation in products, processes, shorten the production time
- Strict input quality control, fast reaction with defected material
- Reducing the amount of waste material with an appropriate choice of materials etc., and
- Definition of the required quantity and quality of material, semi-finished products, and services

Important tasks of the purchasing logistics are also:

- Selecting the most suitable suppliers
- Negotiations, conclusion of a business and its execution
- Ordering from the chosen supplier
- Monitoring and control of orders
- Monitoring and evaluation of the supplier (complaints, records of products and suppliers for documentation and classification), and
- Resolving complaints

Criteria for the selection and negotiation with suppliers are:

- The quality of the ordered goods
- Payment terms (payment deadline, penalty interest, etc.)
- Rebates
- Consideration of complaints and the manner of execution
- Delivery terms, delivery on time, the ability to supply just in time
- Price
- Stocks of goods at the supplier, and
- The response time in emergency situations, etc.

Methods of material purchase are:

- For material which is always available on the market - at the moment when the material is needed (without the cost of the storage).
- Acquisition on stock (to protect company against market fluctuations in supply or supply uncertainty of suppliers and/or if the goods have seasonal offer). Storage costs in this case increase, so it is necessary to determine the optimum amount of material on stock.
- Purchase of the system supplying on the exact time (just in time). The supplier must deliver the material within a specified period, which is determined by production needs of the material. The material is delivered directly from the transport capability to the production sites in order to achieve the shortest lead time of the material (it is the cheapest way, demand for reliable suppliers).

There are more possible causes for a complaint about the goods:

- Inadequate goods
- Inadequately packaged goods
- Improperly labelled goods
- Inadequate quality (visual changes, injuries, foreign bodies)
- Inadequate way of delivery (unsuitable conditions of delivery - high humidity, cold)
- Lack of documentation, etc.

In the case of minor complaints, it is necessary to create a record and the goods should be stored under the status "on hold". For the materials with the unsuitable quality the shipment should be rejected.

### 3.4.2. Internal logistics

Interior (manufacturing) logistics must ensure optimal flow of raw materials, intermediates, products, and services throughout the entire production process from the input warehouse, direct suppliers, production facilities, interim warehouse to the final distribution warehouse.

More specifically, internal logistics includes:

- Planning and management of production, distribution of machinery and equipment and production capacity utilization
- Internal transportation
- Warehousing logistics within the company
- Storing finished products in the warehouse or distribution directly to the customer, and
- Commissioning (design deliveries according to different orders)

The most important roles in this case have:

- Internal transportation
- Storage of goods, and
- Various manipulations (loading, unloading, handling, palletizing, containerization, packing, unpacking, execution of orders - commissioning, etc)

The basic principle is to make the best use of space in a company, shorten journey times and material flow. The spatial distribution of the plant and internal logistics should provide economical production process. Very often the internal logistic has to overcome the defects of poor internal space planning in a company. Manufacturing logistics therefore manages all logistics tasks within a company. Strategic tasks starting with the determination of the production location, selection of equipment and its location, storage location, range of means of transport,

etc. Mainly cooperates with the production planning and should react to all changes dictated by the production and the market. Manufacturing logistics should also be closely connected in its planning and implementation with the purchase and distribution logistics.

Important elements of manufacturing logistics are:

- Flow time (of material and information)
- Logistics costs, and
- Resolving conflicts between different requests (ex. the large scale production requirements corresponding to the production and the small-scale production and corresponding to sales)

A production flow time is the time that elapses from the moment of the input of the material in the production process to the moment when finished products are placed in a warehouse of finished products. A long flow time of the material cause higher stock time in interim warehouse, poor utilization of the machinery and labour source, and thus higher costs of production, or shorter: the definition of flow time could be "period required for completing a specific job or a defined amount of work".

An important factor in reducing the flow time is the automatisisation of the transport and storage process, which should enable optimal relationship between the technical and human aspects of production.

### 3.4.3. Distribution logistics

Distribution logistics is a synonym for physical distribution and sales logistics. Its mission is to design, manage, and control processes that are necessary to enable the products and services delivered to customers in the form, content and time as agreed in the contract. This process cooperates very closely with the sales department.

Distribution logistics therefore includes:

- Planning the distribution of products including storage
- Planning means of transport and timetables of vehicles
- Storing and removal from the storage



- Packaging and manipulation with products, and
- Delivery of products to the customer

The supply of goods must be adapted to the customer's needs:

- In the agreed delivery time
- With the supply readiness (the biggest problem is the inconsistency of demand on the market), and
- Supply reliability

Distribution of products takes place via channels. Channels are sets of interdependent organizations (called intermediaries) involved in making the product available for consumption to end-user. Merchants are intermediaries that buy and resell products. Agents and brokers are intermediaries that act on behalf of the manufacturer but do not take title to products.

Each company can design any number of channels they require. Channels are classified by the number of intermediaries between producer and consumer. A level zero channel has no intermediaries. This is typical of direct marketing. A level one channel has a single intermediary. This flow is typically from manufacturer to retailer to consumer.

CATEGORY	DEFINITION
Intensive distribution	The producer's products are stocked in the majority of outlets. This strategy is common for basic supplies, snack foods, magazines, and soft drink beverages.
Selective distribution	Means that the producer relies on a few intermediaries to carry their product. This strategy is commonly observed for more specialised goods that are carried through specialist dealers, for example, brands of craft tools, or large appliances.
Exclusive distribution	Means that the producer selects only very few intermediaries. Exclusive distribution is often characterised by exclusive dealing where the reseller carries only that producer's products to the exclusion of all others. This strategy is typical of luxury goods retailers such as Gucci.

### T1. Types of distribution

The efficiency of logistics distribution (Table 1) depends on various subjective and objective factors which are reflected in the time used for:

- The arrival of the order from the customer to the manufacturer
- Processing the order
- Selection and completion of the ordered goods in the warehouse
- Creation of shipments (commissioning)
- Loading a truck, and
- External transport of goods to the customer (choice of transport routes, choice of transport type, development of transport infrastructure)

Commissioning is also a part of the distribution logistics. It covers all the operations necessary for the creation of individual shipments under contracts. An efficient commissioning requires the establishment of an appropriate organization, goods flow, and information flow in the repository. The main purpose of commissioning is to minimize the time for the creation of individual shipments and help in optimizing warehouse operations. Commissioning can represent up to 50% of storage costs.

The basic question is what kind of commissioning system will be chosen:

- Man to goods: classic systems of shelves and pallet racks
- Goods to man: flow racks, vertical or horizontal circulation racks and automated warehouses, where transportation objects bring the goods to the commissioning, or
- Combinatory - two-level commissioning

For distribution logistics, documentation and administration associated with the customer are very important. An important strategic decision is whether to perform its own distribution or outsource the distribution to other operators. In footwear sector especially smaller companies usually hire external contractors who must follow the standards of the company.

### 3.4.4. Reverse logistics

Reverse logistics is the least known of the above mentioned subsystems, which gets more and more attention each year. This type of logistics includes all the activities and services that take place after the sale of a certain product. Because each customer wants as much as possible and the best possible service (such as a delivery at home, installation and testing of ordered device, etc.), this way companies are trying to acquire as many customers as possible. This is the youngest subsystem of logistics and, therefore, for some companies still quite unknown and neglected area.

Activities are divided into:

- After-sales marketing and
- Reverse logistics

After-sales marketing includes:

- Exact fulfilment of contracts in terms of quantity, quality, and delivery times
- Marketing control and feedback
- After-sales marketing communication
- Information about new products (presentations, surveys, fashion shows, etc.)
- Elimination of old and introduction of new programs
- Training of personnel, and
- A permanent concern for the reputation of the company and its products

The main task of reverse logistics is to supply waste material generated in all parts of the process (purchasing, production, and distribution). Material flow is in the opposite direction from the previous three parts of logistics. It must follow both objectives: economic and ecological objective.

Specific tasks of reverse logistics are:

- Return of auxiliary transport objects (pallets, reusable containers, etc.)

- Collection, sorting and separation of different kind of waste
- Re-use of residues from the production process (recycling) or their removal and destruction, and
- Claims for damaged or incorrectly delivered merchandise

Because the life cycle of products is getting shorter and the environmental regulations/standards stricter every day, the importance of the reverse logistics is rapidly growing.

### 3.5. Impact of the logistics on the price of the final product

Management in production companies usually focuses on how to increase production efficiency, while the logistics cost is often forgotten. The accuracy of the supply (just in time), rational warehouse management, dispatch management, cost reduction services, the accuracy of products delivery to customers and others savings "in the backyard" are becoming an increasingly important element of competitive advantage and for increased profits of the companies.

The final prices of footwear are increasingly affected also by:

- Costs produced by the compliance with strict directives and requirements and
- Logistics services and process costs

Calculations have shown that by reducing the logistics costs by 1%, the company's profit can be increased up to 3%, while for the same % of the increased profit it is required to increase sales by 15%. To increase the efficiency of supply chain management, companies have to manage key elements such as processes, personnel, working space, material resources, and information technology. The latter plays a very important role, because only with its help we can efficiently support all the elements and ensure their optimal performance of the company.

### 4. Transport

Transport (lat. trans = through, portare = carry) indicates the transfer of people and goods from one place to another place. It is an activity that deals with the management of the material flow from resources to consumers both within and between companies. The first conveyor systems were different devices through which people move objects (ex. limb as mode of transport, stake as a lever, logs as roller conveyors).

Management of transport processes (so called route planning) means planning the best transport routes according to defined parameters (cost, volume, distance, etc.).

The main task of route planning is to reduce operating costs through:

- Reducing the length of the transport path
- Shortening the transport time through the appropriate choice of vehicle
- Increase efficiency and better utilization of vehicles
- Reduction fleet with the analysis of vehicle utilization, etc.

#### 4.1. External transport

External transport is the exchange of goods between different business partners. The services must be supplied:

- In the exact amount
- At a given time, and
- Qualitatively

Transport units should be designed in a way that the implementation of transport and storage is as easy as possible and consequently as cheaper as possible. The following affects the transport and storage costs of a specific product:

- The ratio between volume and weight (transport of heavy goods in a small volume is usually cheaper)
- The ratio between value and weight of the product (more expensive products have less transport costs in share of the value part), and
- Special transport conditions (dangerous goods, food, glass, etc.)

Depending on the type of vehicles the external transport can be divided into (Figure 3):

- Land transport (road and rail transport)
- Ship transport (goods are usually in containers or tanks)
- Air transport, and
- Pipeline transport (cargo in liquid, semi-liquid, gas state of matter)



F3. Different types of transport

TRANSPORT	ADVANTAGE	DISADVANTAGE
Railway transport	<ul style="list-style-type: none"> <li>– Large transport capacity</li> <li>– High speed on long distances</li> <li>– Regular and on time</li> <li>– Independent from weather conditions</li> </ul>	<ul style="list-style-type: none"> <li>– Insufficiently network in some counties</li> <li>– Mostly does not allow the door-to-door delivery</li> </ul>
Road transport	<ul style="list-style-type: none"> <li>– Great accessibility</li> <li>– Fast</li> <li>– Door-to-door delivery</li> <li>– Flexibility</li> </ul>	<ul style="list-style-type: none"> <li>– Low safety</li> <li>– Depending on the weather conditions</li> <li>– Environmentally unfriendly</li> <li>– High energy consumption</li> <li>– Small transport volume</li> </ul>
Air transport	<ul style="list-style-type: none"> <li>– High speed</li> <li>– Lower cost of packaging and insurance</li> </ul>	<ul style="list-style-type: none"> <li>– High transport cost</li> <li>– Depending on the weather conditions</li> <li>– Small transport volume</li> </ul>
River transport	<ul style="list-style-type: none"> <li>– Big transport volume</li> <li>– Cheap</li> <li>– Environmentally friendly</li> </ul>	<ul style="list-style-type: none"> <li>– More rare transport</li> <li>– Not very fast</li> <li>– Mostly does not allow the door-to-door delivery</li> </ul>
Sea transport	<ul style="list-style-type: none"> <li>– Enormous transport volume</li> <li>– Cheap</li> <li>– Environmentally friendly</li> </ul>	<ul style="list-style-type: none"> <li>– Mostly does not allow the door-to-door delivery</li> </ul>

### T2. Advantages and disadvantages of individual transport sectors

Transport of footwear materials and finished footwear usually don't have any special requirements for transportation. Usually, it is enough to have appropriate packaged goods which are not directly exposed to high/low temperature and high/low humidity. Quite different is the transport of e.g., food, where vehicles should provide adequate conditions with refrigerator, humidity controller, appropriate hygiene conditions, etc.

The rules relating to the transport of goods from the producer to the customer are determined by the Incoterms rules. The Incoterms rules or International Commercial Terms are a series of pre-defined commercial terms published by the International Chamber of Commerce (ICC). They are widely used in international commercial transactions or procurement processes. A series of three-letter trade terms related to common contractual sales practices, the Incoterms rules are intended primarily to clearly communicate the tasks, costs, and risks associated with the transportation and delivery of goods.

The Incoterms (shipping) rules are accepted by governments, legal authorities, and practitioners worldwide for the interpretation of most commonly used terms in international trade. They are intended to reduce or remove altogether uncertainties arising from different interpretation of the rules in different countries. As such they are regularly incorporated into sales contracts worldwide.

First Incoterm rule was published in 1936 and it's periodically updated. The latest, eighth version, was published on January 1, 2011 (Table 3).

INCOTERM 2010	EXPORT CUSTOMS DECLARATION	CARRIAGE TO PORT OF EXPORT	UNLOADING OF TRUCK IN PORT OF EXPORT	LOADING ON VESSEL IN PORT OF EXPORT	CARRIAGE (SEA/AIR) TO PORT OF IMPORT	INSURANCE	UNLOADING IN PORT OF IMPORT	LOADING ON TRUCK IN PORT OF IMPORT	CARRIAGE TO PLACE OF DESTINATION	IMPORT CUSTOMS CLEARANCE	IMPORT TAXES
EXW	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer
FCA	Seller	Seller	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer
FAS	Seller	Seller	Seller	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer
FOB	Seller	Seller	Seller	Seller	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer
CPT	Seller	Seller	Seller	Seller	Seller	Buyer	Seller	Buyer/Seller	Seller	Buyer	Buyer
CFR(CNF)	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer/Seller	Buyer	Buyer	Buyer	Buyer
CIF	Seller	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer	Buyer	Buyer	Buyer
CIP	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Buyer/Seller	Buyer	Buyer	Buyer
DAT	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer	Buyer	Buyer
DAP	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer
DDP	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller

**T3. Allocations of costs to buyer/seller according to Incoterms 2011**

The abbreviations in the first column are:

**EXW** – Ex works (named place). The seller makes the goods available at their premises. This term places the maximum obligation on the buyer and minimum obligations on the seller. The buyer arranges the pickup of the freight from the supplier's designated ship site, owns the in-transit freight, and is responsible for clearing the goods through Customs. The buyer is also responsible for completing all the export documentation.

**FCA** – Free carrier (named place of delivery). The seller delivers the goods, cleared for export, at a named place. This can be to a carrier nominated by the buyer, or to another party nominated by the buyer.

**CPT** – Carriage paid to (named place of destination). The seller pays for the carriage of the goods up to the named place of destination.

**CIP** – Carriage and insurance paid to (named place of destination). This term is broadly similar to the above CPT term, with the exception that the seller is required to obtain insurance for the goods while in transit. CIP can be used for all modes of transport, whereas the equivalent term CIF can only be used for non-containerised seafreight.

**DAT** – Delivered at terminal (named terminal at port or place of destination). This term means that the seller covers all the costs of transport (export fees, carriage, unloading from main carrier at destination port and destination port charges) and assumes all risk until destination port or terminal.

**DAP** – Delivered at place (named place of destination). Can be used for any transport mode, or where there is more than one transport mode. The seller is responsible for arranging carriage and for delivering the goods, ready for unloading from the arriving conveyance, at the named place. Duties are not paid by the seller under this term. The seller bears all risks involved in bringing the goods to the named place.



**DDP** – Delivered duty paid (named place of destination). Seller is responsible for delivering the goods to the named place in the country of the buyer, and pays all costs in bringing the goods to the destination including import duties and taxes.

Sea and inland waterway transport.

**FAS** – Free alongside ship (named port of shipment). The seller delivers when the goods are placed alongside the buyer's vessel at the named port of shipment. This means that the buyer has to bear all costs and risks of loss of or damage to the goods from that moment. The FAS term requires the seller to clear the goods for export, which is a reversal from previous Incoterms versions that required the buyer to arrange for export clearance. However, if the parties wish the buyer to clear the goods for export, this should be made clear by adding explicit wording to this effect in the contract of sale.

**FOB** – Free on board (named port of shipment). FOB means that the seller pays for delivery of goods to the vessel including loading. The seller must also arrange for export clearance. The buyer pays cost of marine freight transportation, insurance, unloading and transportation cost from the arrival port to destination. The buyer arranges for the vessel, and the shipper must load the goods onto the named vessel at the named port of shipment according to the dates stipulated in the contract of sale as informed by the buyer. Risk passes from the seller to the buyer when the goods are loaded aboard the vessel.

**CFR** – Cost and freight (named port of destination). The seller pays for the carriage of the goods up to the named port of destination. Risk transfers to buyer when the goods have been loaded on board the ship in the country of Export. The Shipper is responsible for origin costs including export clearance and freight costs for carriage to named port. The shipper is not responsible for delivery to the final destination from the port.

**CIF** – Cost, Insurance and freight (named port of destination). This term is broadly similar to the above CFR term, with the exception that the seller is required to obtain insurance for the goods while in transit to the named port of destination.

### 4.1.1. *The choice of correct transport vehicle*

Transport vehicles should provide quick and quality transportation of goods and other operations before and after transport at optimal costs. During organizing the transport process needs to pay special attention to choosing a suitable transport vehicle, which should meet the following criteria:

- Correct purpose of use of the vehicle (e.g., correct choice of vehicle for different cargo)
- Correct capacity of the vehicle
- Ability of rapid loading and unloading
- Minimize the fuel consumption of the vehicle
- Ability to adapt to driving conditions (e.g., road or climatic conditions)
- Easy and safe driving of the vehicle, and
- Availability of the driving pool and the costs of vehicles

The choice of vehicle therefore influences on the utilization of capacity, speed of transport, fuel consumption and other factors that affect the cost of the transportation. These facts should be considered when purchasing the vehicle. Important factors are also: maintenance costs, sustainability, safety, and of course the price.

In the road transport, as one of the most important in footwear sector, work is carried out with the expression of transport services (transport work), which determine the difference between the place and time of production/ consumption of goods. To determine the value of the carrier's work, the following factors are most important:

- Transport length
- Weight and volume of good
- Type of goods
- Relation between gross and net weight
- Level of vehicle amortisation
- Level of transport evenness
- Conditions of exploitation, and
- The quality of transport service

How to calculate the performed work (metric unit [tkm] = tonne-kilometres):

$$U=Q*L$$

Equation 1: Net transport work in [tkm]

$$R=(Q+T)*L$$

Equation 2: Gross transport work

Where:

Q = Weight of the cargo [t]

T = Weight of the vehicle [t]

L = Distance [km]

The coefficient of useful work tells us how much of transport is carried out by vehicles loaded with goods.

$$\text{Coefficient of usefull work} = \frac{\text{route made without load}}{\text{route made with load}}$$

Equation 3: Coefficient of useful work in transport system

The coefficient of useful work is useful information for the analysis of transport, regarding optimization of work and scheduling of workers and vehicles. At the same time, they should also consider the nature of goods, long-term and stability of contracts/lines, user specific requirements, etc.

### 4.1.2. Specific transports

Specific transport services are services which are provided under special conditions, namely:

- Transport of dangerous goods
- Exceptional transports
- Transportation of quick perishable goods, and
- Animal transport

From the above mentioned services, the footwear industry quite often uses only transport of dangerous goods. Therefore, it is described in more detail below:

Dangerous goods in transport represent a special danger, because it is a cargo which may cause an explosion, fire, poisoning, etc. In the footwear sector this could be: adhesives, solvents, halogens, release agents, hardeners, and products for shoe finishing. Because of the nature of this cargo, special security measures during transport must be taken. Measures should ensure safe work of all participants in the whole transport chain and in the other hand, not only the safety of people but also of other things and environment that surround the transport.

The Slovenian "Transport of dangerous goods" law provides:

- The conditions for the transport of dangerous goods for each transport sub-system (in all systems of transport – road, rail, air, and sea/river transport)
- The duty of all persons involved in the transport
- The conditions for packaging and vehicles
- Appointment of a safety adviser in company
- Training of persons involved in the transport cycle
- The responsibility of national authorities, and
- Inspection of the implementation of the law

In the context of regulating the transport of dangerous goods by road, the law on Transport of dangerous goods is related to the international agreement ADR (European Agreement Concerning the International Carriage of Dangerous Goods by Road), which was signed in 1957 and was entered into force 12 years later (in 1969). Detailed rules in context with dangerous goods are collected in Annexes A and B. Till today this agreement has undergone many changes. The last valid version was published in begin of 2015.

According to the Law the vehicles with dangerous goods must be marked with:

- Warning orange coloured plate displaying the hazardous identification number and UN number (Figure 4) and
- Labels which show the type of hazard each cargo presents (Figure 5)



F4. Orange coloured warning plate for transport of dangerous goods



F5. Warning signs for different types of hazardous transport

### 4.2. Internal transport

Internal transport within the company is an integral part of the production process. It includes the supply of working phases with the necessary raw materials/components and removal of finished products and waste material. Its main task is to combine elements of the production process; this is the subject of labour, resources, and manpower within the production process.

Moving of goods runs from one working operation to another or from one to another workplace. Moving of goods can also mean a change in technological properties of the goods (raw material to finished product).

The term "bottleneck" is also connected with the internal transport. Bottleneck is a point of congestion in a system that occurs when workloads arrive at a given point more quickly than that point can handle them. The inefficiencies brought about by the bottleneck often create a queue and a longer overall cycle time. For this reason, one of the main tasks of internal transport is to eliminate those bottlenecks from production.

Ways in which transport is carried out by internal transport vehicles is the transport route. Transport routes must enable fast and safe ways for material transported on them. They also cannot be dangerous for persons employed in the vicinity of these transport routes.

Internal transport routes should be predicted by a technological process of the production and should be as short as possible, should avoid path crossing and return journey of empty vehicles.

In the case of internal transport different vehicles can be used for transport:

- Conveyors (chain conveyors, roller conveyor, belt conveyor, vertical conveyors, elevators)
- Lifts
- Hand transport vehicles (hand trucks, containers on wheels, etc.)
- Mechanized vehicles (forklift lorry, electric trolleys, etc.)

They carry out horizontal and vertical change of place or change of location of cargo.

### 4.2.1. Conveyors

Continuous conveyor systems can be divided according to the different starting points:

- Intensity of transport
- Connection to the floor
- Mobility of transport equipment
- Motor drive
- Direction of movement, and
- Transporting of various forms of goods

Special features of such production are:

- The need for material in mass production are generally uniform and
- Continuous conveyors have a very large capacity, because they operate continuously, loads follow each other steady and in very short distances

Mostly used conveyors in footwear industry are:

- Belt conveyors in production department – for transport of plastic boxes with cut upper parts
- Roller conveyor (Figure 6) is usually used for transport of finished products in final warehouse and for transport of transport packages to the truck
- Suspended transport includes self propelled and free hanging conveyors (Figure 7), usually used for transportation between production departments in different buildings, and
- Scroll conveyor is usually used for transport of free-flowing material in footwear industry, mostly used for direct injection of polymer components



**F6.** Roller conveyor for short transport between two working phases



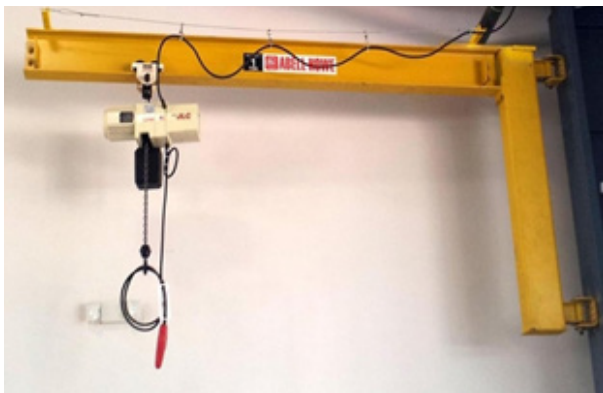
**F7.** Free hanging conveyor for box transport from production to warehouse

### 4.2.2. Lifts

Lifts are one of the oldest devices for material handling. The main purpose of the lift is a vertical lift of heavy loads. Lifts are typically combined with other transport vehicles. There are several types of lifts:

- Winches
- Pulley
- Non-movable and movable lifts
- Cranes
- Overhead bridge cranes and hoist, gantry cranes, jib cranes (Figure 8)

Normally, they are used for the transport of more heavy cargo, so they are not so often in the footwear industry (e.g., for easier and quicker exchange of moulds for injection moulding in production of plastic boots or plastic components).



F8. Cantilever jib crane

### 4.2.3. Hand transport vehicles

Hand transport vehicles are the oldest among all transport devices. Examples of such devices include pallet truck, various trolleys, bathtub, mats on wheels, etc. Due to easy use, huge possibility of customization, and low price, this kind of vehicles are very often use also in the footwear industry (for transport of plastic boxes with material or semi-finished products, finished shoes before packaging, pair boxes in warehouse, etc. (Figure 9)



F9. Two different hand transport vehicles in footwear industry



### 4.2.4. Mechanized vehicles

Mechanized vehicles are mainly used for the rapid transport of material on non-permanent routes. For their operation mechanized vehicles do not need a lot of space. The most commonly used forms of mechanized vehicles are: electrical trolleys and different kinds of forklifts (Figure 10).

From the environmental aspect, it is recommended to use electric or gas trolleys and forklifts. The use of electrical vehicles is especially recommended in closed buildings.



**F10.** Electrical fork lift (left)  
and electrical transport trolley (right)

### 4.3. Warehouses

Warehouse management involves managing the flow of orders, inventories, and shipments. With correct planning it is possible to optimize the utilization of storage, flow and the utilization of warehouse space, the width of the transport routes, location and execution on loading platforms, the number and type of forklifts or vehicles in warehouse etc. (Figure 11 and 12).

The primary task of storage services is to receive, protect and take out raw materials, intermediate materials, semi-finished products and other goods. Furthermore – additional functions of warehouses are:

- Documentation processing in relation to cargo and goods
- Safe placement of goods in the warehouse, and
- Packaging, if necessary

Storage is one of the most important areas of management in any organization. It represents a kind of shock absorber on the material flows, allowing normal course of production processes, providing uninterrupted supply at the scheduled time.

Rationally constructed and arranged warehouse:

- Should ensure minimal manipulation in warehouse, transportation routes as short as possible, as little movements, no congestion in transport, thus carrying out transport tasks with a minimum volume of work
- Goods must be stored transparent and accessible and the flow of goods from the acquisition to the take out needs to be clear and unambiguous, storage system must allow good monitoring of goods
- It has to facilitate the even distribution of work, to minimize rush hours and waiting times
- Should ensure the quality of the stored goods according to organizational or technical solutions of the company
- Should allow the flexibility if various changes inside or outside the company occur



F11. Material warehouse

There are several types of stock:

- Lowest - the quantity of material, which should always be in stock
- Warning - stock that warns that it is necessary to order material
- Security - for example, unexpected events in the supply (delays in supply, increased demand for material), and
- Highest - represent the upper limit to which it is economical to store material

Maximum stock is one of the key factors used when planning the storage space for new warehouse.

### 4.5. Tracking of goods and shipments

Traceability is the ability to determine the location and what is happening with a single unit of cargo. It is necessary to ensure the implementation of traceability between the physical flow of goods and the flow of data relating to them. This requires the management of successive links between what is received, produced, packed, stored, and dispatched across the entire supply chain.

Introducing new computer systems for tracking goods, logistics units, control of the movement of goods and work in warehouses give also new technologies for the identification of goods (bar codes, electronic tags, smart chip), which can, by use of sensors for temperature, humidity and others, continuously record the state of the consignment.

The most common methods of identification technologies that enable traceability are:

- EPC code - Electronic product code (Figure 13) is a standardized code which is derived from the EAN code and is used in the EPCglobal network. EPCglobal network uses radio frequency identification (RFID) and web technologies to allow safe acquisition and communication of information on the movement of each product in the supply chain in real time. This improves tracking options and increases the level of automation processes of management units (more detailed description in Chapter 4.6.).

### 4.4. Supplies of the material

Logožar notes that when examining warehouse operations we should also take into account the stock. Their range is usually determined by the capacity of storage room and its equipment, as well as the number of employees in warehouses.

The aim of purchasing department is economy purchase and turning the stock in warehouse as minimal as possible. Because of fluctuations in production, sales and other factors they are constantly changing.

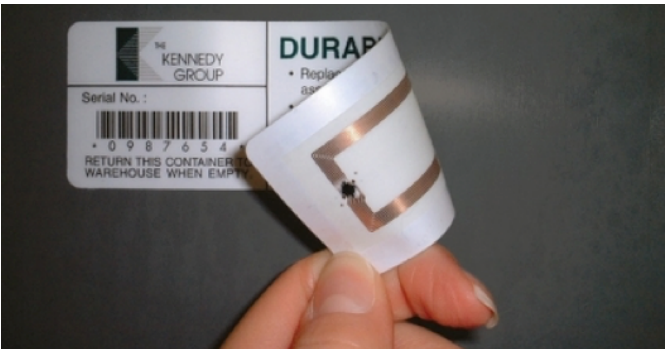


F12. Warehouse of finished boots

- The technology of radio-frequency identification (RFID) uses a chip with an antenna which via radio waves (without physical or optical contact) allows the transmission of information (Figure 14).
- Serial shipping container code (SSCC) is a standard identification number used for unique identification of logistic units.
- Computer interchange data (RIP) enables automatic transmission of messages among computer systems. Thus replaces slow, expensive, and unreliable procedure manual input, processing and exchange of data, and increases the productivity of companies.

EPC Type	Manufacturer	Product Type	Unique Item
01 . 1234567 . 891011 . 001122DBC			
Header 8-bits	EPC Manager 28-bits	Object Class 24-bits	Serial Number 36-bits
256 Combinations possible	268,435,456 Combinations possible	16,777,216 Combinations possible	68,719,476,736 Combinations possible

F13. Electronic Product Code (EPC)



F14. RFID identification

4.6. EAN Standard

An EAN-13 barcode (originally European article number, but now renamed to International article number even though the abbreviation EAN has been retained) is a 13 digit (12 data and 1 check) barcoding standard which is a superset of the original 12-digit Universal product code (UPC). The system was developed in 1970 by George J. Laurer. The EAN-13 barcode is defined by the standards organization GS1.

The 13 digits in the EAN-13 barcode are grouped as follows:

- The left group: Digits 2-7. The left group also encodes digit 1, through a scheme of odd and even parity.
- The right group: Digits 8-13, digit 13 is the check digit.

The EAN-13 barcodes (Figure 16) are used worldwide for marking products often sold at retail point of sale. All the numbers encoded in UPC and EAN barcodes are known as Global trade item numbers (GTIN), and they can be encoded in other GS1 barcodes.

The less commonly used EAN-8 barcodes (Figure 15) are used also for marking retail goods; however, they are usually reserved for smaller items, e.g., confectionery. 2-digit (EAN 2) and 5-digit (EAN 5) supplemental barcodes may be added for a total of 14 or 17 data digits. These are generally used for periodicals (to indicate the current year's issue number), or books and weighed products like food (to indicate the manufacturer suggested retail price or MSRP), respectively.



F15. EAN-8 barcode



F16. EAN-13 barcode

### 5. Developing sustainable supply chain strategy

In order to respond to quick market changes the supply chain managers need to be able to identify and understand new sustainability issues in their company and in business environment. In general, it is possible to distinguish between three decisive factors which determine a business environment and consequently the strategy of a corporation: demand (e.g., customers, target groups, etc.); supply (e.g., competitors, employees, suppliers, etc.); and the general environment (e.g., regulations, society, natural resources, etc.). In today's business all these factors are becoming more and more complex, are changing all the time, and together determine the behaviour of market players.

A company's supply chain now plays an important part and therefore represents an essential strategic resource in the achievement of strategic goals. In other words - not only companies but rather, whole supply chains, are in competition.

The supply chain could be the key competitive advantage for many companies and could significantly determine the social, economic and environmental impacts of each company. Hence a sustainable supply chain strategy must exhibit the following characteristics:

- It is aligned to the underlying corporate and competitive strategy.
- It considers demand, supply, and in particular other, wider general conditions.
- It incorporates environmental, social, and economic perspectives in all proposed actions.
- It builds increased shareholder and stakeholder value, especially customer satisfaction.

#### 5.1. Ingredients of a sustainable supply chain strategy

Logistics and supply chain managers are often mainly focused on measures that appear to lie within their responsibility. They have often implemented environmental and social policies as a kind of aside; often without integrating them with the economic dimension. Sometimes to a greater and sometimes to a lesser degree, they have not really viewed or addressed economic, environmental or social responsibility issues holistically. So the managers should take more strategic and holistic approach to the sustainably chain strategy:

- Define sustainability as a strategic issue in company.
- Enhance learning and transfer knowledge from existing good as also from failed or "worse" cases. They should understand the specific customer and market needs as well as changing business environment.
- Broaden the responsibility of your supply chain managers. Sometimes very small changes in product development can have a big impact on logistics and eco-efficiency. So supply chain managers should be involved in product development at very early stages.
- Establish a dedicated organisation, train and motivate people. Sustainable projects may have a broad impact on several operations inside company and also external.
- Sustainability is an opportunity - natural resources are scarce and expensive so invest in R&D.
- Create values, knowledge, and culture with the right people and the right image. Very often the idea comes from very simple ideas from the people directly responsible.
- Researches show also that best practice companies put strong emphasis on sustainability at executive and senior management level, and the ideas are generally transferred from management down to employees.

The managers should also recognize and assess current and future macroeconomic and social trends. The challenges for supply chain managers in this context are to identify the trends which are relevant to their complete supply chain and to access and evaluate their potential negative and positive impacts (scenario planning and understand cause-effect relation between trends and company supply chain).

Very important in the sustainable supply chain strategy of a company is also to motivate the people involved in the process to make them aware of the long-term benefits of the project.



### 5.2. *An iterative approach to developing your sustainable supply chain strategy*

A systematic approach to strategy design and integration can help companies to develop a sustainable supply chain to create a value proposition. The following five questions define the road map to a sustainable supply chain, helping to change or redesign your current supply chain strategy:

- Who we are?
- What is changing?
- How do we fit?
- How should we fit?
- How do we get there?

The action plan will be derived from the risks and opportunities your supply chain faces in the present business environment, and will face in future.

From these five questions we get the iterative six-step approach. This has to be seen as a cycle which should be executed regularly in your supply chain, since relevant conditions may change quite quickly and sometimes radically (for example oil price).

- Step 1 aims to take stock of the current state of company ("as-is") - and supply chain - specific characteristics regarding strategy, resources, and current and planned practices. It is mainly concerned with internal factors and considers elements which are usually within the control of a company.
- Step 2 aims to identify current and forecast potential future developments and trends, focusing on external factors influencing the supply chain. It considers factors which are usually not under the direct influence of a company.
- Step 3 aims to evaluate the impact of the scenarios on your current supply chain strategy, risks and opportunities derived from these internal and external factors. It serves to define company- and supply chain-specific "sensitivity".

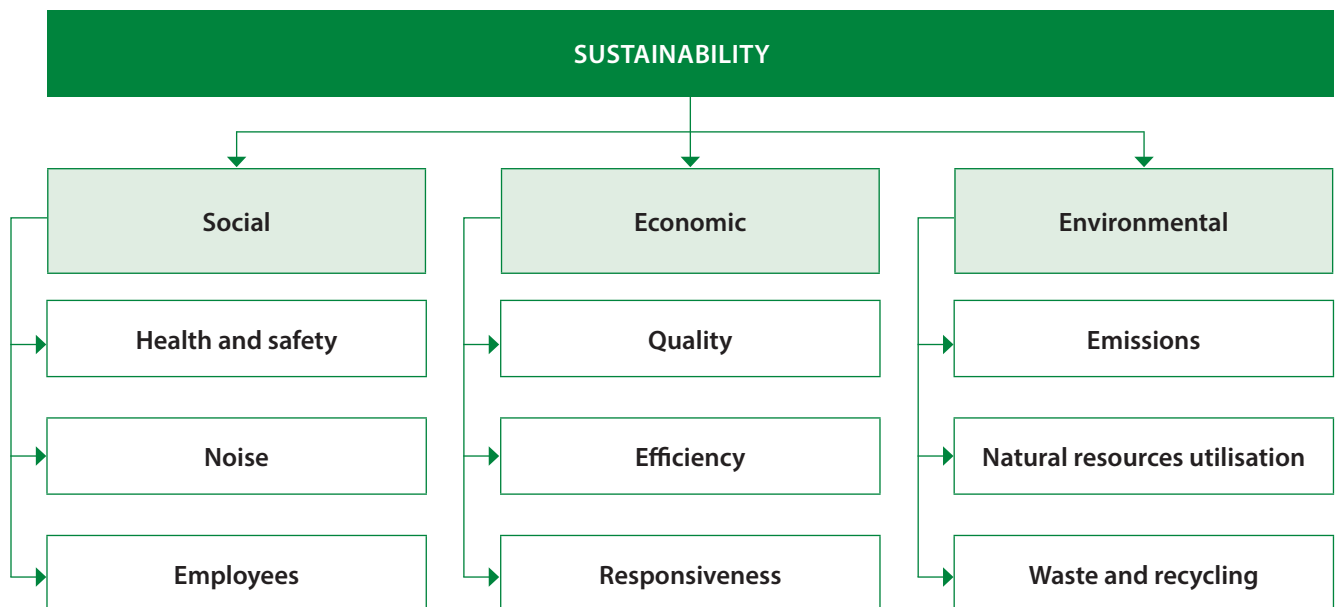
- Step 4 takes this analysis to the existing supply chain strategy, and institutes a strategy change or redesign process with regard to the sensitivity identified.
- Step 5 focuses on implementation issues in order to balance social, economic, and environmental objectives, with the aid of a novel sustainable supply chain concept.
- Step 6 focuses on the key ingredients required to successfully implement the sustainable supply chain strategy in the relevant organisations.

Actually, it is possible to put these six steps into two main groups: designing the supply chain strategy (step 1 to 4) and integrating the sustainable supply chain (step 5 and 6).

### 6. Monitoring performance

Performance measurement is necessary to monitor how a selected strategy is realised and the defined goals achieved. It also provides information for decision-making at an operational level and reduces risks. In this case it's not enough to talk only about financial outcome, but also wider. However, the performance cannot be discussed if it is not evaluated and compared against defined objectives or the performance achieved by business partners or competitors. Performance also cannot be analysed without understanding the context in which the company operates, including the social and economic aspects. The typical performance measurement methods originating from traditional

performance measurement approaches were designed for internal use and mainly to measure economic indicators, and were developed from managerial accounting and reporting. In most cases, sustainability measures are missing in such a measurement system. When the sustainability dimensions are taken into account, the scope of the measurement should be extended. Sustainable development includes not only economic, but also social and environmental dimensions. (Figure 17). It would be ideal, if the whole supply chain of organization would be analysed, but this is sometimes impossible as well as sometimes too much expensive.



**F17.** Main metric dimensions for evaluating supply chain sustainability



Economic performance is the most important because company without profit will not exist for a long time. The problem is that traditional companies look more or less on the economic aspect of the company dimension, but forget about social and environmental aspects. The economic issue should include also the measurement of quality (e.g., number of complains, order delays and returns, damaged products, etc.), efficiency (cutting costs, resource utilization, process time reduction, etc.), and responsiveness (how can company respond to customer needs and demands, etc.).

The environmental dimension includes three sub-groups: emissions, natural resources utilization, waste and recycling. When analysing the impact of a company to the environment, we need to check how activities of that company influence the environment. One of the most popular targets at this moment is measuring and calculating CO2 emissions (mostly fossil fuels). This also overlaps the sub-category of nature resources utilisation (fuel, water, land use). All such aspects are quite easy to measure. There are also categories of emissions which should be captured related to the impact on the environment e.g., waste and recycling.

Traditionally, the social dimension is incorporated into human resources department. However, people and their skills and their impact on society are one of the key issues in sustainability. Health and safety incorporates metrics such as the number and type of work-related accidents. Employment can be measured at different levels, as overall job creation or reduction, level of absenteeism, number of new employees, percentage of key staff turnover, etc. Knowledge and training of employees play an important role. The problem is that these values are difficult to present (e.g., by the amount of training expenses, % of staff with certain level of education, etc.).

To manage supply chain performance, looking solely at outcomes is not enough. Performance is influenced also by two other related elements: process and product. Product can be defined as the subject of the supply chain and the process as change of the product, or support product delivery. Long term supply chain performance measurement is influenced by both, so in many cases trade-offs between both need to be addressed. However, this is not always possible. Nevertheless there are options to select and source products by considering the product

impact on supply chain sustainability (e.g., local sourcing can reduce the need for transport). Only fully available information about products, processes and performance, provides the ability to create a fully visible supply chain and capture the impact of the whole supply chain.

### 6.1. Benefits and use of performance management

Measurement should generate benefits for the individual supply chain members and for the supply chain as a whole. Performance measurement can improve the understanding and collaboration between supply chain partners and increase supply chain integration. The use of common measurement metrics, methods and tools allow consideration of almost all supply chain performance. Supply chain metrics could improve decision making processes, helping to define, test and implement new strategies. At the supply chain level, performance measurement creates the opportunity to analyse the performance of the whole supply chain, as well as the impact of an individual organisation on the supply chain. The results of performance measurement can also be used to demonstrate the company impact on social and environmental dimensions, communicating to business partners and customers. In the following paragraphs will be explained how performance measures can be used and for what purposes:

- Use measures to establish current impact and performance of the company. When they are identified, then steps for improvement can be taken.
- Define measures for different time periods. Integrate long-, mid- and short term measures. For more realistic results and goals only short term measurements can be misleading.
- Use performance measures in planning. Targets and goals should be reflected in numbers and values. Measures can also include scenarios, what-if questions, acknowledging that performance can depend on external factors.
- Monitoring strategy implementation can be monitored using metrics (Key Performance Indicators – KPI) and trigger actions that help achieve defined goals. Not only to measure economic progress, but also to monitor the impact society and the environment. Performance metrics allow goals to be set, to track progress, and to initiate any corrective actions required to achieve the strategy defined.

- Use measures to manage processes. Process control and performance monitoring help to manage and improve processes. Measures related to processes, sub-processes, and activities help to eliminate non-value added tasks and track improvement.
- Performance measurement can be applied to reduce risks (internal and external). Early warning measures can help you to be better prepared for challenging times.
- Motivation can be used to motivate people, teams, and business partners. Can be set and expressed in numbers. In such way the progress can be monitored. Rewards and celebrations are also part of increasing motivation.
- Communicate to employees and enhance responsibility. The company impact and the impact of individual processes can be communicated to employees by providing relevant measures. This can extend the responsibility of individual managers, as they will be able to see how their decisions influence not only economic but also social and environmental impacts.
- Use metrics for external communication. Metrics and measures can be used as a communication with external partners. Different measures and performance values can be assigned to different processes, regions, customers, and stakeholders groups.
- Know where your products come from and product tracing (use of forbidden substances, use of child labour, etc.). Link your measures with existing standards. Different standards and certificates used in supply chain management include various measures that you can apply.
- Standardise metrics with your partners. Check how your business partners reflect performance, how they measure it and when. It will reduce problems if you standardise your metrics so that both organisations have the same view of performance in the same time period.
- Benchmark your performance. The mayor aim of benchmarking process is the identification of key performance metrics. When the company knows what performance level was achieved, it can be compared with the performance of organisations that are perceived as the best or best performing. Benchmarking is most commonly used at the organisational or business unit level and is based on the assumption that it is important to learn from organisations that are perceived as the industry or sector

leaders. Benchmarking could be operational, managerial, and strategic. This allows comparison of the company performance at various levels and searching for ways to improve it. Issues such as company size, sector, structure and other organisational factors, influence results achieved, and should not be ignored. Looking at performance without context can result in misinterpretation, an unclear view between cause and effect.

### 6.2. Problems with measuring performance

Measuring the whole supply chain is not an easy task. The main problem is that in most cases it is unclear or unknown what should be measured, when and by whom. There is also a lot of other problems that should be discussed before measuring or comparing two measures:

- Language barriers, as well as different data and IT standards, are first obstacles to measure end-to-end supply chain performance.
- Even though there are examples when the supply chain is measured and monitored from raw materials to end customer, such examples are limited to some companies, industries and specific situations. How to compare them with the footwear sector?
- At the moment, the total end-to-end performance measurement across the whole supply chain is an exception, not a standard. In many cases, small organisations do not have the time, resources, and information required to analyse their activities and some of the medium sized organisations may have information, but do not have the skills to interpret this information. Large organisations are able to capture performance details of their operations, but only internally only or in relation to their closest business partners. However, in many cases such data are confidential and are not publicly shared.
- Another problem of supply chain measurement is the lack of common measurement standards, approaches, and tools. There is particularly a lack of accepted metrics related to environmental and social issues across different markets.

- At the same time, companies have to deal with an overwhelming number of operational metrics used in various organisations used by different business partners. To create a successful supply chain measurement system, managers need to deal with various challenges at three levels: company, supply chain, and context.
- Metrics may not be related to strategy, may not provide a forward-looking perspective, may not be tied to effectiveness and efficiency, may be isolated and often changed, and may not be connected with customer needs. There is a domination of financial metrics that creates a misbalance between financial and non-financial perspectives.
- Another problem is related to the lack of connections between strategy and performance measurement systems. This promotes a concentration on internal, not supply chain perspectives. Moreover, there is a low level of differentiation between strategic, tactical, and operational metrics, as well as between internal, organisational, and supply chain metrics.
- Additionally, managers have difficulty understanding metrics that are outside their functional area, and so naturally prefer to be evaluated based on outcomes that are under their control, while good supply chain management depends on inter organisational cooperation.
- Every organisation in the supply chain has a different corporate culture, policies and routines, goals and objectives, while performance measurement systems generally ignore the different strategies of individual organisations. This creates challenges to overcome mistrust and suspicion between organisations in order to build and use the measurement system.
- There are industry-specific differences as certain metrics and performance standards are developed within the sector. For example, there are different characteristics for the automotive or footwear sectors.
- Performance is related to context and time. Context is dynamic and influences the performance achieved by organisations. To fully understand organisational performance, social, technological, economic, environmental and political factors should be captured (and ideally quantified) as well as their changes over time. This helps both the selection and usage of performance systems, as well as providing a greater understanding of

the performance achieved, to establish links between context and performance, between drivers, actions, and outcomes. Looking at performance without capturing the context is pointless.

### 6.3. Supply chain performance measurement: Methods and approaches

Traditionally, companies have tracked performance based largely on financial accounting principles. Financial accounting measures are certainly important, but insufficient to measure supply chain performance. In response to some of these deficiencies in traditional accounting methods for measuring supply chain performance, a variety of measurement approaches have been developed:

- The balanced scorecard
- The supply chain council's SCOR model
- The logistics scoreboard
- Activity-Based Costing (ABC)
- Economic value analysis (EVA)

**The balanced scorecard** recommends the use of executive information systems (EIS) that track a limited number of balanced metrics that are closely aligned to strategic objectives. While not specifically developed for supply chain performance measurement, balanced scorecard principles provide excellent guidance to follow when doing it. The approach would recommend that a small number of balanced supply chain measures be tracked based on four perspectives:

- Financial perspective (e.g., cost of manufacturing and cost of warehousing)
- Customer perspective (e.g., on-time delivery and order fill rate)
- Internal business perspective (e.g., manufacturing adherence-to-plan and forecast errors), and
- Innovative and learning perspective (e.g., APICS-certified employees and new product development cycle time)

**Supply chain council's SCOR model** provides guidance on the types of metrics one might use to get a balanced approach towards measuring the performance of one's overall supply chain. The SCOR Model approach advocates a set of supply chain performance measures comprised of a combination of:

- Cycle time metrics (e.g., production cycle time and cash-to-cash cycle)
- Cost metrics (e.g., cost per shipment and cost per warehouse pick)
- Service/quality metrics (on-time shipments and defective products), and
- Asset metrics (e.g., inventories)
- In contrast to the balanced scorecard, which is focused on executive enterprise-level measurement, the SCOR Model approach directly addresses the needs of supply chain management with balanced measurements.

**The logistics scoreboard** approach was developed by the company Logistics Resources International Inc., a consulting firm specializing primarily in the logistical (i.e., warehousing and transportation) aspects of a supply chain. The company recommends the use of an integrated set of performance measures falling into the following general categories:

- Logistics financial performance measures (e.g., expenses and return on assets)
- Logistics productivity measures (e.g., orders shipped per hour and transport container utilization)
- Logistics quality measures (e.g., inventory accuracy and shipment damage), and
- Logistics cycle time measures (e.g., in-transit time and order entry time)

**Logistics Resources** sells a spreadsheet-based, educational tool called The Logistics Scoreboard that companies can use to pilot their supply chain performance measurement processes and to customize for ongoing use. In contrast to the other approaches discussed, The logistics scoreboard is prescriptive and actually recommends the use of a specific set of supply chain performance measures. These measures, however, are skewed toward logistics, having limited focus on measuring the production and procurement activities within a supply chain.

**The Activity-Based Costing (ABC)** approach was developed to overcome some of the shortcomings of traditional accounting methods in tying financial measures to operational performance. The method involves breaking down activities into individual tasks or cost drivers, while estimating the resources (i.e., time and costs) needed for each one. Costs are then allocated based on these cost drivers rather than on traditional cost-accounting methods, such as allocating overhead either equally or based on less-relevant cost drivers. This approach allows one to better assess the true productivity and costs of a supply chain process. For example, use of the ABC method can allow companies to more accurately assess the total cost of servicing a specific customer or the cost of marketing a specific product. ABC analysis does not replace traditional financial accounting, but provides a better understanding of supply chain performance by looking at the same numbers in a different way. ABC methods are useful in conjunction with the measurement approaches already discussed as their use allows one to more accurately measure supply chain process/task productivity and costs by aligning the metrics closer to actual labour, material, and equipment usage.

One of the criticisms of traditional accounting is that it focuses on short-term financial results like profits and revenues, providing little insight into the success of an enterprise towards generating long-term value to its shareholders – thus, relatively unrelated to the long-term prosperity of a company. For example, a company can report many profitable quarters, while simultaneously disenfranchising its customer base by not applying adequate resources towards product quality or new product innovation.

To correct this deficiency in traditional methods, some financial analysts advocate estimating a company's return on capital or **Economic value analysis (EVA)**. These are based on the premise that shareholder value is increased when a company earns more than its cost of capital. One such measure attempts to quantify value created by an enterprise, basing it on operating profits in excess of capital employed (through debt and equity financing). Some companies are starting to use measures like EVA within their executive evaluations. Similarly, these types of metrics can be used to measure an enterprise's value-added contributions within a supply chain. However, while useful for assessing higher-level executive contributions and long-term shareholder value, EVA metrics are less useful for measuring detailed supply chain performance.



### 7. Megatrends in the global environment – (managing the unexpected)

The challenges faced by the organization at the beginning of the 21st century are very different from the challenges of the 70's and 80's of the 20th century. The world is changing faster than ever. Modern megatrends have a major impact on business logistics.

Megatrend represents a large, strong, and well recognizable way of development. It is always and everywhere the same; it means to make people ready to use current logistics facilities rationally and efficiently, which means on the basis of:

- Common objectives
- Coordinated behaviour, and
- Flexibility with regard to changes in the environment

Business logistics is changing in accordance with social development tendencies. The challenge of logistics management represents more different megatrends that tend to change their business and provide the development of business logistics in recent years. Compliance with social megatrends helps companies to achieve competitive advantage through selected logistics strategy.

There are not a lot of companies without uncertainties – what are commonly called “risk”. Much risk is unforeseen and prone to present unusual challenges that are difficult to deal with, and seldom timely. These unforeseen trends increase the possibility of unexpected – so special attention needs to be given to it in this chapter.

Risks come in all shapes and sizes, but for easy reference can be categorized as:

- **Controlled risk:** Risk taking is an essential part of business management – even the smallest enterprise develops a business plan of some kind that weighs up strategies and practices matching resources to tasks with some degree of calculated risks that influence the profitability. For the most part, these risks are controlled in the sense that they have been evaluated and built into company planning and activity.
- **Uncontrolled risk:** Most people identify uncontrolled risk as being synonymous with natural disasters, emergencies or economic crises on a national or global scale that are beyond their ability to control. They take many forms,

and supply chains are particularly vulnerable to their consequences because supply chain activity relies heavily upon satisfactory infrastructure and pre-conditions, such as secure global trading. Nobody can afford to become fully equipped to deal with every eventuality and the means of dealing with them often lie in the hands of others. But, uncontrolled risks can be mitigated at least to some degree (Figure 18).

- **Controllable risks:** internal and external. Many risks in supply chains can be reduced, and even converted into controlled risks because they can be recognised and addressed. In principle, controllable risks divide into those arising within the business – internal risk (bad internal supply chain practice) and those arising from the conduct of others working with you – external risk (the conduct of your material suppliers and customers). Both varieties are usually within reach and can be eliminated at a reasonable price by the application of good practice.



**F18.** Uncontrolled risks (floods, earthquake, war, and economic crisis)



### 7.1. Globalization

Globalization is derived from the word "globe". It covers the whole earth without any borders. It means a comprehensive coverage of the world, built from the network that meets and connects foreign cultures.

Globalization is the process of networking of regions and cultures in the world system. For this reason, parts of the world are integrated in one integral whole with computer network, internet, etc. It means also the elimination of barriers between parts of the world (nations, ethnic economies, cultures, and regions), in order to be able to establish cooperative relations between different elements of the system.

Globalization causes:

- Standardization of products and services. That's mean the equalization of various types and forms of materials and concepts. The standardization leads to the streamlining of the processes (due to unification), reducing costs, increasing the production and intensive mass marketing.
- Increasing the competitiveness. Companies are forced into competitive battle to lower their prices. Because all companies can't survive the competitive fight and price reductions, there is a concentration (merger) of the companies in the industry and trade. This causes the decline of prices and a higher standard of customers.
- Mass production with standardized channels of distribution and central warehouses. This creates large areas of distribution, allowing greater regulation of the market and eliminates the barriers between suppliers and customers.

### 7.2. Individualisation of the company – mass customization

Each individual customer has its own individual (personal) needs and desires that lead to specific problems for companies/manufacturers. Company - provider shall organize the services in a way that is specific to individual user's preferences. This means flexible (customizable) production, which allows the production of specific products and customer-oriented business logistics.

That provides companies a differentiation strategy - the strategy of individual solving of problems. When searching for solutions in such a way, sometimes companies find brilliant solutions for reducing costs and introducing innovations in the marketplace.

There are many books and research projects regarding this field. The most important book for shoemaking industry is "Mass customization and footwear: Myth, salvation or reality", meanwhile two important international projects were finished in this field: EUROShoE, where the basic research for mass customization on European market were done and project "DOROTHY – Design Of customer driven shoEs and multi-site factorY" – where different techniques of the mass customization in footwear industry were examined.

### 7.3. Sustainability and environmental issues

Ecological awareness or consciousness about environmental protection occurs mainly in industrialised countries, and it is still increasing. This means a special production demand for environmentally friendly products, services, and distribution.

Logistic system offers a good solution for this, because:

- Inhibit input (entrance) and output (exit) of harmful substances
- Concern for reprocessing of waste materials (recycling), and
- Concern about destruction or permanent deposit of useless waste

Here we should mention also the climatic unpredictability factor, because of the global climate change, global warming, and changes connected with this risk.

### 7.4. Infrastructure and information technology

The development of infrastructure and communications technology, transport and process control is a very important megatrend nowadays.

Information technology within the company provides the following:

- Change of working asset in enterprises, which enables reduction of high inventories with timely information about market situation
- Information about the production
- Logistical know-how (e.g., licenses)
- Human work will be replaced by programmed robots integration
- Use computers for analytical tasks
- Small number of employees
- Programmed process control and automated communication, and
- Flexible production and flexible logistics (just in time)

Infrastructure and transportation depend on a steady infrastructure in the widest sense. It relies upon reasonable fuel price, secure transit conditions without interference (e.g., terrorism), and needs space to operate efficiently (e.g., an uncongested road or rail network). Overall, transportation is very vulnerable to disruption in a variety of forms, affecting supply chain performance accordingly.

### 7.5. Terrorism and crime

The process of globalization, which carries out enormous pressures on economical and political decision-making, economical competition, political instability, limitation or lack of some key raw materials, is causing numerous conflicts, resulting in terrorist acts and organized crime.

#### 7.5.1. Terrorism

One of the main targets of terrorist acts could be economical consequences (besides the physical and psychological damage), since such an attack can affect almost the entire economy of a company or even more (e.g., 11th September 2001).

Negative consequences of terrorism can be:

- Economic damage as direct effects: the destruction of property (buildings, business, equipment, power grid, transportation routes), human life, removing debris, restoration of buildings, costs of first aid, temporary care, emotional involvement, etc.
- Economic damage as indirect effects: loss of income, lower consumption, unemployment, lower productivity, etc., and
- Macroeconomic effect: disruption of production and transportation, concern about safety, reduced demand on market, abnormal behaviour of customers, lower consumption of luxury goods, etc.

Positive consequences are:

- Growth in the value of shares of certain companies (e.g., security companies, companies producing weapons, detection equipment, construction, pharmaceutical companies) and
- The opportunity for the development of certain companies

#### 7.5.2. Crime

There are various forms of crime, namely:

- Traditional crime: theft, burglary, prostitution, smuggling of weapons, drugs, etc.
- Organised business crime: it is well organized, with entrepreneurial mode of crime implementation (money laundering)

Organised crime groups are groups that use violence or corruption in order to achieve the objectives (assets) or social superiority (greater power in public). They:

- Can be professionals
- Are hierarchically organized groups that have at least three members
- Carry out physical and psychological violence, intimidation, corruption (abuse of power for personal interests - accepting bribes, concessions in return for improper implementation of duties)
- Can be connected with the government, administrative institutions, the police, etc.
- Pose a high risk because they have a lot of power, in organizational and effective means

Here we can include also illegal entrepreneurship. This is acquiring illegal profits or evasion of tax payments. It works on illegal/black market and the main activities are: supply market with illegal goods (drugs, weapons, etc.), cheating, forgery, converting illegally obtained money into legal (money laundering), etc.

Another big problem in the footwear sector is fake footwear products on the market. Footwear goods have been counterfeited for many years. Such products are usually manufactured to appear as if they have been made by a well-known company, whereas these items have really been illegally made by an enterprise intent on cashing in on a popular brand owner's good reputation and financial investment in research and design. By legal definition, counterfeit goods 'infringe the rights of a trademark holder by displaying a protected trademark or by using an identification mark which cannot be distinguished in its essential aspects from such trademark, and which thereby infringes the rights of the holder of the trademark' (Figure 19).

According to the Counterfeiting Intelligence Bureau (CIB) of the International Chamber of Commerce (ICC), up to 7 per cent of all branded goods sold around the world are not genuine.



**F19.** Fake vs. real footwear (left) and "sufficient difference" between original and fake footwear (right)

### 7.6. Future development of megatrends

#### 7.6.1. Lean logistic

Lean logistics is the basis of lean manufacturing. Lean manufacturing or lean enterprise means operating without waste, that is, without undue and useless work and material consumption and resources. It is a tool to improve quality, shorten production times, and reduce costs.

Lean production originates in the Toyota production system, or the Toyota's philosophy of organizing production and logistics (the interaction between suppliers and customers).

The main goal of lean manufacturing is to systematically eliminate any possible delays and losses, so the continual improvement work is carried out as evenly as possible. This means that company's activities within the whole process need less:

- Work
- Production space
- Investment
- Working tools, and
- Time

It is supported by various working tools that quickly detect existing quality problems and reduce waste. The most known are:

- Kaizen (continuous improvement): the continuous improvement of processes. It is the system of recognition and disposal of losses in the processes.
- Poka - yoke ("mistake-proofing"): eliminates product defects by preventing, correcting, or drawing attention to human errors.

Any error or imperfection in the system or in the process results in inadequate production of products or the execution of inappropriate services that do not meet customer expectations. If this error or shortcoming is detected and removed on time, it is possible to achieve the desired results.

- Kanban - production management system based on the principle of pulling, which requires the production of the necessary parts only in the required quantities and at the right time.

Some other tools, methods, techniques, and strategies have been developed and are used to improve quality, productivity, and production efficiency. These are:

- Six Sigma - a tool for continuous quality improvement of products, services, processes, optimal use of resources within the organization, while reducing costs and increasing productivity.
- 5S: Seiri: sort, Seiton: systematic arrangement, Seiso: shine, Seiketsu: standardize, Shitsuke: sustain. 5S is a systematic and organized approach, which means order and cleanliness in all working processes.
- 20 keys: represents 20 business areas. With this method, the company focuses on achieving improvements in 20 areas that have a significant impact on the quality, delivery time, and cost of production (three elements of competitive advantages acquisition).
- SMED (Single Minute Exchange of Dies - change the tools in less than 10 minutes) is a method for shortening the setup time for working tools, machines, production lines in the transition from one product to another, where it is necessary to adjust the production line accordingly.

### 7.6.2. Logistics outsourcing

It is putting logistics services for rent to the external service. There are huge potential benefits from outsourcing. There are also huge potential risks associated with each of the four major steps in outsourcing:

- Strategy - determining whether or not to outsource and, if so, what to outsource
- Selection - finding and evaluating potential outsourcing partners
- Implementation - the relationship between outsourcing partners is defined and established, and
- Management - the monitoring and evolution of the ongoing outsourcing relationship

Each step comes with its own unique set of risks, which, if addressed, will go a long way to make the benefits of logistics outsourcing a reality.

### 8. Conclusions

As it is evident from the presentation in the previous chapters, the concept of the sustainable supply chain is spreading among a growing number of companies. In other words – it is becoming a true global trend. Nevertheless, the environmental aspect is still too often neglected compared to the economic benefit of individual company. It would be right, if during their planning of the supply chain, companies would consider the relevant compromises between all involved aspects (social, economic, and environmental).

Customers have the key role in this. If manufacturers can manage to convince customers of their correct concept of development, production, and sales, then they can count on a successful sale of their products. Since it is difficult for the customers to find if this is true or only a successful “marketing move” to attract customers, establishing an appropriate trust in the manufacturer–customer or provider–customer relationship is essential. All manufacturers (providers) must be aware of this fast, because lost trust of customers is very difficult to recover, and above all, it is as very time-consuming process associated with huge costs.

### 9. Test of knowledge

Choose the correct option:

- Q1. What is the basic difference between the modern supply chain management and the traditional concept of logistics?**
- The traditional concept of logistics focuses only on the logistical elements of an individual company (internal and external), while modern supply chains focus also on maintenance and inventories
  - In addition to traditional concepts of logistics, a modern supply chain considers also activities in marketing, development of new products, finance, and service
  - There is no significant difference between them
- Q2. Which elements are important when deciding on appropriate steps of development or establishment of an individual supply chain?**
- Knowledge, possibility of development, innovations, and advertising
  - Marketing, finances, marketing management, and company's reputation
  - Production, inventory, location, transportation, and information
- Q3. What is the main characteristic of the safety inventory?**
- The reduction of the seasonal influences on deliveries
  - To create stock in case of any problems with future supplies
  - Cost reduction
- Q4. What is protected with the safety inventory?**
- Uncertainty of deliveries
  - Regular deliveries
  - Seasonal influences
- Q5. Which inventory has the lowest costs of storage?**
- Safety inventory
  - Cyclic inventory
  - Seasonal inventory
- Q6. Which factors are important when choosing a location of production and warehouse?**
- Location, costs of labour, taxes, proximity to suppliers and customers
  - Connections with local politicians
  - Proximity of large cities and transport links



**Q7. Does the footwear industry use ship transport?**

- ☐ No
- ☐ Yes
- ☐ Yes, but only for the transportation on large rivers

**Q8. How long does a ship travel from Hong Kong to London (approximately)?**

- ☐ 20 days
- ☐ 30 days
- ☐ 40 days

**Q9. How long is a direct flight from Hong Kong to London (approximately)?**

- ☐ 12 hours
- ☐ 24 hours
- ☐ 36 hours

**Q10. Which intercontinental transport is the cheapest?**

- ☐ Airplanes
- ☐ Ships
- ☐ Trucks

**Q11. How decisions are made and how the information circulates between individual companies (suppliers) in virtual integration?**

- ☐ From the supplier to the manufacturer
- ☐ From the manufacturer to the supplier
- ☐ In both directions – from the supplier to manufacturer and back

**Q12. The trend in organizations is to place the supply chain management function:**

- ☐ Under the manufacturing function
- ☐ Under the finance function
- ☐ At the same level as the other major functions

**Q13. Which of the following is not a reason that companies are depending more on their suppliers?**

- ☐ More focus on core competencies
- ☐ Need for more flexibilities
- ☐ More control over their suppliers

**Q14. As a part of which sciences logistics started to develop?**

- Tourism
- Military sciences
- Industrial revolution

**Q15. A successful management of logistics in a company is:**

- Strategic management of all goods and material in a company and all the related information
- Tighten control over all transportation means of a company
- Control over all the suppliers

**Q16. Are all transportations within a company also a part of logistics system of an individual company?**

- No
- Yes, but only in larger companies
- Yes

**Q17. What is the basic task of the purchasing logistics?**

- To supply companies with goods and services necessary for the production or service
- To search for the cheapest suppliers
- To search for suppliers with the shortest delivery time

**Q18. Which markets the purchasing logistics should be familiar with?**

- Markets of the country in which it manufactures and sells its products
- Global, regional, and local
- Markets in a circle with a diameter of 100km

**Q19. Can the diversity of the goods supplied in relation to the approved pattern be a reason for a complaint or a refusal?**

- Yes, but only if the goods is already paid by an advance payment
- Yes, but only if it is in business with a supplier for a long time
- Yes, if the supplied goods is not consistent with an approved pattern, this can always be a reason for a complaint or a refusal of a shipment

- Q20.** Which branch of logistics is responsible for the recovery of reusable packaging, sorting and appropriate removal of various types of waste, recycling, compliance with the latest environmental standards, etc.?
- Internal logistics
  - External logistic
  - Reverse logistics
- Q21.** What govern Inconterm shipping rules?
- Relations between manufacturer and customer in respect of transportation and transportation costs
  - Costs, which must be borne by the customer, if he/she wants transportation of goods to the door of his/her company
  - Conditions of transportation of goods in air transportation
- Q22.** According to Incoterm conditions, which rule stipulates that all transportation costs from the manufacturer's door to the customer's company are borne by the customer/recipient of goods?
- FAS
  - FCA
  - EXW
- Q23.** Which international agreement specifies the conditions for the transportation of dangerous goods on roads?
- ADR
  - RID
  - TIR
- Q24.** According to the ADR international convention, what does the top number on the orange coloured plate in the transportation of hazardous substances means?
- UN number of each dangerous chemical
  - Hazard identification number of each chemical
  - Telephone number for emergencies in the event of accident during transportation
- Q25.** Which UN number is for adhesives containing flammable liquid?
- 1133
  - 1090
  - 1203

**Q26. Do express shipping services carry also packages with hazardous chemicals (e.g., UPS, TNT, DHL, FedEx, etc.)?**

- ☐ Yes
- ☐ Yes, but not all express shipping services
- ☐ No

**Q27. Which international agreement specifies conditions for the transportation of hazardous substances with train?**

- ☐ ADR
- ☐ RID
- ☐ TIR

**Q28. Which is the most appropriate “fuel” for internal transportation within companies?**

- ☐ Gasoline
- ☐ Gas
- ☐ Electricity

**Q29. Which transport vehicle is the most suitable for lifting loads in a warehouse?**

- ☐ Electrical fork lift
- ☐ Cantilever jib crane
- ☐ Lifts

**Q30. What are the required conditions in a warehouse of leather?**

- ☐ No special requirements
- ☐ Temperature between 20-25°C and relative humidity between 50-65%
- ☐ It is important that leather does not freeze in the warehouse and that the relative humidity does not fall below 20% or exceeds 80%

**Q31. What is not a task of a warehouse?**

- ☐ To receive, protect and issue materials, components, semi-finished products and final products
- ☐ Record keeping and documentation for packages arriving / departing to / from the company
- ☐ Preparation of export and import documentation for the carrier

**Q32. What kind of inventory is a warning inventory?**

- The purchasing body is warned when you run out of material in stock
- The purchasing body is warned when the inventory falls below the agreed quantity
- The purchasing body is warned when the inventory exceeds the agreed quantity

**Q33. Which is the most common EAN code?**

- EAN-8 barcode
- EAN-11 barcode
- EAN-13 barcode

**Q34. Which decisive factors determine the business environment and consequential strategy of a company?**

- Demand (customers, target groups), supply (competition, employees, suppliers), and environment (legislation, social policy, natural resources)
- Economic and financial factors (profit)
- Cooperation with the environment in which the business environment is involved (sponsoring, cooperation with the ruling elite, employment of local VIPs, etc.)

**Q35. Who in the company should deal with environmental policy of the company, if the company wants to achieve substantial progress in the field of environmental protection and ecology?**

- Only the person responsible for the environment and ecology
- Product managers in cooperation with the developers and the person responsible for the environment and ecology
- Every employee in the company can add his/her piece to the mosaic of environmentally conscious companies (from the director of the company to the employee in production), ideas are usually transmitted from management down to employees

**Q36. What are the most common problems of small and medium-sized companies in introducing environmentally acceptable products?**

- Lack of adequate staff and expertise in the field of ecology, which usually only large companies have
- Lack of more environmentally acceptable materials and processes in the market
- Not embracing more environmentally acceptable products in the market



- Q37.** **Is it possible to facilitate future uncontrolled risks (phenomenon of earthquakes, wars, floods, stock market crash, etc.)?**
- Consequences are impossible to facilitate
  - They are quite possible to facilitate
  - With proper company policy they can be facilitated only to some extent
- Q38.** **If two potential suppliers can deliver a part with the same quality and price, the selection should be based on:**
- A coin flip
  - Outside evaluation
  - Capabilities and flexibilities of the firms
- Q39.** **Just-in-time supply chain management purchasing requires the following condition:**
- Many suppliers
  - Short-term contracts
  - Continuous competitive bidding
- Q40.** **How many fake products in comparison to the originals are supposed to circle around the world at this moment?**
- Approx. 2%
  - Approx. 7%
  - Approx. 20%

### Answer Key:

Q1.	In addition to traditional concepts of logistics, a modern supply chain considers also activities in marketing, development of new products, finance, and service
Q2.	Production, inventory, location, transportation, and information
Q3.	To create stock in case of any problems with future supplies
Q4.	Uncertainty of deliveries
Q5.	Cyclic inventory
Q6.	Location, costs of labour, taxes, proximity to suppliers and customers
Q7.	No
Q8.	30 days
Q9.	12 hours
Q10.	Ships
Q11.	In both directions – from the supplier to manufacturer and back
Q12.	At the same level as the other major functions
Q13.	More focus on core competencies
Q14.	Military sciences
Q15.	Strategic management of all goods and material in a company and all the related information
Q16.	Yes
Q17.	To supply companies with goods and services necessary for the production or service
Q18.	Global, regional, and local
Q19.	Yes, if the supplied goods is not consistent with an approved pattern, this can always be a reason for a complaint or a refusal of a shipment
Q20.	Reverse logistics
Q21.	Relations between manufacturer and customer in respect of transportation and transportation costs
Q22.	EXW
Q23.	ADR
Q24.	Hazard identification number of each chemical
Q25.	1133
Q26.	Yes, but not all express shipping services
Q27.	RID
Q28.	Electricity
Q29.	Electrical fork lift
Q30.	Temperature between 20-25°C and relative humidity between 50-65%
Q31.	Preparation of export and import documentation for the carrier
Q32.	The purchasing body is warned when the inventory falls below the agreed quantity
Q33.	EAN-13 barcode
Q34.	Demand (customers, target groups), supply (competition, employees, suppliers), and environment (legislation, social policy, natural resources)

### Answer Key:

- |      |  |
|------|--|
| Q35. | Every employee in the company can add his/her piece to the mosaic of environmentally conscious companies (from the director of the company to the employee in production), ideas are usually transmitted from management down to employees |
| Q36. | Lack of adequate staff and expertise in the field of ecology, which usually only large companies have  |
| Q37. | With proper company policy they can be facilitated only to some extent   |
| Q38. | Outside evaluation   |
| Q39. | Short-term contracts   |
| Q40. | Approx. 7%   |

### 10. Glossary

- **Carbon footprint** is the total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tonnes of carbon dioxide (CO<sub>2</sub>).
- **Cardboard:** A material made from cellulose fibres (wood pulp) like paper but usually thicker.
- **Customer** is a person, company, or other entity which buys goods and services produced by another person, company, or other entity.
- **Distributor** is an entity that buys products or product lines, warehouses them, and resells them to retailers or direct to the end users or customers.
- **EAN code** is a worldwide standardized bar code numbering scheme (e.g., 8, 10 or 13-digit) for identifying packages, shipping containers, parts practically anything.
- **Globalization** is a process of interaction and integration among the people, companies, and governments of different nations, a process driven by international trade and investment and aided by information technology.
- **Hazardous substances:** causes damage or are able to be harmful to the human body or in a wider sense (animals, nature, etc.).
- **Label:** A slip of paper, film, or foil to be affixed to a packaging. The label usually carries a graphic design and printed information about the product.
- **Life-cycle assessment** (LCA, also known as life-cycle analysis, eco-balance, and cradle-to-grave analysis) is a technique to assess environmental impacts associated with all the stages of a product's life from cradle to grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).
- **Logistics** is the aspect of operations that deals with the procurement, distribution, maintenance, and replacement of materiel and personnel.
- **Mass customization** is a production of personalized, custom-tailored goods or services to meet consumers' diverse and changing needs at near mass production prices
- **Non-refundable packaging** is the packaging for single use only. After use, it is recycled or otherwise harmlessly removed.
- **Packaging:** The general term for the functions, materials, and overall concept of a coordinated system of preparation of goods for handling, shipment, storage, marketing, distribution, and use at optimum cost, and compatible with the requirements of the product.
- **Paper:** The general name for a wide variety of fibre based materials primarily made from vegetable or wood fibre base, formed from a water suspension by withdrawing the moisture through a fine wire screen.
- **Paperboard:** A form of paper, the distinction being that paperboard is heavier in basis weight, thicker and more rigid than paper.
- **Producer** is a person or organization that produces goods or services for sale.
- **Product life cycle (PLC)** is the cycle through which every product goes through from introduction to withdrawal or eventual demise.
- **Production** is a processes and methods used to transform tangible inputs (raw materials, semi-finished goods, subassemblies) and intangible inputs (ideas, information, knowledge) into goods or services. Resources are used in this process to create an output that is suitable for use or has exchange value.
- **Radio frequency identification device (RFID):** Microchip encased in plastic that is attached to packages and other articles for identification and tracking purposes.
- **Recycling** is a process to convert waste materials into new products to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air and water pollution by reducing the need for "conventional" waste disposal, and lower greenhouse gas emissions as compared to plastic production.
- **Reusable (returnable) packaging** is packaging that is intended to be reused several times for the same purpose. Reusable packaging includes reusable pallets, racks, bulk containers, hand-held containers, and dunnage, which move product efficiently and safely throughout the supply chain.

- **Service provider** is an organization, business or individual which offers service to others in exchange for payment.
- **Supply chain:** is a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer. Supply chain activities involve the transformation of natural resources, raw materials, and components into a finished product that is delivered to the end customer.
- **Transport** indicates the transfer of people and goods from one place to another.
- **Warehouse (storehouse)** is a place in which goods or merchandise are stored.



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Project Duration:  
30 months  
October 2013 - March 2016

## ***How to implement Sustainable Manufacturing in Footwear - New Occupational Profile and Training Opportunities -***

The project ***STEP to SUSTAINABILITY*** aims at:

Developing a new qualification profile  
and correspondent training in the field  
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Training technicians with knowledge and  
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