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## DISTRIBUTION CHANNEL REENGINEERING: A CASE STUDY

### ABSTRACT

*For the last few decades there has been growing interest in making more integrated business decisions across larger segments of the logistic and distribution networks. Modern information technology is allowing this idea to be implemented, but there is need to develop a way of effective use of information technologies that support this business direction. In this paper a methodology to assist distribution networks reengineering with the aim of integrating logistic processes within the distribution supply chain has been promoted. The emphasis of methodology is on the business processes modelling and reengineering in the distribution network. Finally, this paper presents an oil company case study to illustrate how the methodology can be applied in practice.*

### KEYWORDS

*distribution process, business process modelling, reengineering, information sharing, logistics*

### 1. INTRODUCTION

To succeed in the modern global economy, it is critical to build a logistic network that is information-rich, highly flexible, cost effective, and defined by both customer needs and internal corporate strategy. Organizations must constantly reinvent their logistic networks to allow for growth and change. The nature of the distribution process is changing from simply holding physical inventory towards a business model that relies on information and inventory linkages with customers and suppliers. Customer expectations now include both traditional activities associated with warehousing and distribution and new activities like technical support, electronic order processing, and customized

financial services, to name a few (more added value activity). Structural changes in distribution channels are currently taking place which are accelerating deliveries to customers. These new distribution channel structures, in which logistics management is typically centralized, have proven to be both extremely cost efficient and effective in improving customer services. The value of centralized logistics activities within logistic channels has been analyzed in [1, 2, 3, 4]. Modern information technology (IT) has been a necessary enabler of the move to more centralized distribution structures [5]. High operational efficiency is dependent on quick, accurate and continuous exchange of information between organizations and also between and within different functions within organizations. Rapid developments in IT have increased the availability of information and also the opportunities to transfer information between different inter and intra-organizational units.

However, the simple use of IT applications to improve information transfers between supply chain members is not enough to realize the benefits of information sharing and centralized logistics management. A mere increase in information transfers does not mean that the efficiency of logistics processes will be improving. The business models of existing distribution processes have to be changed so as to facilitate better use of the information transferred [6]. The aim of this article is to describe and explain the reengineering of distribution processes from traditional distribution to distribution applying the logistic principles and involving the centralization of logistics activity in distribution networks through using the proposed methodology. The core steps of the methodology are based on the business processes modelling and simu-

lation. An explanatory methodology framework has been developed and applied to a company case study. The distribution network, observed in this case study, represents a network of one distribution centre, multiple retailers and customers. The distribution centre's task is to deliver the goods to each retailer so that the customer demands are met to the most desirable levels possible. The proposed methodology assumed an integrated logistic decision-making to assist the distribution centres in performing their tasks.

The next section briefly reviews the basic principles about the distribution channel reengineering. Section 3 introduces the term of business process modelling. Section 4 defines the proposed methodology. Section 5 formulates the case study and outlines the business process models for the current and proposed state for the distribution network under consideration, and details a simulation study. Section 6 discusses the results and provides a conclusion.

## 2. DISTRIBUTION CHANNEL REENGINEERING

In reengineering theories, organizational hierarchies and the representation of organizations in terms of different functions are replaced by a process-oriented perspective. Organizational structures are redesigned by focusing on business processes and their outcome. According to [7] three different restructuring concepts can be distinguished: total quality management (TQM), time-based management (TBM) and business process reengineering (BPR), and the most important contribution of these theories has been to extend a process orientation into a strategy paradigm. The process-oriented design for the logistic and distribution systems is based on efficient use of IT [8]. Information sharing between members of a distribution supply chain using new IT should be increased to reduce uncertainty and improve the logistic performances [9]. However, companies need to invest large amounts of money for redesigning internal organizational and technical processes, changing traditional and fundamental product distribution channels and customer service procedure to achieve IT-enabled supply chain. The main problem when developing an innovative IT-integrated distribution system is lack of integration between IT and business model [10, 11, 12]. Hence, the formation of a business model is crucial for full utilization of improved information system. Information should be readily available to all companies in the distribution channel, and the business processes should be structured to allow full use of this information. The objective of this paper is to offer insights into the distribution channel reengineering using business process modelling and simulation.

## 3. BUSINESS PROCESS MODELLING

Business process reengineering is enabled by business process modelling. A business process model is an abstraction of a business that shows how business components are related to each other and how they operate. Its ultimate purpose is to provide a clear picture of the company's current state and to determine its vision for the future. Modelling a complex business requires the application of multiple views. Each view is a simplified description (an abstraction) of a business from a particular perspective or vantage point, covering particular concerns and omitting entities not relevant to this perspective. To describe a specific business view process mapping is used. It consists of tools that enable us to document, analyze, improve, streamline, and redesign the way the company performs its work. The process mapping provides a critical assessment of what really happens inside a given company. The usual goal is to define two process states: AS-IS and TO-BE. The AS-IS state defines how a company's work is currently being performed. The TO-BE state defines the optimal performance level of AS-IS. In other words, to streamline the existing process and remove all rework, delays, bottlenecks and assignable causes of variation, there is a need to achieve the TO-BE state. Business process modelling and the evaluation of different alternative scenarios (TO-BE models) for the improvement by simulation are usually the driving factors of the business renovation process [13]. In the next section the proposed methodology for distribution channel reengineering is presented.

## 4. THE PROPOSED DISTRIBUTION CHANNEL REENGINEERING METHODOLOGY

The methodology presented in this section is the outcome of an iterative process from theory, practice, and case studies. There have been a number of papers published describing reengineering methodologies [14, 15, 16, 17, 18]. Most focus on major phases of redesign, others go into exquisite detail. Review of those methodologies shows significant lack of research on methodology of logistic distribution channels renovation. Hence, the main motivation of this research was to define a new methodology frame that would allow academia and practitioners to restructure the existing distribution channels from traditional distribution to distribution applying the logistic principles and involving the centralization of logistics activity in distribution networks. So the main advantage of the proposed methodology is its suitability for applying reengineering of different kinds of logistic distribution channels in order to increase the successful rate of the reengineering project.

The proposed methodology is a generic six-step approach that guides the actions to assist business process reengineering in logistic distribution networks. It is a guide, not a procedure or manual. The structure for the methodology is shown in Figure 1. An outline of the content of the proposed methodology is given below.

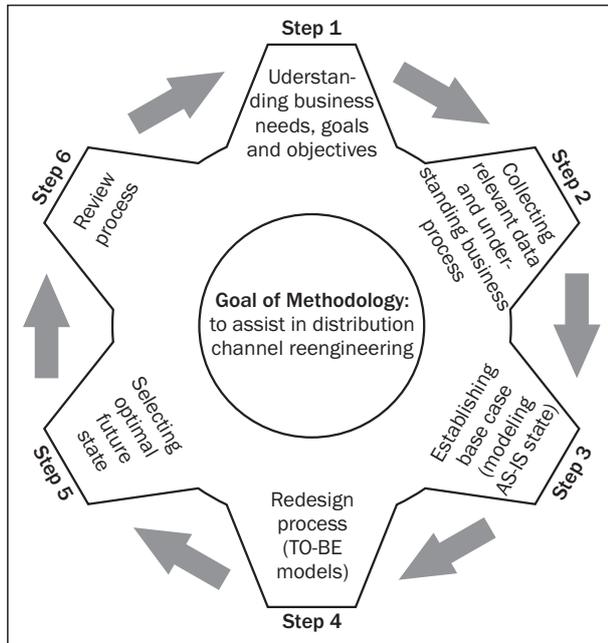


Figure 1 - The proposed methodology for distribution channel reengineering

*Understanding business needs, goals and objectives:* The first step on the road to a reengineering distribution system is to assemble a team of strategic decision makers and influences from a variety of corporate levels. Not only is it important to fostering a universal sense of ownership in the process by these key personnel, but these people will also source the needed data on the past and current operations, as well as about future corporate plans. Outputs of this initiation stage are: assigning project teams, setting business performance goals and clear understanding and well defining project scope.

*Collecting relevant data and understanding the business process.* Once the goals of the distribution channel reengineering process have been defined, it should be fairly clear what types of data need to be collected for the analysis. Also, the business process architecture has to be identified. Through this diagnosis stage responsibilities and roles for each process will be assigned. After that it could be possible to make a selection of the strategic (added-value) processes for redesign.

*Establishing the base case.* Now that all the data have been collected and the process has been defined, it is time to use that information to create an AS-IS model of current distribution channel operations,

called the base case. The objective of this stage is identifying and modelling the strategic (value-added) processes that are feasible to change. The base case will be used as a standard against which the potential future-state operating scenarios will be compared.

*Redesign process - analyzing and evaluating potential future-state scenarios.* Once the AS-IS model is established, it is time to build TO-BE models as potential scenarios of future conditions and compare them with the current reality. To do this it is important to first establish and prioritize which variables will present the key factors in the analysis. These variables could be inventory costs, transportation costs, required service levels, ordering costs, labour availability, etc. The model of the new redesigned process has to contribute to simplification, minimization and automation of steps, and efficiency optimization through using new information technology.

*Selecting the optimal future-state.* After all it is time to assess the various future-state scenarios that are developed by manipulating the data that established the base case. For that purpose simulation was used. After creation of the simulation model of the business process, these options were compared and the model that best supports the organization's strategic plans related with the distribution process was chosen.

*Reviewing new process.* After selecting the optimal future process model, it is necessary to develop the strategic view of the new business process, set the process targets and performances, and to develop a plan to meet the targets. This implies the process team training in order to efficiently manage and operate the new process, and the introduction of the redesigned process into the business organizational structure.

## 5. DISTRIBUTION CHANNEL REENGINEERING: A CASE STUDY

The case study is a Serbian petrol distribution company. Its sales and distribution cover the full range of petroleum products for the domestic market. The distribution channel comprises the distribution centre, petrol stations and final customers. The products are distributed using tank trucks. In line with the aim of the paper only a fragment, namely the procurement and distribution process, will be shown in the next section. A broader description of the case study can be found in [19].

From the distribution point of view, the oil industry is a specific business, and for many reason it is still generally based on the traditional model. The product is manufactured, marketed, sold and distributed to customers. In other industries, advanced logistic and distribution operations are becoming increasingly driven by demand-pull requirements from the customer. There is strong vertically integrated nature of

oil companies and that may be a potential advantage. In other industries, much attention is focused on value chain integration across multiple manufacturers, suppliers and customers. In the oil industry, more links in the logistic chain are "in house", suggesting simpler integration. In practice, there is still a long way to go to achieve full integration of logistic processes in the oil distribution chain.

A case study has been used as a research method to underline the theoretical findings set out in previous sections, i.e. to show how the distribution channel reengineering can be adopted with business process modelling. In addition, the purpose of the case study is to show how the benefits of the distribution channel reengineering can be assessed by using the proposed combination of business process modelling and simulation. The presented research is only partly of an exploratory nature in researching the possibility of assessing distribution channel renovation and integration benefits.

The business process modelling and renovation project was initiated by the Serbian petrol company in order to reduce the operating costs, shorten lead times and improve inventory management. The project started with the formation of a project group consisting of members of the petrol company and consultants. The first step of the project was a workshop for the project group in which the members were acquainted with the reengineering goals and methodology. After the workshop, the key business process groups were identified by a discussion and brainstorming. One of the most crucial processes was the procurement process (Step 1 in *Figure 1*).

Appropriate database was established based on the company official data and by interviewing people from the company that perform the viewed activities. Apart from business process data, the industry-specific data were used (e.g. oil prices, tank volumes) which were available from literature [4]. According to the collected data, organizational model, developed process objectives, identified business process architecture the model of the current distribution process could be developed (Step 2 in *Figure 1*).

The objective of Step 3 (*Figure 1*) was to map out in a structured way the distribution processes of the observed petrol company. The description of the procurement and distribution processes are as follows: the stock level is measured manually once a day. The results are faxed to the sales and purchasing departments, which collects information from all petrol stations. The purchasing department predicts future demand and takes additional consultation with petrol station managers. Tacit employee knowledge is used to make and optimize orders and transport routes. The analytical sector controls possible changes in demand and supply patterns and transport routes. If necessary, it can adjust or cancel orders. After that, the orders are

sent to the transport department. The orders are fulfilled with the available fleet. The modelling tool used in this case study was iGrafx Process. The AS-IS model was initially designed so that the personnel involved in the distribution processes could review them, and after that the final model shown in *Figure 2* was developed.

The core objective of distribution chains is to deliver the right product at the right time, at the right price and safely. In a highly competitive market, each aims to carry this out more effectively, more efficiently and more profitably than the competitors do. Because both the prices and the quality of petrol in Europe are regulated, the main quality indicator in petrol distribution is the number of stock-outs. The main cost drivers are therefore: the number of stock-outs, stock level at the petrol station and process execution costs. Lead time is defined as the time between the start (measurement of the stock level) and the end (either the arrival at a petrol station or the decision not to place an order) of the process.

The main problems identified when analyzing the AS-IS model relate to the company's performance according to local optimization instead of global optimization. The silo mentality is identified as prime constraint in the observed case study. Other problems are in inefficient and costly information transfer mainly due to the application of poor IT. There is no optimization of the performance of the distribution chain as a whole. Purchasing, transport and shipping are all run by people managing local, individual operations. They have targets, incentives and local operational pressures. Everything was being done at the level of the functional silo despite the definition that local optimization leads to global deterioration. Based on the mentioned problems, some improvements were proposed. The main changes lay in the improved integration of whole parts of the distribution channel and centralized distribution process management.

The emphasis in business process reengineering is placed on changing how information transfers are achieved. A necessary, but by no means sufficient condition for this is to implement new IT which enables efficient and cheap information transfers. Hence, IT support is not sufficient as deep structural and organizational changes are needed to fully realize the potential benefits of applying new IT. In this case a study of two different propositions for business process reengineering (two TO-BE models) was developed to show how the implementation of new IT without business process renovation and the related organizational changes does not mean full optimization of distribution network performances (two TO-BE models were built as potential scenarios of future conditions in comparison with the current reality). The first renewed business model (TO-BE 1) is shown in *Figure 3* and represents the case of implementing IT without structural changes to distribution processes. In the TO-BE 1

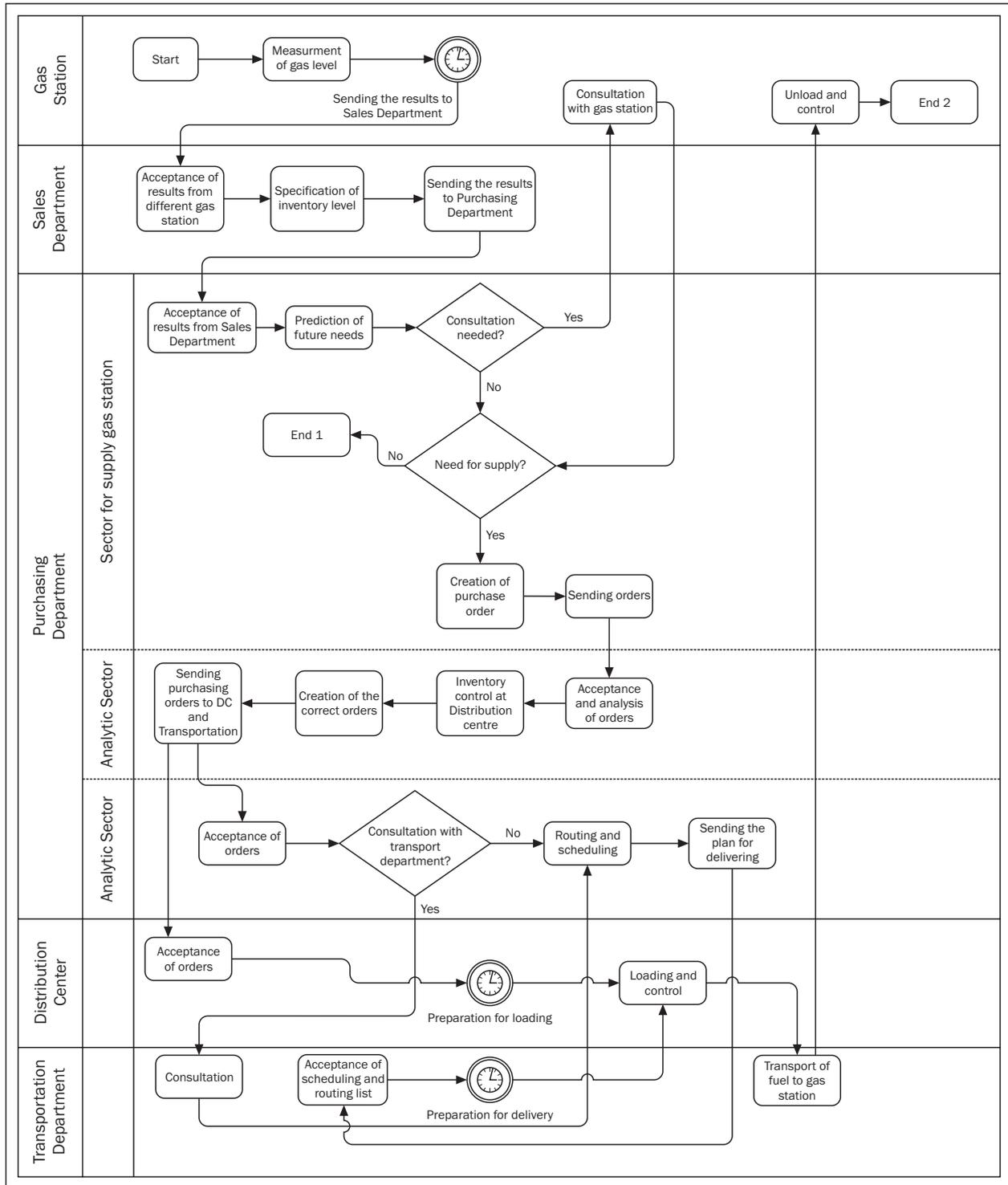


Figure 2 - AS-IS model of the process

model, there is no integrated and coordinated activity through the distribution channel. Inventory management at the petrol stations and distribution centre is still not coordinated.

The TO-BE 2 model assumes that the processes in the whole distribution channel are fully integrated and the distribution centre takes responsibility for the whole procurement process. The TO-BE 2 business

model is shown in Figure 4. The main idea is that a new organizational unit within the distribution centre takes on a strategic role in coordinating inventory management and in providing a sufficient inventory level at the petrol stations and distribution centre to fulfil the demand of the end customer. It takes all the important decisions regarding orders in order to realize this goal. Other changes proposed in the TO-BE 2 model are the

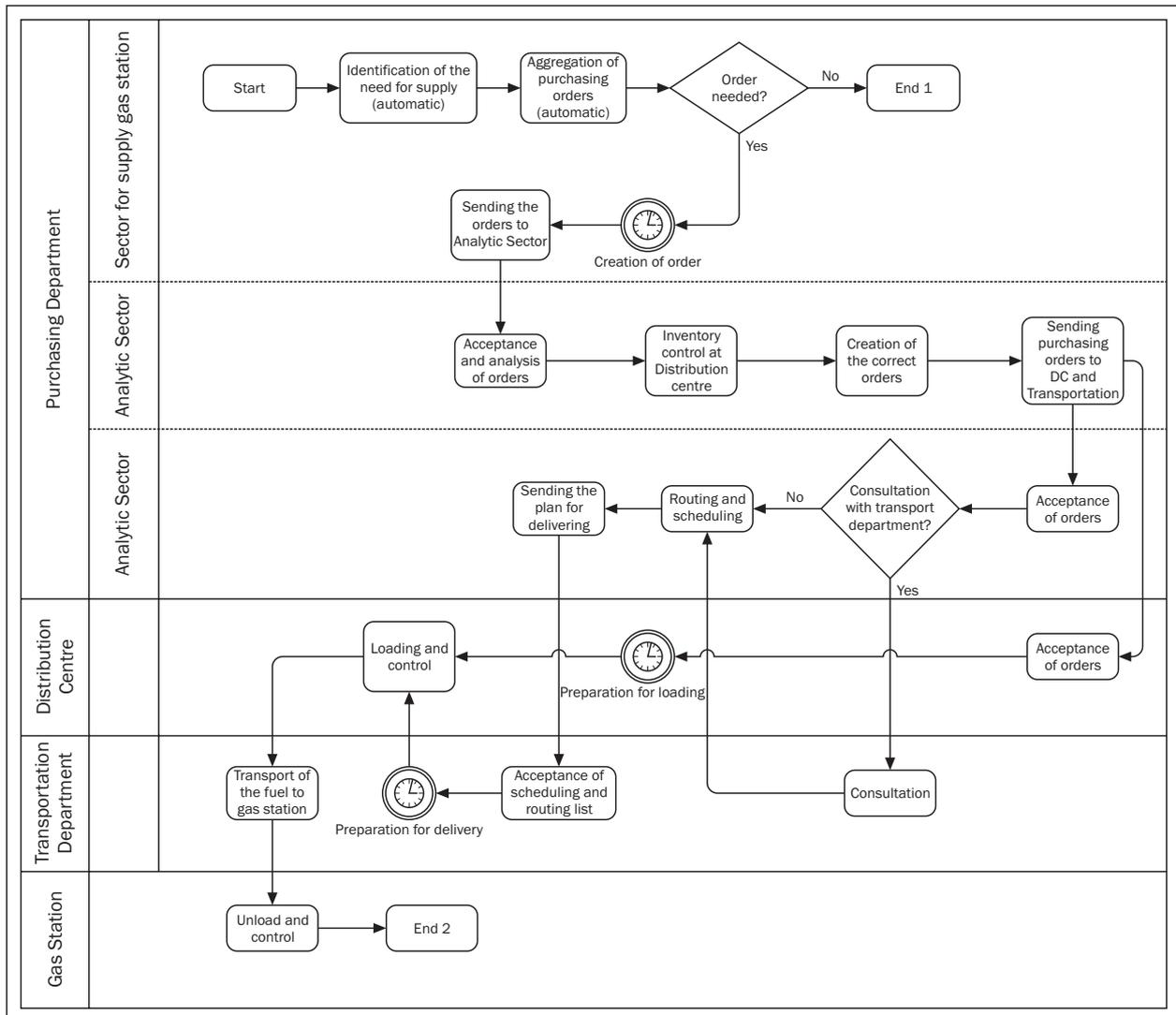


Figure 3 - TO-BE 1 model of the process

automatic measurement of petrol levels at petrol stations and the automatic transfer of such data to the central unit responsible for petrol replenishment; the predicting of the future demand by using progressive tools; and using operations research methods to optimize the transportation paths and times. The role of IT in all of these suggestions is crucial.

In the next step (Step 5 in Figure 1) we compared the current state and the proposed options and chose the best model of the distribution process. For this we use simulation. We simulated the business process to investigate the impact of business process reengineering on the defined distribution performances: lead times and transactional costs. This simulation is important as they enable us to estimate the consequence of possible experiments. For estimating changes in the process execution costs and lead times, a three-month simulation of the AS-IS and of both the TO-BE models was run. In the AS-IS model a new transaction is generated daily (the level of petrol is checked

once a day); in the TO-BE model it is generated on an hourly basis (the level of stock is checked automatically every hour). The convincing results are summarized in Table 1. The label “Yes” refers to those transactions that lead to the order and delivery of petrol, while the label “No” means a transaction where an order was not made since the petrol level was sufficient.

The comparison of simulation results (Table 1) shows that the proposed changes (TO-BE 1 and TO-BE 2) significantly lower the transactional costs as well as the average lead times. There is also significant distinction between the proposed TO-BE 1 and TO-BE 2 models with regard to transactional costs and average lead times. This means that in order to foster business value out of IT implementation, the company has to apply the distribution channel reengineering with business process modelling. The comparison of AS-IS and TO-BE 2 model shows the average process costs are reduced by almost 50%, while the average lead times are cut by 62% in the case of the TO-BE 2 business

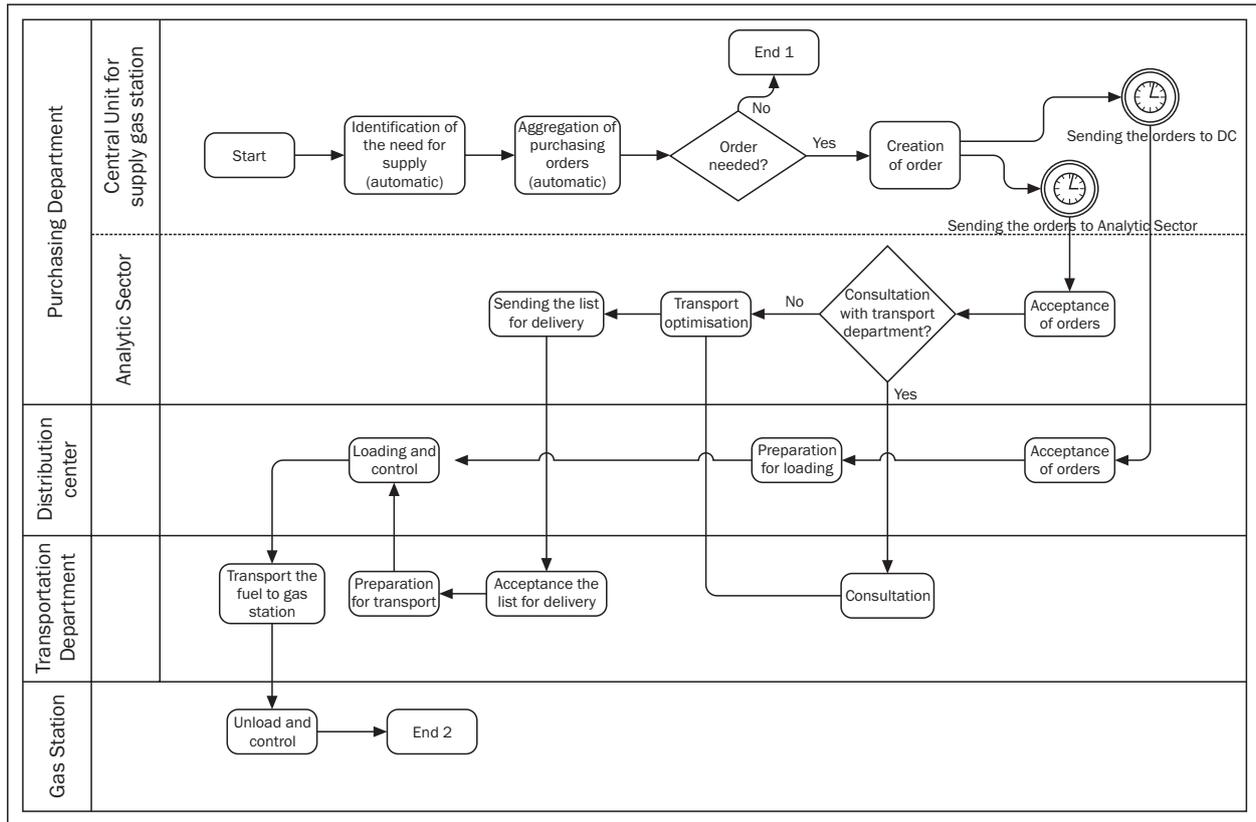


Figure 4 - TO-BE 2 model of the process

Table 1 - Comparison of simulation results for the AS-IS and TO-BE models

Transaction	No.	Av. lead-time (hrs)	Av. work (hrs)	Av. wait (hrs)	Average costs (€)
Yes (AS-IS)	46	33.60	11.67	21.93	60.10
No (AS-IS)	17	8.43	2.40	6.03	8.47
Yes (TO-BE 1)	46	27.22	10.26	16.96	56.74
No (TO-BE 1)	1,489	0.00	0.00	0.00	0.00
Yes (TO-BE 2)	46	12.85	4.88	7.98	32.54
No (TO-BE 2)	1,489	0.00	0.00	0.00	0.00

model. From this it is clear that this renovation project is justifiable from the cost and time perspectives. Furthermore, through case study it was clarified that the companies in reengineering their distribution channel have to adopt systematic approach in order to streamline their processes. The case study results show that full improvement in logistic performances is only possible in case of implementing both IT which enables efficient information sharing and the redesign of the business processes. The significance of this paper is that it not only clarifies that mere IT implementation will not result in an expected business change, but also provides methodology that systematically assists in distribution channel reengineering.

Changes described in the TO-BE 2 model have later been adopted by the petrol company. The validity of the model was tested by ex-post comparison of simu-

lated and real business operations data. The comparison validated the TO-BE 2 model since the data from operations fit simulations. The validation also supports the methodology of distribution channel reengineering (Step 6 in Figure 1).

## 6. CONCLUSION

The paper presents a methodology for the distribution network reengineering. The goal was to overcome numerous reengineering methodologies that focus either on major phases of redesign or are too detailed. The presented methodology represents a comprehensive tool for both academia and practitioners to apply it to the distribution channel reengineering in order to increase the successful rate of the reengineering project.

The methodology has been tested on a petrol distribution company in order to explore the effect of information sharing with regard to the performance. The business process reengineering in the distribution channel, realized through the proposed methodology, described in this paper helped achieve significant savings for the case study company by improving the effectiveness in the distribution network. The conclusions of the simulation experiments are significant savings in the cost and time measures. The presented case study shows the applicability of the proposed methodology; however, further case studies have to be done in the future to prove the validity.

This research has also exposed a series of issues for the future work. First, the proposed methodology, which is process-based, needs to be further developed in the way of connecting with IT solutions for the problems such as vehicle routing and fleet optimization. Second, a framework for security and risk management aspects also needs to be created. Only in that way the proposed methodology for distribution channel reengineering can be incorporated into a broader change management perspective. Currently, the proposed methodology focuses on the costs and lead times, and it should be definitely extended into the stock level, resource optimization and risk management.

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## SAŽETAK

### PRISTUP REINŽENJERINJU KANALA DISTRIBUCIJE: STUDIJA SLUČAJA

Poslednjih decenija prisutan je rastući interes za integrirano poslovno odlučivanje između velikog broja članova logističkih distributivnih mreža. Savremene informacione tehnologije omogućavaju implementaciju ovih ideja, međutim, javlja se potreba definisanja što efikasnijeg načina iskorišćenja prednosti koje pružaju informacione tehnologije kao podrška poslovnom odlučivanju. Shodno tome, u ovom radu promovisana je metodologija reinženjeringa logističkih distributivnih mreža, sa ciljem integriranja logističkih procesa unutar distributivnih lanaca snabdevanja. Akcenat razvijene metodologije je na modelovanju poslovnih procesa i reinženjeringu distributivnih mreža. Konačno, u radu je obrađena studija slučaja naftnog preduzeća u cilju ilustracije načina primene date metodologije u praksi.

## KLJUČNE REČI

proces distribucije, modeliranje poslovnih procesa, reinženjering, razmena informacija, logistika

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