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# LOGISTICS SUPPLY CHAINS AND THEIR APPLICATION

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## Abstract:

*Logistics is a set of activities for planning and implementing the relocation of materials. Since sources of raw materials, factories and outlets are not usually in the same location it is therefore necessary to conduct a series of logistics activities for supplying products or services to end users. Logistics manages the flow of data from suppliers, movement of materials through various operations within the organization as well as the flow of materials to final customers.*

*Integrating these logistics activities is performed through supply chains which provide opportunities for cost saving and offering better services to customers.*

*The supply chains in the Macedonian Army are an important factor in the planning and implementation of logistics support.*

**Key words:** *supply; servicing; planning; materials; logistics; implementation; activity.*

## Introduction

The optimization of supplying logistic materials is necessary for the integration of logistics activities across the supply chain. The goals are low cost and satisfied users, which can only be achieved with good integration, coordination and synchronization of all activities and processes of the participants in the supply chain.

The success of any enterprise and the Army of the Republic Macedonia depend on how supply chains are able to fully adapt to market changes and the economic situation. In terms of globalization and economic crisis, lower costs will require greater efficiency of supply chains.

The benefits of supply chains are: reduced inventory and associated costs, adding a value to the products, expanding resources, customer retention and improved accuracy in forecasting, improved communication and cooperation.

The mission of logistics and supply chains is getting the right products or services to the right place, at the right time and in the desired state with the lowest cost and greatest profit of the investment.

The most widely accepted view of what logistics is is summarized as follows:

*Logistics = Supplying + Manage materials + Distribution*

According to the above, logistics includes physical flows and information flows from raw materials to the final distribution of finished products. In this way, the supply and management of material flows represent the entrance and flows throughout the production process, while the distribution represents flows of the last manufacturing operation to the customer or end user (Rushton, Oxley, Croucher, 2000).

The inputs which logistics activities depend on are: natural, human, financial and information resources. Raw materials provided by suppliers are handled through logistics management as: raw materials, inventory during processing and finished products. Through the processes of planning, implementation and management, a framework of management activities is provided. The benefits of effective logistics systems are reflected through: competitive advantage, utilizing time and space, and bringing efficient and prompt delivery service to customers. These benefits are provided through effective and efficient logistics activities undertaken (Stock, Lambert, 2001).

The concept of supply chains shows that more organizations must be involved on the way of a product to the market. This means to create a logistic pipeline that will enable an effective and efficient flow of products right to the end customer in order to achieve the maximum effect in a partnership between producers and retailers.. These partnerships and alliances are necessary to include other participants along the chain.

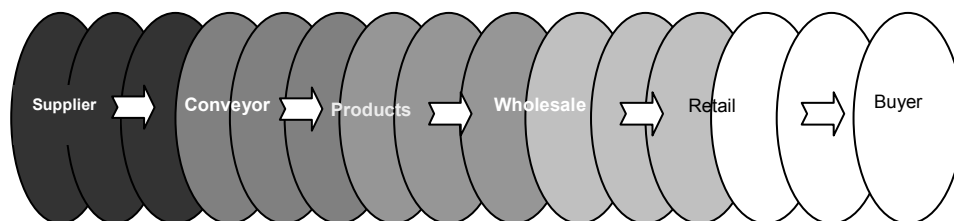


Figure 1 – The concept of managing supply chains  
Slika 1 – Koncept upravljanja lancima za snadbevanje

An additional element how a supply chain can be simplified and made more efficient is given in Figure 2, which is the movement of materials delivered directly from factories to customers and streamline supply chains wholesalers.

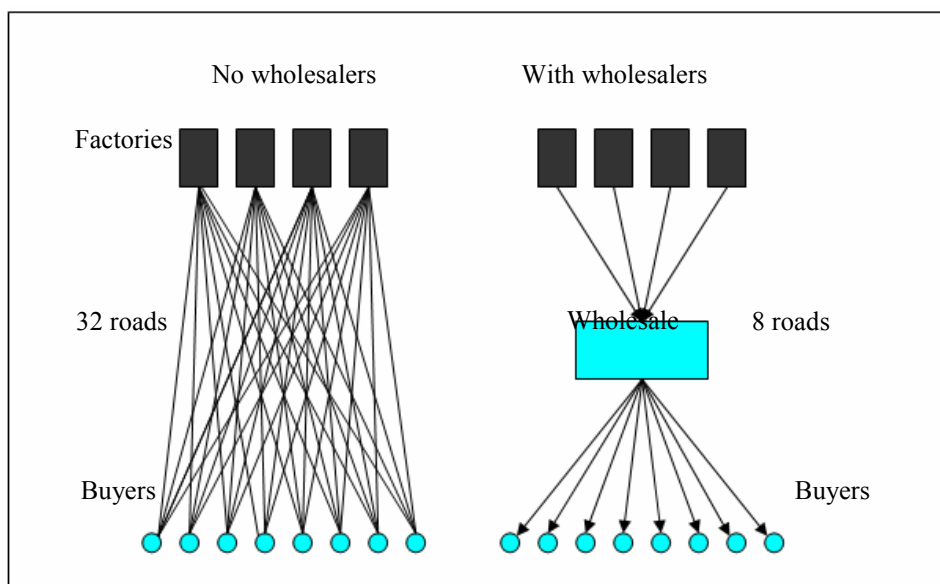


Figure 2 – Simplification of material movement to wholesalers  
Slika 2 – Pojednostavljanje kretanja materijala prodavcima na veliko

Figure 2 simplifies the supply chains with wholesalers in the movement of materials from factories to customers in terms of when the movement is directly from factories to customers. In case of 8 customers and direct movement of the materials, there are 32 routes, while using the wholesaler there are only 8 roads.

It can be seen that the importance of supply chains, with their ability to respond to customer's needs, depends on the competitiveness of firms in the market. The main objectives of the supply chain are low cost and satisfied users and they can only be achieved with good integration, co-ordination and synchronization of all activities and processes of the participants in the supply chain.

Logistics is an essential part of the functioning of any organization. Christopher says "Logistics has always been a central and essential component of all economic activities" (Christopher, 1986). Shapiro and Hesketh agree, saying that "there are few aspects of human activity

which is ultimately dependent on the movement of goods from point of origin to point of spending" (Shapiro, Heskett, 1985). Bowersox says "It is difficult to visualize the achievement of marketing, production or trade without logistics" (Bowersox, Closs, Cooper, 2007).

To put it simply, no movement of material operations can be completed without logistics, nothing can be done, no product can be delivered and consumers cannot be served or attended. Consumers generate demand for products which operations generate necessary resources and logistics to move on the target system.

## Supply chains as an efficient tool for managing materials, products and services

From the above, it can be concluded that organizations could not work in isolation. Each organization acts as a client when acquiring materials from its suppliers, while it acts as a supplier when it provides materials for its clients. A manufacturer buys raw materials from suppliers, assembles them into finished products and then sells to wholesalers. As a result, most products are moving through a series of organizations as they travel between original suppliers and consumers.

Supply chains are defined as a system of organizations, people, technology, activities, information and resources involved in the movement of funds or services from a supplier to a consumer. Activities in the supply chain transform natural resources, raw materials and components into finished products which are delivered to end users. According to Vijay Kasi, supply chains can be viewed as a set of activities (production, distribution) with inputs (raw materials) and outputs (finished products) to achieve the basic objectives (low cost and user content) (Kasi, 2005).

Supply chains cover all participants in the supply, starting from the initial supplier to the end user associated with the movement of materials, return materials, information and funds. Integration, coordination and synchronization of activities and processes of all participants in the supply chain are managing supply chains.

Each product has its own unique supply chain which can be long and complex. For example, the supply chain in the production of alcoholic beverages begins with the cultivation of vineyards and ends when the customer buys these products in stores. Supply chains for textile products begin with the cultivation of cotton in the fields, through the production of textiles, sewing of finished products to their purchase by the customer.

## Managing supply chains, risks and uncertainties

The managing of supply chains is expanding the notion of the integrative nature of logistics. It is a concept of complete logistics which represents the benefits of reviewing the various elements as an integrated whole. Managing supply chains is a similar concept, but the difference is the inclusion of the supplier and the end user in the process. To get a clear picture of Figure 3, this concept is illustrated by the so-called access "pipeline" where a big difference can be seen between the management of supply chains and traditional logistics.

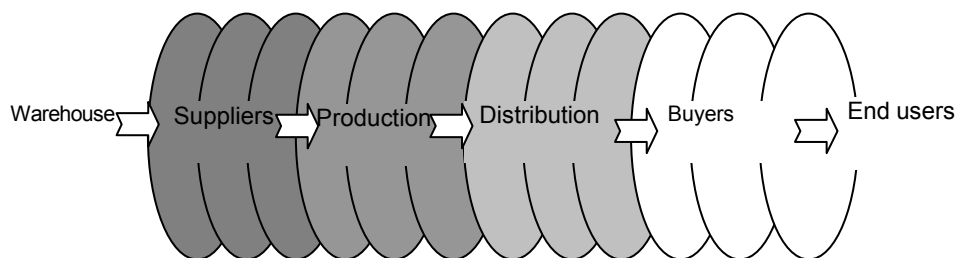


Figure 3 – The flow of products through the supply chains represented as a "pipeline"  
Slika 3 – Protok proizvoda niz lance snabdevanja predstavljen kao „cevovod”

There are four differences that elevate the management of supply chains in terms of the classical view of logistics, although some of these elements are accepted as the key to successful planning of logistics operations. The four elements are:

- Managing the supply chains is observed as a whole, rather than as a set of fragmented parts as: procurement, production, distribution, etc. This approach to logistics is accepted by advanced companies.
- Managing the supply chain is the process of strategic planning, with a significant emphasis on the strategic decision-making.
- The management of supply chains provides a different approach to dealing with stocks across the entire "pipeline". The traditional approach inventories were used as a safety valve between the different components in the "pipeline", which contributed to the creation of oversized and overpriced supplies. Managing supply chains strive to change this principle, creating the stocks last place to balance the integrated flow of products through the "pipeline".
- An important component to the success of effective management of supply chains is the use of integrated information systems that are part of the overall system of supply chains, which proves to be much better than functioning in isolation for each component separately. This provides an overview of product demand and inventory levels along the

supply chain ("pipeline"). This became possible as a result of new advances in the technology of information systems (Rushton, Oxley, Cr- oucher, 2000).

The managing of supply chains is defined as managing the move- ment of materials and information in the supply chain in order to ensure the highest level of satisfaction of the customer with the lowest possible cost (Whitten, Green, Zelbst, 2012, 28-30).

The objective of managing the supply chain is to achieve optimal alignment between staff, materials and information. The efficiency of supply chains depends on the quality of its management (Pešić, 2010).

The management of modern supply chains requires well-trained specialists in manufacturing, procurement and distribution that will lead chains unconditionally to achieve commercial success of enterprises (Ferdows, Michael, Machuca, 2004).

The best supply chain (Kechen DJ, Rebarik c., G.T.M. Hult, 2008) is a chain that maintains an ideal balance between speed, quality, cost and flexibility, which is based on the strategic management level of enterpri- ses, adaptable, agile and ready for assembly with other companies in order to reduce costs and meet the demands of consumers (Ketchen, Rebarick, Hult, Meyer, 2008). From that point of view, competition between firms in the market is increasingly turning into competition between supply chains.

Global supply chains operate in different areas, on different continents, involving business partners with different cultures, in dynamic environment with high expectations and changing demands of consumers, with short lifespans of products and new challenges. Natural disasters, fires, wars, terrorist attacks, strikes of employees, bankruptcy of business partners can delay or even stop the flow of materials, infor- mation and finances throughout the supply chain (Chopra, Sodhi, 2004).

There are several definitions of the risks for the supply chain. Accord- ing to Svensson 2000, Klajndorfer 2005 and Hendricks 2008, risks of supply chains are defined as unplanned and unforeseen events that dis- rupt the normal flow of materials and resources throughout the supply chain (Azevedo, Machado, 2009).

According to Davis, 1993, in the design of a supply chain, it is very important to know how to deal with performance uncertainties. Sources of uncertainties in the supply chain are suppliers (delivery canceled), manufacturers (machine breakdown) and consumers (changeable requi- rements). Because of uncertainty, many factors in the supply chain such as receivables from customers or the time of delivery should be treated as variables because they are not permanent and are not known in advance.

## Strategy of supply chains

The management of the supply chain consists of developing a strategy to organize, motivate and control the resources involved in the flow of materials and services in the framework of the supply chains that are interwoven throughout the organization. It is difficult to imagine a process in which a company is not under any influence of a supply chain. The strategy of the supply chain is essential for service as well as manufacturing firms.

The fundamental purpose of the supply chains for manufacturers is to control inventory by maintaining the flow of materials. A typical manufacturer spends more than 60 percent of its total revenue from the sale of purchased materials and services and a typical service company spends about 30 to 40 percent.

Since the materials are consuming so much of the income from sales, manufacturers can make huge profits with small reductions in the cost of materials, making the management of supply chains the key competitive weapon.

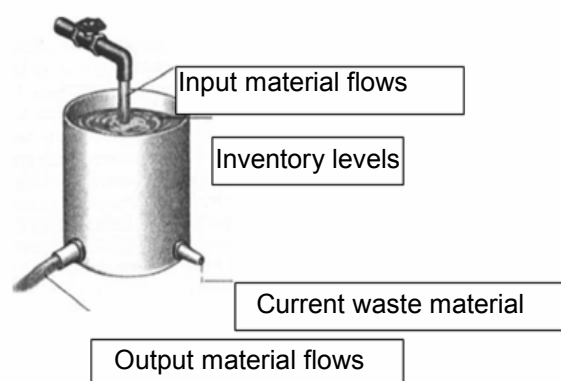


Figure 4 – Creating stocks  
Slika 4 – Kreiranje zaliha

Figure 4 shows how stocks are created by analogy with dish water. The flow of water to the pot raises the water level. Incoming water flow from the intake material shown, for example steel, components parts, office supplies or finished products. The water level shows the amount of stocks held in a factory, service capacity, warehouse or retail.

The flowing of the water out of the vessel reduces the level of water in the container. The flow of water out represents demand materials inventories, such as orders by consumers or requests for supplies such as food or furniture. Another possible output flow is of the waste material, which also lowers utility supplies.



Together, the flow rates of input and output determine the level of inventories. Inventories are elevated when more materials flow into the container than go out. They fall when more material flows. Figure 4 also shows clearly why companies use Sigma (Sigma) and TQM (Total Quality Management) to reduce defective materials. The more growing flow of waste material, the greater flow of input materials is required for a given level of output.

### *Coordination, adaptability and pooling of supply chains*

Distorted information or lack of information is the main reason for the "whip effect", named after the looks of its amplitude, which increases in length (Figure 5). The whip effect says that fluctuations in orders increase at each step of the supply chain from the consumer to the supplier of raw materials.

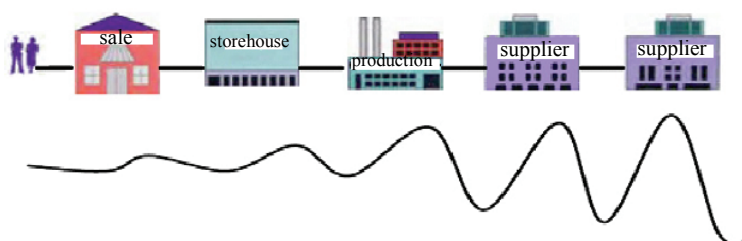


Figure 5 – "Whip" effect  
Slika 5 – Efekat „biča“

A simple way to see how cruel the whip effect is in production is to examine the volatility of rising sales in the consumer part of the supply chain and to compare the volatility of increasing production at the opposite end of the chain (Figure 6). Supply chains that use real and fresh information and effectively at that will have smaller amplitudes, which is shown in the figure with the red color. Otherwise, amplitudes are much larger and they are shown in black.

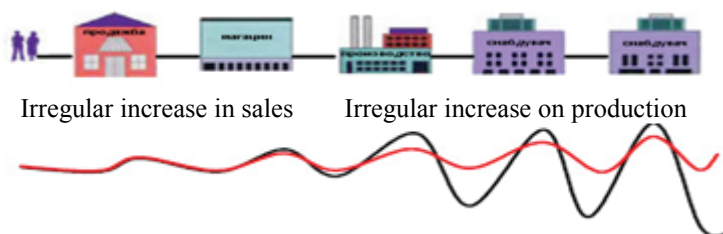


Figure 6 – Impact on production  
Slika 6 – Uticaj na proizvodnju

For example, J.C.Penney has implemented a revolutionary computer system that takes information directly from the sales themselves crates (the lowest level of the hierarchy of recovery). Rather than making assumptions based on how managers think it will sell, now they are making assumptions based on real data.

Distorted information and the whip effect also increase the inventory in all stages of the chain of suppliers. In many cases, stocks reliability against irregularities in the chain of suppliers and the increased inventory must be stored to meet demand and to have relaxed production. Unused and unsold inventories cause huge costs: costs for storage, warehousing, insurance costs and spoilage. Therefore, manufacturers have to optimize their operations to have little inventory.

The analysis of the chains of different companies shows that long and complicated chains are very sensitive to changes in the work (eg. mistake in a production series, bankrupt subcontractor, etc.).

Therefore, these supply chains fail to adapt to new conditions and the functioning when the company is questioned.

The success of any enterprise depends on how the supply chain is capable of adapting to the changes in the market and the economic situation (adaptability), how the chain is able to respond quickly to changes in the requirements of the end user (agility) and how willing it is to coordinate their processes with the same distribution of costs, risks and revenues between all parties involved (association) (Whitte, Green, Zebst, 2012).

From the above, we have seen how important the coordination of supply chains is in order to avoid the whip effect which is the result of distorted information or lack of information. The result of untimely and inaccurate information is increasing inventories at all stages of the chain of suppliers, which increases inventory in many cases and is a certain sign of the existence of irregularities in the chain of suppliers.

Increasing the quantities causes huge costs and therefore the manufacturers optimize their operations to have little inventory and to avoid the whip effect. As an important factor for successful supply chains, their ability and adaptability to market needs should be also mentioned.

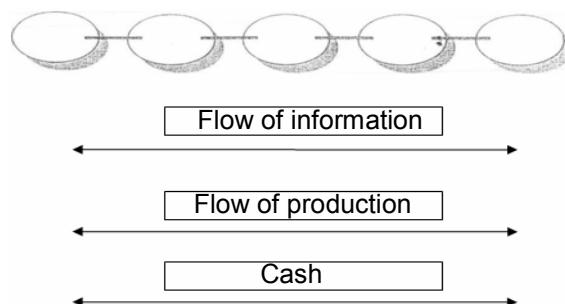


Figure 7 – Supply chain  
Slika 7 – Lanci snadbevanja

The successful management of supply chains is based on the integration and management of three types or core processes: products, information and cash. The three main streams exist between the members of the channel, which can be seen in Figure 7.

The concept of management of the supply chain which is used today came from marketing, logistics and manufacturing.

## Application of supply chains

The use of supply chains to increase the effectiveness of the business, lower costs and optimize for greater profitability in the civilian sector was particularly interesting to study in the early '90s of the 20th century. The rapid increase in the global business market moves to reorganize production and distribution operations to assembled partnerships with their suppliers and customers and creates supply chains that offer a significant competitive advantage. To achieve the primary mission of the Army, it is required to have quality and well organized logistic support. Logistics in the Army is set to a hierarchical structure consisting of three levels: strategic, operational and tactical level, with the system of supply chains covering the process chain as follows:

- Strategic level: supply of funds that are not available from Inventories are carried directly from the companies that contract for support or purchase at the local level, in the area of operations;

- Operational level: supply is done "by itself" at a place of unloading (warehouses, port, airport) or from local sources to the user units. Loads consisting of material from multiple units are first sorted before – being forwarded to the receiving unit;

Tactical level: when the time and the mission allows, we use the system "by itself", which provides supply. When the situation permits in the area of operations when the commodity is available, supplies are running through method "to yourself".

The overall logistic support of defense is implemented through various processes or formally related actions. All these interrelated processes form a chain of logistic support from which the resources of materials and services are ranging from sourcing to users and the information requirements of the users (units) to the holders of support.

The General Staff of the Army of Republic of Macedonia determines priorities and submits norms, criteria or guidance to the Joint Operational Command for the units with materials supply classes 1 to 5.

The units with fixed assets of all classes of supply are done by material formations and priorities made by tactical carriers.

### *Comparison of supply chains in the Army and the civilian sector*

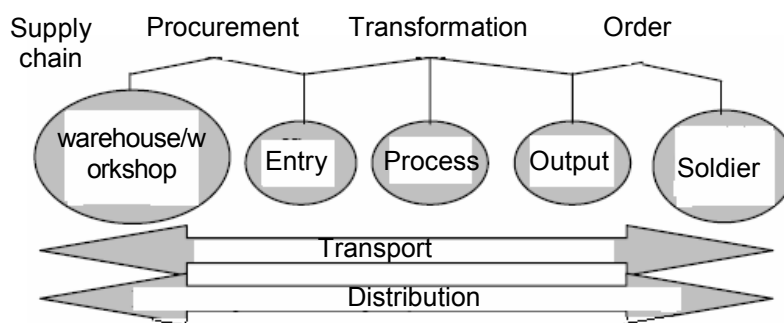
As we have already pointed out in the previous chapters, the supply chains in the civilian sector operate in this way:

Companies that produce raw materials at the beginning of the supply chain, deliver raw materials to enterprises that produce finished products stored in their warehouses until they receive a request from distribution centers. From distribution centers, products are delivered to retail centers where they are sold to consumers. In some cases, products of manufacturers can be delivered directly to sales centers which follow the market situation, identify the needs and inform distributors. If goods are in stock, distributors deliver them. If it is not the case, distributors submit a request for providing the goods from manufacturers.

In peacetime, the difference between the supply chains in the civilian sector and the supply chains in Army is minimal. The Macedonian Army does not have production facilities, only capacities for assets, maintenance and repair. Because the production process of the supply chains in the civil sector or supply chains in the Army replaced the process for maintenance/repair funds.

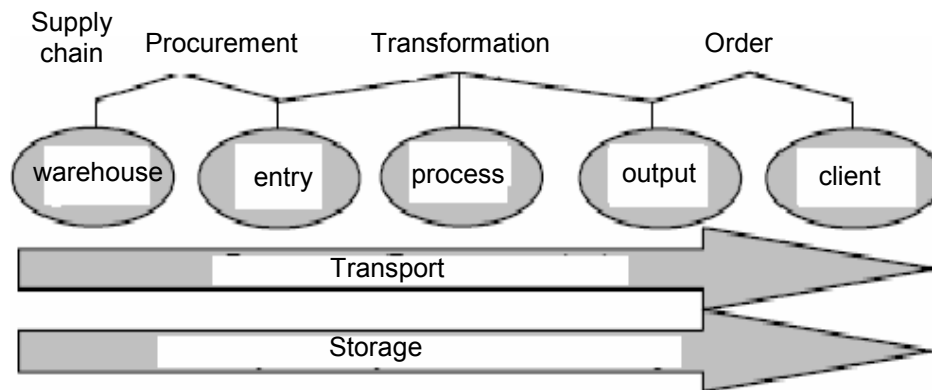
In supply chains in the civil sector, the delivery of a product to a consumer ends an interest in the supply chain for the product or the direction of movement of assets through a civilian supply chain from a producer to a consumer.

In the supply chains of the Army, movement of assets or duplex means they can be returned to the warehouse or shipped for repair in workshops as "Reversible logistics". The logistics in the Army of the Republic of Macedonia takes care of the whole lifecycle of assets, i.e. tracks their path through the supply chain from procurement, through their use to their disposal.



External factors: the needs of the soldiers, regulations of the Ministry of Defence.

*Figure 8 – Supply Chain in the army*  
*Slika 8 – Lanci snadbevanja u vojsci*



External factors: globalization, government regulations, competition.

Figure 9 – Supply chain in the civilian sector  
Slika 9 – Lanci snadbevanja u civilnom sektoru

It is common for supply chains in the civilian sector and supply chains in the army that they aspire to optimize available resources, rapid delivery of assets to consumers, establishing standard procedures and application of general terms and equipment and the use of modern technique which will provide accurate and timely information on the current status of the stocks (Pešić, 2010).

Providing the resources needed to support the military operations is far more complex and requires extensive analyses such as those concerning the layout of distribution centers, their distance from combat positions, modes of transport to be used, safety requirements, etc.

The difference between the supply chains in the civilian sector and the supply chains in the army is that the latter is much more complicated and longer. Supply chains in the army should provide various means of hygiene supplies, spare parts, food, ammunition, weapons, vehicles, combat vehicles to helicopters, to be ready for war at any time and at any place and to respond to the requirements for providing and to be defined according to priorities. The distribution of assets in the supply chains for military service in combat zones is more complex than in the civilian sector.

The term "analysis" can be defined as a breakdown of the whole to its parts, real or theoretical, until its elements remain indivisible (Radovanovic, 1993).

The analysis implies specific procedures such as a breakdown and comparison which are the two most important analytical methods, mutually dependent. With the analysis, we provide conclusions about units, whether their specific tasks are carried out rationally and economically, thus indirectly contributing to the success of the units (Kocoski, Ivanovski, 2000).

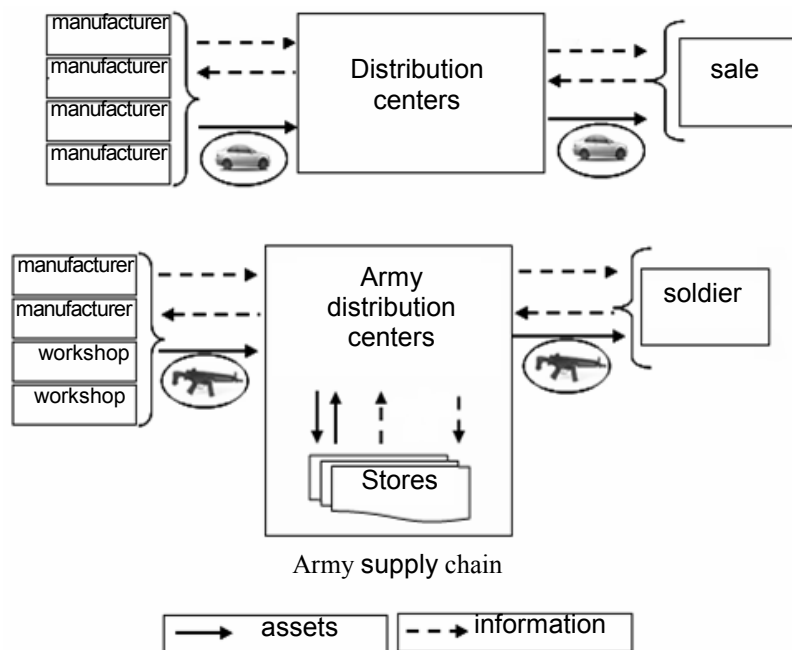


Figure 10 – Comparison of the civilian supply chain and the supply chain in the army  
Slika 10 – Uporedjivanje civilnog lanca snadbevanja i lanca za snadbevanje vojske

Although regular analyzes are made, and some manufacturers provide a list of parts with quantities that should be kept in warehouses, the number of unforeseen defects should not be neglected.

The demand for spare parts for regular annual maintenance (eg. tires, filters, batteries) can be planned for unexpected defects, especially defects of expensive resources. The army uses very specific and expensive equipment for which spare parts demands are predictable.

## Conclusion

The main objectives of the supply chain are low cost and satisfied users, and they can only be achieved with good integration, coordination and synchronization of all activities and processes of the participants in the supply chain.

We can conclude that the benefit of enterprises have effective and efficient management of multiple supply chains, so competition between firms in the market is increasingly turning into competition between supply chains.

The information is a key element in the management of supply chains. Accuracy and visibility of information are important factors in achieving

effective supply chains. Coordination of the supply chain is very important in order to avoid the whip effect, which is the result of incorrect or lack of information. The result of untimely and inaccurate information is increasing inventories at all stages of the chain of suppliers that substantially cause huge costs. Therefore, manufacturers have to optimize their operations to have little inventory and to avoid the whip effect.

The management of supply chains covers a broad spectrum of logistics activities to the end product which can be found on the market, in the hands of the buyer or the user.

They integrate logistics activities and provide the opportunity for cost savings and offer better customer service. The essence of the management of supply chains is to make cost savings as well as to offer better service to customers.

From our experience, we can conclude that the management of supply chains in the army for commercial sector will contribute to the improvement of logistics in the Army.

Some benefits that could be mentioned are: better support for troops, lower costs, reduced logistics resources, reduced costs for the determination of stocks and reduced time necessary for applications.

The perspectives of the development of the supply chains in the army are in the form of an agile, flexible and uninterrupted supply chain, tailored to specific requirements of soldiers, which also allows smooth functioning of military forces during peacetime, military operations and war.

The best choice for managers of supply chains in the civilian sector is to monitor the market situation and the requirements of consumers for shaping their supply chain model.

However, it is not possible to accurately predict all the claims that arise in the army, especially during military operations. In civilian enterprises, the lack of inventory leads to the reduction of profits and the lack of military supplies: food, ammunition, fuel, etc.

In war conditions, this can increase losses of human lives. Essential products and services should be addressed in logistics planning and the amount of inventory available must be always kept in mind. So a continuous process of supplying required products is necessary in view of successfully performing assigned tasks and missions.

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#### LANCI SNABDEVANJA U LOGISTICI I NJIHOVA PRIMENA

OBLAST: menadžment u odbrani  
 VRSTA ČLANKA: stručni članak  
 JEZIK ČLANKA: engleski

#### Sažetak:

*Logistika je skup aktivnosti kojim se vrši planiranje i realizacija premeštanja materijala. Imajući u vidu da se izvori sirovina, fabrike i prodajna mesta najčešće ne nalaze na istom mestu, neophodno je da*



*se sprovede niz logističkih aktivnosti kako bi se proizvod ili usluga mogli naći na prodajnom mestu, odnosno u rukama kupca/korisnika. Logistika rukovodi protokom podataka od nabavljača, kretanjem materijala preko različitih operacija u okviru organizacija i protokola završnih materijala do klijenata. Integrisanje ovih logističkih aktivnosti realizuje se preko lanaca snabdevanja, kojim se pruža mogućnost uštede troškova i ponuda bolje usluge potrošača. Korišćenje lanaca snabdevanja u Armiji Republike Makedonije predstavlja značajan faktor pri planiranju i sprovođenju logističke podrške.*

*Ključne reči: snabdevanje, servisiranje, planiranje, materijali, logistika, izvršenje, aktivnost.*

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