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**BACK**

# STRATEGIC PLANNING OF INFORMATION TECHNOLOGY SUPPORT FOR INVENTORY OPTIMISATION IN SUPPLY CHAINS

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## ABSTRACT

The growing needs for optimization in the supply chains are caused by inadequate, slow freight flow and the impossibility of real-time tracking of the flow of goods. At the same time, concurrent requirements for business analysis and logistic planning have brought to the need of strategic approach in planning the introduction of information technology support for inventory optimization in the supply chains. As a dynamic phenomenon, the logistic chain includes several interrelated organizations and activities that need to insure a smooth flow of materials and information from the original supplier to the end user. On the other hand, the inventories represent a “backup” which eliminate disturbances that may occur in the supply chain. Regarding the complexity of supply chains and the related inventory optimisation issue, advanced information technology solutions need to be introduced into the system in order to coordinate the activities and the information flow in the supply chain. The trends in the production with the increase in the variation of the products and their restoration cycles result in the tendency of increasing the inventories in the supply chain. The implementation of information technology support allows partial “replacement” of the inventories in the supply chain by information, thus providing free space for better efficiency of the freight and information flow through the supply chain. All this leads to the realization of assumptions to increase the competitiveness of the business subjects on the globalizing market which would then be more competent in reacting to the market requirements and more competitive in relation to the end users, consumers of goods and services.

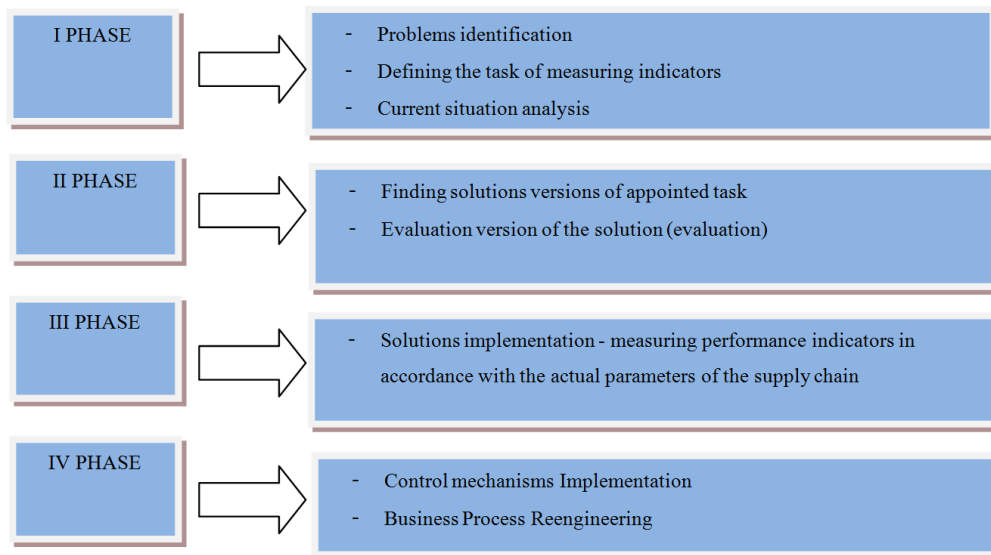
## 1 INTRODUCTION

In order to prepare the model to optimize inventory management in supply chain, it is necessary to adopt a series of decisions which will achieve the set goals. The prerequisite for change is the adoption of strategic, tactical and operational decisions and strategy definition. Implementation Strategy of IT support for the inventories optimization in the supply chain depends on a number of specific economic systems, economic activities, market environment, organization and relationship with partners - suppliers and users of services. A key parameter in the strategic planning of IT support for the inventories optimization is defining the planned

level of service that we deliver to market, and defining the measures and activities that will provide answers to questions that we will achieve the objectives of the appointment. Stocks are simply "fuse" to protect the company from uncertainty and disturbances that may occur in the supply chain. They are necessary for reasons of balancing supply and demand, and ensure the availability of goods and the assumption of adequate customer service. For the purpose of performing business functions of economic systems, it is necessary to provide continuity in monitoring the quality of inventory management taking into account the criteria that was set up in front of almost all sectors of the economy - to ensure a high level of customer service with optimal cost of stocks. From strategy to optimize inventory management in supply chain is expected to be "reconciliation" of earlier mentioned requests - the maximization of service on the one hand to minimize costs associated with inventory on the other. The aim of this study was to define the impact of implementation of IT support to the optimization of inventories in the supply chain of automotive post sales.

## 2 STRATEGIC PLANNING CRITERIA OF IT SUPPORT TO OPTIMIZE THE SUPPLY CHAIN STOCK

Whether it is business or function, „the strategy describes the main features of the company and ways the company refers to various external and internal environment influences" [1]. Selecting strategies of IT support implementation to optimize inventory management companies realize competitive advantage in the marketplace because, citing L. Darwin that "It is not the strongest of the species that survives, nor the most intelligent, but rather the one most adaptable to change" The result of a strategic approach is in the review and redefinition of processes and indicators of inventory management quality in supply chain, to undertake activities to measure performance indicators. Strategic approach is a developmental process which can be viewed through several developmental stages:



**Figure 1:** The strategic approach is defined through the developmental stages

Source: Authors

In its definition logistics chain includes more subjects that are more or less, directly or indirectly involved in fulfilling customer demands [2]. The logistics chain is not only connecting manufacturers and suppliers of goods, but also transports organizations, warehouses, retail locations and customers and service users. In addition, the logistics chain includes more related organizations and activities that ensure the movement of materials from

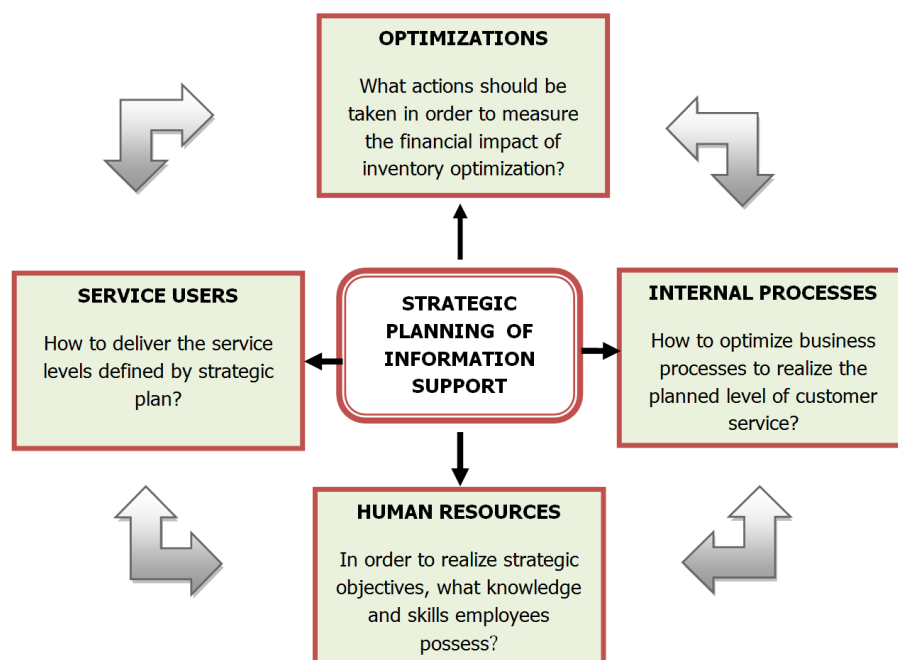


the original supplier to end customer or consumer [3]. The logistics supply chain is defined as a dynamic phenomenon that involves a series of activities, information exchange, on several levels and dimensions, with the primary purpose of the goods transported from point of manufacture to end consumer. In managing the logistics supply chain management the strategic importance of information, ICT or IT support should be especially noted.

The criteria for the implementation of IT support for the optimization of inventories in the supply chain are the strategic objectives set by the company as they want to deliver competitive advantage in the market. It is strategically important to be determined by:

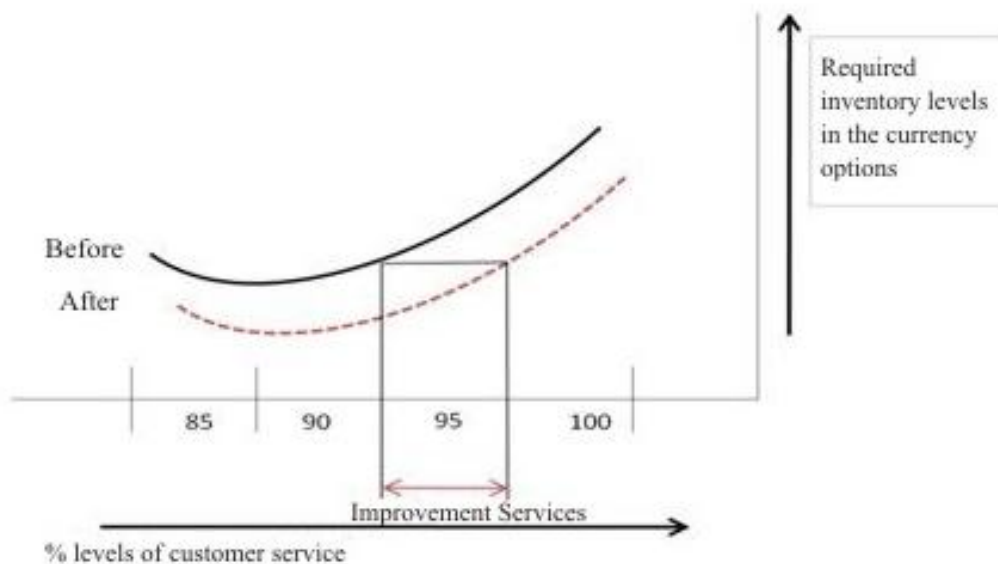
- Criteria for increasing the availability of goods to final consumers
- The level of service and strategic approach to the definition of goods in which they will be aware, in order to rationalize the expense associated with stocks, to market, offer a lower level of service. It is important to consider the possibility of substitution of goods or other services that for users provide substitution level of service
- Elements of the logistics system and logistics processes that occur in the structure of supply chain
- Investments in information and communication systems, whose primary task is creating, collecting, processing and distribution of information that are later assumption of inventories optimization in the supply chain
- Internal processes that take place in specific economic systems
- Investments in lifelong learning and raising levels of knowledge, competencies and skills of logistics operators, who are responsible for the implementation of operational strategies

The expected result of strategic planning to implement the IT support for the optimization of inventories in the supply chain has to define operational objectives, measures and objectives that will achieve the objectives aimed at increasing service levels for customers, measures relating to employees, internal processes in the organization and financial optimization indicators.



**Figure 2:** The structure of balanced goals in the function of inventories optimization in the supply chain; Source: Authors

The strategic planning of IT support for the inventories optimization in the supply chain is consider the application of information and communication systems that occur as a function of warehouse operations optimization and productivity increasing. Mainly, it refers to software tools Warehouse Managemnet System (WMS) radio frequency (RFID) identification and voice (English Voice) technology. WMS system allows work organized storage and optimal use of storage space, control of all business operations, reduce operating costs, speed and accuracy. Radio frequency (RFID) technology uses radio waves to uniquely identify the marked products, while the concept of voice technology is based on two computer technologies - speech recognition and synthesis. Software tools for warehouse management allow stocks in the supply chain to be attached with certain information. Inventory partially replaces the information and directly contributes to the rationalization of inventory in the supply chain. Similarly, the release of warehouse space that was previously engaged for the accommodation of supplies in the warehouse, and other resources (financial, technological, organizational) opens the space required to implement activities to increase the value of goods in warehouses



**Graph 1:** Improving service levels as a result of the introduction of WMS

### 3 IMPACT OF IT SUPPORT TO OPTIMIZE THE SUPPLY CHAIN STOCK

IT support systems and information which it generates are the basis for successful planning business with inventory, managing business policies and control the realization of set goals. Information and communication system is a tool necessary for the timely provision of appropriate measures aimed at possible adjustments in organization, technology or management. Similarly, the information communication system is a prerequisite for the implementation of the defined inventory management strategy. Properly conceived, taking into account the elements of nature activities, market environment, elements of procurement and sales, information and communications system provides the preconditions for substantial rationalization of resource-related stocks.

Models of inventory classification allows distinguishing important from less important stocks, ranking stocks according to their value, and considering the structure of their share in total sales structure. In order to confirm the objectives of this study, the research in the post sales automotive centres.

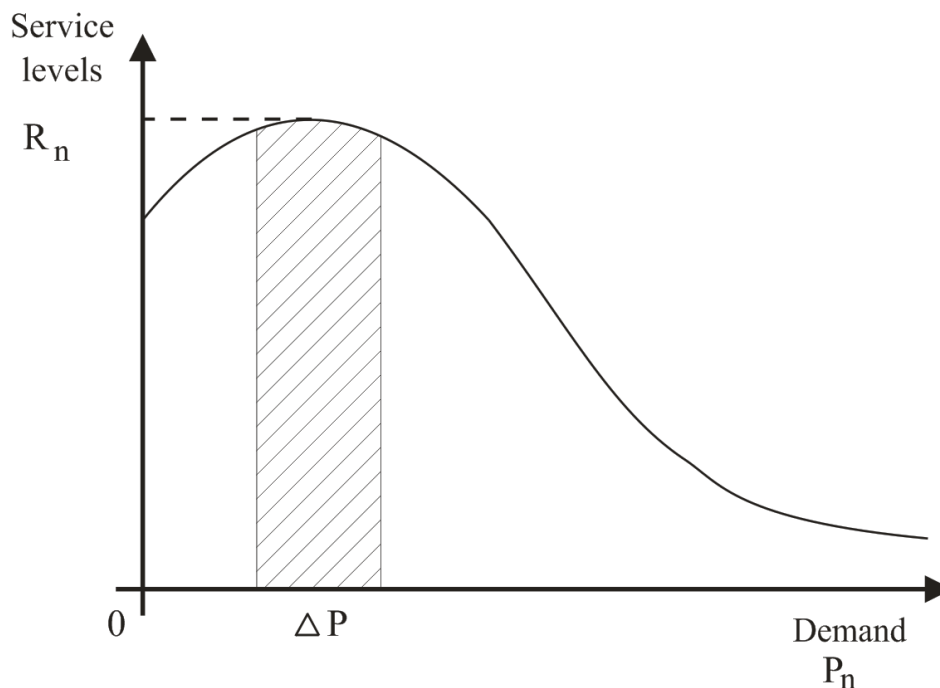
It was found that the specific service center that performs work in the service of vehicle brands Volkswagen group uses e-procurement without the backing of inventory management.

The current system of e-procurement functions in a way to recover of the stock performs in a way that by analysis of the historical indicators of selling goods by the moving sectional method projects the future demand in the coming period, two to eight weeks. Given that the survey found that the transportation system and supply of goods are stable, and that the ordered goods are delivered within 24 to 48 hours maximum, this approach results in increased stock and significant investment of financial funds needed to finance inventories. For this reason, the classification of stocks according to the ABC method should be made on the concrete example.

**Table 1:** inventories classifications in accordance with post sales automotive ABC classification proposal

Classification of supplies categories	Annual sales revenue	Annual sales share	Basic elements of a car in automotive post sales
Supplies A	12.500.000 kn	63%	transmission, electrical and electronic systems, components tinsmithing, lightweight materials, summer and winter tires, accessories
Supplies B	4.800.000 kn	24%	engine parts, exhaust system, front and rear suspension, levers
Supplies C	2.400.000 kn	12%	spare parts required for routine vehicle maintenance (oil, filters, brake fluid, etc.), supplies
In total	19.700.000 kn	100%	

Category A stocks ascribe a high value sales, and their control should add considerable attention both in the management information and communication system and direct control of the logistics operators who are in companies responsible for inventory management. Category B items in stock which are numerically more, along with a lower unit value and lower value of sales for that period. Managing the category of stocks are left to the information communication system with periodic and periodically control of the logistics provider. Products category C with the lowest share in the value of sales should be controlled by information and communication system with minimal administration by the logistics provider. The specificity of category C stocks in the post sales in the auto industry is necessary to provide the same high level of service, at least 97% for reasons of service users sensitivity to access the goods.



**Graph 2:** Relationship between changes in demand and the level of customer service  
Source: Authors

The ratio changes of demand in relation to the planned level of customer service, we describe by the model:

$$\forall \Delta p + n, n \rightarrow \infty; R_u \rightarrow 0 \quad (1)$$

$$\forall \Delta p - n, n > 0; R_u \rightarrow \min \quad (2)$$

As the supply of spare parts ordered by the current system of e-procurement comes every 14 days, research has shown possibilities of rationalization of inventory in the way of making proposals to change the current system of e-procurement. Redesign e-procurement system resulting in decreased levels of safety stock, and thus optimal order quantity. In parallel, providing a differentiated approach to inventory management classifications A, B or C, is achieved optimization by the strategic guidelines of the planned service levels.

#### 4 CONCLUSION

Strategic planning model to optimize inventory management in supply chain involves making a series of decisions which will achieve the set objectives, primarily those related to the level of service quality and minimize costs in the supply chain. Implementation Strategy of IT support for the inventories optimization in the supply chain depends on a number of specific economic systems, their activities, environment, organization and relationship with suppliers and users of services. A key parameter in the strategic planning of IT support for the inventories optimization is defining the planned level of service that we deliver to market and defining the measures and activities that will provide answers to questions how to achieve the objectives of the appointment. The research on the specific example of automotive sales in the post sales of auto industry proved the interdependence between the strategic approach in

planning the informatic equipment for the optimization of inventories to the level of service that we supply to the market, which is related to a particular classification label stock.

## REFERENCES

1. I. Mencer, *Strateški menadžment i poslovna politika*, Sveučilište u Rijeci, Rijeka 2003., pp.24.
2. S. Chopra, P. Meindel, *Supply Chain Management*, Second Edition, Boston Spa, 2004., pp.3.
3. D. Waters, *Logistics, An Introduction to Supply Chain Management*, New York, 2003. pp.7.