

Full Length Research Paper

Achieving competitive supply chain through business process re-engineering: A case from developing country

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Recent business development in the light of increased competition has caused many companies to explore new drivers in order to remain competitive. In this context, business process re-engineering is the key to the successful implementation of effective supply chain management which has become a potentially valuable way of securing competitive advantage. This paper presents the characteristics of business re-engineering effort and how business process modeling can be used for these purposes. Effective supply chain management requires a high degree of coordination and information sharing between partners in the supply chain. The main idea was to show through business process modeling how the business process re-engineering of existing process needs to follow the introduction of new information technologies into organizations to improve information sharing. This paper will show that only harmonized implementation of information technology and business process re-engineering will bring to the effective supply chain management and full improvement of companies competitiveness.

Key words: Supply chain management, business process re-engineering, business process modeling, competitiveness, case study.

INTRODUCTION

In the 1980s companies discovered new manufacturing technologies and strategies that allowed them to reduce costs and better compete in different markets. In the last few years, however, it has become clear that many companies have reduced manufacturing costs as much as is practically possible. Many of these companies are discovering that effective supply chain management is the next step they need in order to increase profit and market share (Simchi-Levi, 2003). In order to compete the effective management of the supply chain is critical.

In today's dynamic market, companies can no longer exploit the traditional drivers in order to remain competitive. The nature of competition has forever changed, and more significant change will occur going forward. Companies can no longer compete by designing, manufacturing and selling a single product,

and manufacturing that product in advance to handle anticipated demand. 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. Today's sophisticated customers demand products specifically tailored to their needs, when they need them. Responsiveness to customer needs requires a high degree of coordination and information sharing between partners in a supply chain. Such a revolutionary change in the supply chain requires new information technology (IT) which will be employed to facilitate and accelerate a new set of business processes. A new business processes are gained by renovation of current business practice in order to fully realise the benefits of improved information quality and share. The simply use of IT applications to improve information transfers between supply chain members is not in itself enough to realise the benefits of information sharing. The business models of existing processes have to be changed so as

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to facilitate the better use of the transferred information (Trkman et al., 2007).

A supply chain is the set of business processes and resources that transforms a product from raw materials into finished goods and delivers those goods into the hands of the customer. Supply chain management (SCM) has been defined as "the management of upstream and downstream relationship with suppliers, distributors and customers to achieve greater customer value-added at less total cost" (Wilding, 2003). The understanding and practicing of SCM has become an essential prerequisite for staying competitive in the global race and for enhancing profitability. SCM need to be defined to explicitly recognize the strategic nature of coordination and information sharing between trading partners and to explain the dual purpose of SCM: to improve the performance of an individual organisation, and to improve the performance of the whole supply chain. The goal of SCM is to integrate both information and material flows seamlessly across the supply chain as an effective competitive weapon (Childhouse and Towill, 2003). In this paper we present the business process re-engineering (BPR) as a tool for effective supply chain management, which is the principal determinant of the ability to compete, and illustrate through a case study how business process modelling (BPM) can help in achieving successful improvements in sharing information and the integration of supply chain processes.

SUPPLY CHAIN MANAGEMENT

The objective of supply chain management is to provide a high velocity flow of high quality, relevant information that enables suppliers to provide for the uninterrupted and precisely timed flow of materials to customers. Supply chain excellence requires standardized business processes supported by a comprehensive data foundation, advanced information technology support and highly capable personnel. It needs to ensure that all supply chain practitioners actions are directed at extracting maximum value. Council of Logistics Management (CLM) defines SCM as the systematic, strategic coordination of the traditional business functions and tactics across these business functions within a particular organisation and across businesses within the supply chain for the purposes of improving the long- term performance of the individual organisations and the supply chain as a whole (CLM, 2000).

The concept of SCM has received increasing attention from academicians, consultants, and business managers alike (Tan et al., 2002; Feldmann and Miler, 2003; Croom et al., 2000). Many organisations have begun to recognize that SCM is the key to building sustainable competitive edge for their products and/or services in an increasingly crowded marketplace (Jones, 1998). SCM

has been considered as a critical strategy for effectively competing in the 21 century. Successful companies recognizes that with effective SCM they are not only be able to reduce production cost by eliminating non-value added activities, but also to create a new set of market capabilities that are difficult to replicate. However, implementation of a successful supply chain may encounter resisting forces that include lack of SCM actor's support, inadequate measurement and information systems, and organisational culture. Thus successful supply chains can create value contingent on their ability to overcome resisting forces through various mechanisms (Migiro and Ambe, 2008), and BPR may be one of them.

Information sharing

Companies historically have considered information an asset to be hoarded and protected, rather than shared. Sharing information with suppliers, for examples, weakens negotiating positions. Such mentality (silo mentality) also led to large vertically integrated corporations that allowed a company to work closely with a few internal suppliers without having to leave the boundaries of the company. A fundamental shift in the ways in which companies compete is driving a new way of thinking. Today, rather than companies competing against companies, supply chains compete against supply chains. Effective information sharing means that you no longer have to own all the pieces of the supply chain to effectively operate as a single entity. And the ability to form the appropriate partnerships in a timely manner and effectively operate as a single entity allows some supply chains to thrive while others fail (Sturim, 1999).

Information sharing is a key ingredient for any SCM system (Moberg et al., 2002). Many researches have suggested that the key to the seamless supply chain is making available undistorted and up-to-date marketing data at every node within the supply chain (Childhouse and Towill, 2003, 1997). By taking the data available and sharing it with other parties within the supply chain, an organisation can speed up the in-formation flow in the supply chain, improve the efficiency and effectiveness of the supply chain, and respond to customer changing needs quicker. Therefore, information sharing will bring the organization competitive advantage in the long run. The value of information sharing within a supply chain has been extensively analysed by researches. Various studies have used a simulation to evaluate the value of information sharing in supply chains (Towill et al. 1992; Bourland et al., 1996; Chen, 1998; Dejonckheere et al., 2004; Ferguson and Ketzenberg, 2006). The existing literature has investigated the value of information sharing as a consequence of implementing modern IT. However, the formation of a business model and utilization of information is also crucial. Information should be readily available to all companies in supply

chains and the business processes should be structured so as to allow the full use of this information (Trkman et al., 2007). One of the objectives of this paper is to offer insights into how the value of information sharing within case study supply chain is affected when two different models of business process re-engineering are applied.

Time and value adding activity along supply chain

The majority of organisations have a traditional supply chain strategy. In this strategy, each department has its own workspace, and interactions usually occur intra-departmentally. It has been found that within a company whose strategy is of such a traditional form much of the work being executed is non-value-adding. By this, a significant number of the tasks which are carried out are performed more out of procedure than necessity and, had they have been removed, effective output and the general running of the company would not suffer. On the contrary, in fact, the remove such tasks may be beneficial to the company. Over a decade ago, a few companies had been seen to be aware of this and consequently restructured their supply chain to address this matter.

In set up effective SCM, the key factors that need to be focused on are building relationship and creating value. When this is achieved companies become more agile, responsive, and competitive. One of the most significant things in understanding how to build effective SCM is understanding of the time dimension of the supply chain. Within supply chains the need for improvement with respect to time-based resource management is receiving increasing recognition. Research indicates that it is not uncommon for the time spent actually "adding value" i.e. doing things that a customer is willing to pay for, to be as little as one tenth of 1% (Wilding, 2003). Value-adding time is characterized using three criteria:

- Whether the process is physically changing the nature of the consumable item (that is the customer's product/service);
- Whether the change to the consumable item produces something that the customer values or cares about and may be willing to pay for;
- Whether the process is right first time, and will not have to be repeated in order to produce the desired result that is valued by the customer.

Non-value adding activity can be split into three categories: queuing time, rework time and time wasted due to management decisions. A time-based process map can be used to gain transparency of the value adding and non-value adding activities. This map also enables the user to gain transparency of the supply chain process. Example of this time-based process map will be presented in the case study section.

BUSINESS PROCESS RE-ENGINEERING

In re-engineering theories, organisational hierarchies and representation of organisations in terms of different functions are replaced with a process oriented perspective. Organisational structures are redesigned by focusing on business processes and their outcome. Business process re-engineering (BPR) may be seen as an initiative of the 1990s, which was of interest to many companies. The initial drive for re-engineering came from the desire to maximize the benefits of the introduction of IT and its potential for creating improved cross-functional integration in companies (Davenport and Short, 1990). Business redesign was also identified as an opportunity for better IT integration both within a company and across collaborating business units in a study in the late 1980s conducted at Massachusetts Institute of Technology. The initiative was rapidly adopted and extended by a number of consultancy companies and "gurus" (Hammer, 1990).

In BPR, a business process is seen as a horizontal flow of activities while most organizations are formed into vertical functional groupings sometimes referred to in the literature as "functional silos". BPR by definition radically departs from other popular business practices like total quality management, lean production, downsizing, or continuous improvement. BPR is based on efficient use of IT, hence companies need to invest large amount of money to achieve IT-enabled supply chain. BPR is concerned with fundamentally rethinking and redesigning business processes to obtain dramatic and sustaining improvements in quality, cost, service, lead times, outcomes, flexibility and innovation. In support of this, technological change through the implementation of simulation modeling is being used to improve the efficiency and consequently is playing a major role in BPR initiatives (Cheung and Bal, 1998).

BUSINESS PROCESS MODELLING

The business process is a set of related activities which make some value by transforming some inputs into valuable outputs. 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 enterprise'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 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, analyse, improve, streamline, and redesign the way the company performs its work. Process mapping provides a critical assessment of what

really happens inside a given company.

The aims of using BPM are: (1) to help the BPR team obtain a holistic view of the process under study; (2) to identify areas for improvement; (3) to visualize the impacts and implications of new processes; and (4) to describe the rules that underlie the business process (Kovacic, 2007). 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, and bottlenecks, there is a need to achieve the TO-BE state. BPM and the evaluation of different alternative scenarios (TO -BE models) for improvement by simulation are usually the driving factors of the business renovation process (Bosilj-Vuskic et al., 2002). In the next section a detailed case study is presented.

A CASE EXPERIENCE OF BUSINESS PROCESS RE-ENGINEERING

The case study is a Serbian oil downstream company. Serbia is an upper -middle income economy by the World Bank, with a GDP at \$10,792 per capita for 2008 (World Bank, 2008). The point of the case study is to present methodological approach applied in the company of the one developing country which can be helpful for the companies in other developing countries. Observed company's sales and distribution cover the full range of petroleum products for the domestic market: petrol stations, retail and industries. The company supply chain comprises fuel depot-terminals (distribution centre), petrol stations and final customers. The products are distributed using tank trucks. The majority of deliveries is accomplished with own trucks, and a small percentage of these trucks is hired. The region for distribution is northern Serbia. It is covered by two distribution centres and many petrol stations at different locations. In line with the aim of the paper only a fragment, namely the procurement process, will be shown in the next section. A broader description of the case study can be found in (Maslaric, 2008). In order to simulate this business process and identify non-value adding activities, a business process models was developed using the iGrafx Process software. Information about the system was collected from workers and interviews with managers and engineers. An increasing number of details were then added to the model and tested repeatedly, which gradually contributed to the development of the simulation model.

AS-IS model development

The next section covers the modeling of the existing situation (AS-IS) in the procurement process of the

observed downstream supply chain case study. The objective was to map out in a structured way the distribution processes of the oil company. 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 1 was developed.

The core objective of supply 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. Because both the prices and quality of petrol in Europe are regulated, the main quality indicator in oil supply chains is the number of stocks-outs. The main cost drivers are therefore: 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 (Trkman et al., 2007).

The main problems identified when analysing the AS-IS model relate to the company's performance according to local optimisation instead of global optimisation. The silo mentality is identified as a prime constraint in the observed case study. Other problems are in inefficient and costly information transfer mainly due to the application of poor information technology. There is no optimisation of the performance of the supply 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 optimisation leads to global deterioration. The full list of problems identified on tactical and strategic level are identical to those in (Trkman et al. 2007), so for greater detail see that paper. Based on the mentioned problems, some improvements are proposed. The main changes lie in improved integration of whole parts of the supply chain and centralized distribution process management.

TO-BE models development

The emphasis in BPR is put on changing how information transfers are achieved. A necessary, but no means sufficient condition for this is to implement new IT which enable efficient and cheap information transfer. Hence, IT support is not enough as deep structural and organizational changes are needed to fully realise the potential benefits of applying new IT. In this case study we develop two different propositions for BPR (two TO-BE models) to show how the implementation of new IT without BPR and the related organizational changes does not mean the full optimisation of supply chain performance. The first renewed business model (TO -BE 1) is shown in Figure 2 and represent the case of implementing IT without structural

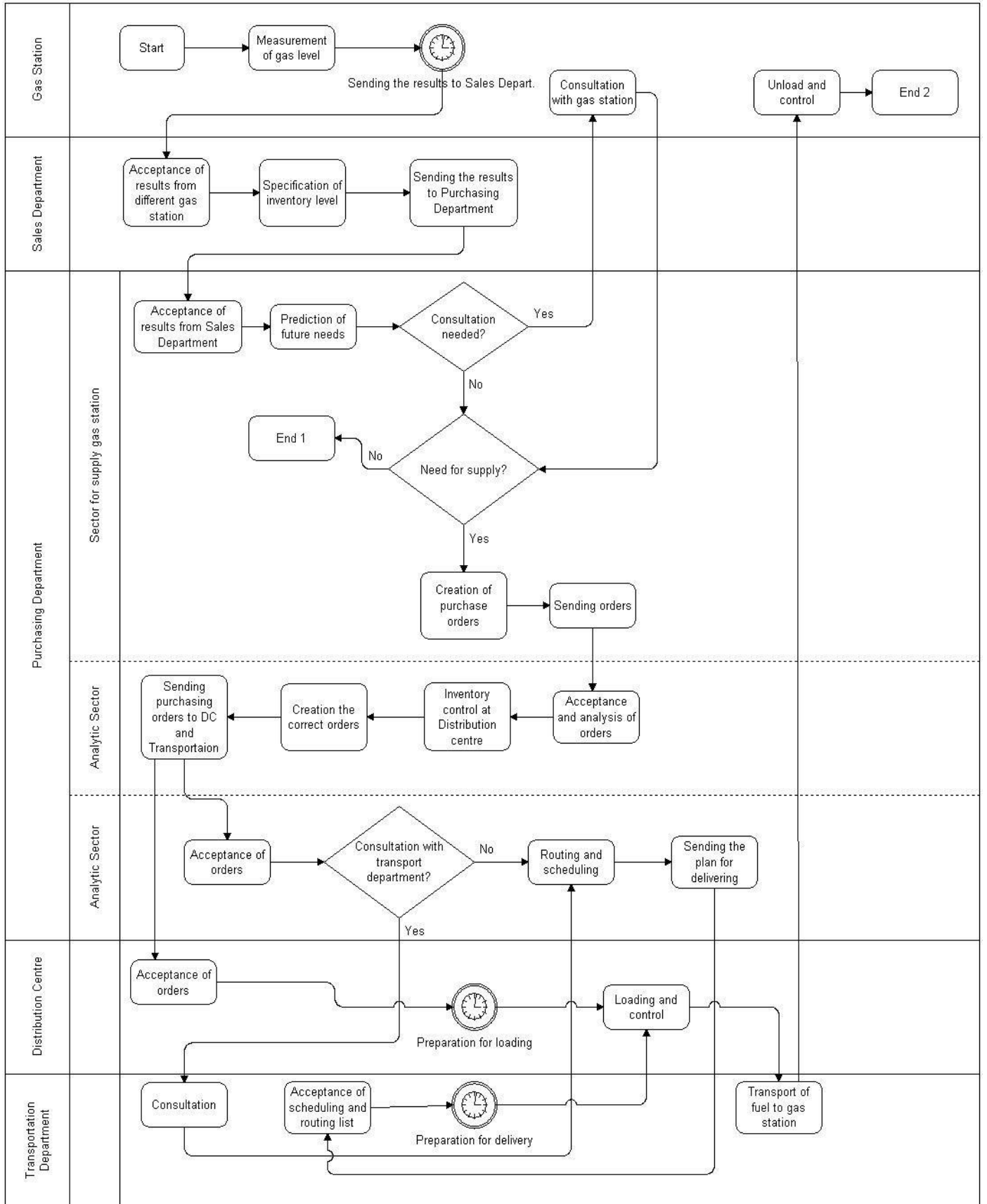


Figure 1. AS-IS model of the process.

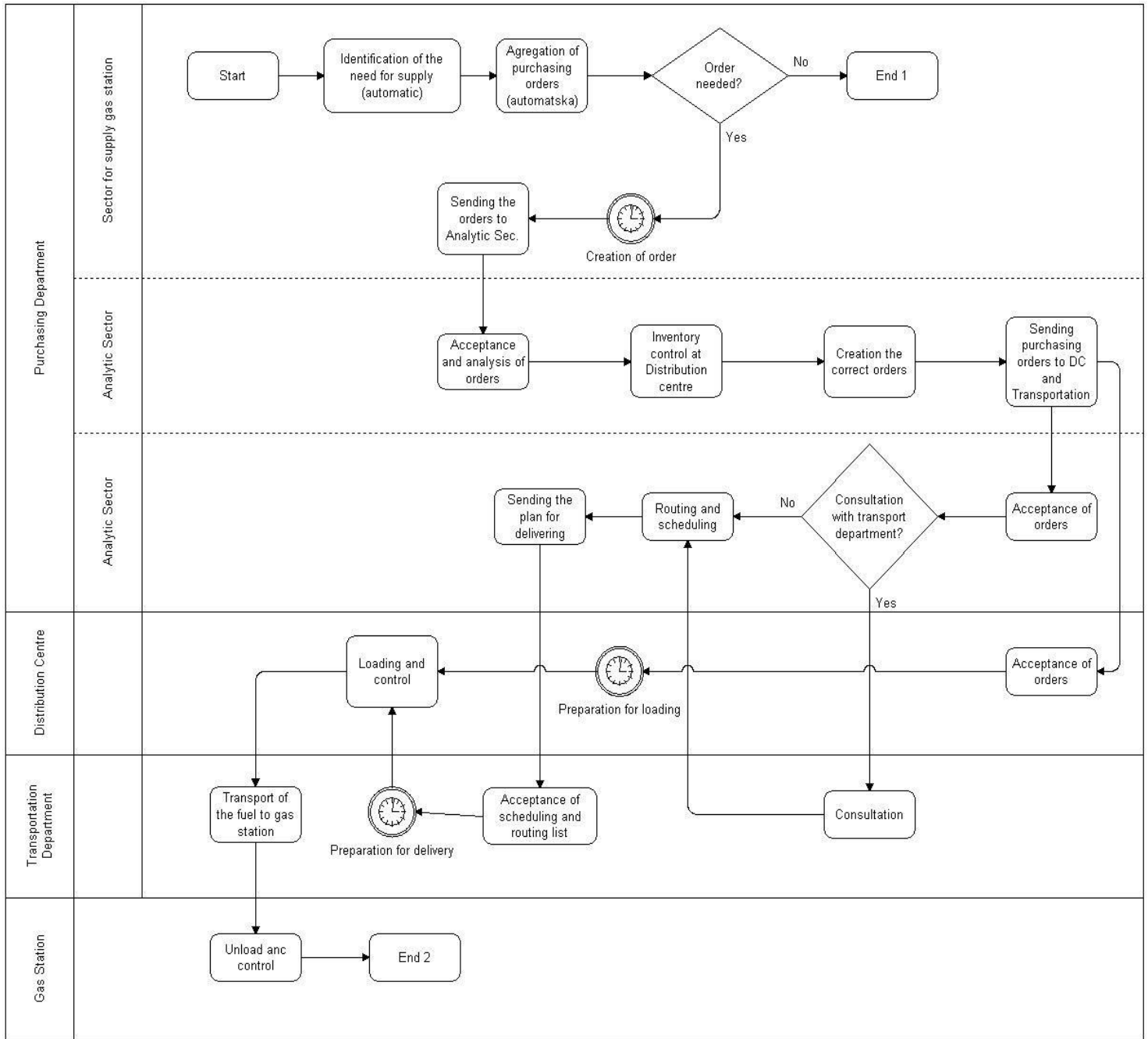


Figure 2. TO-BE 1 model of the process.

changes to business processes. In the TO-BE 1 model, there is no integrated and coordinated activity through the supply chain.

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 downstream oil supply chain are full integrated and the distribution centre takes responsibility for the whole procurement process. The TO-BE 2 business model is shown in Figure 3.

The main idea is that a new organizational unit within the distribution centre takes on a strategic role in co-ordinating inventory management and in providing a sufficient inventory level at the petrol stations and distribution centre to fulfill the demand of the end customer. It takes all the important decisions regarding orders in order to realise this goal. Other changes proposed in the TO-BE 2 model are the automatic measurement of petrol levels at petrol stations and the automatic transfer of such data to the central unit responsible for petrol

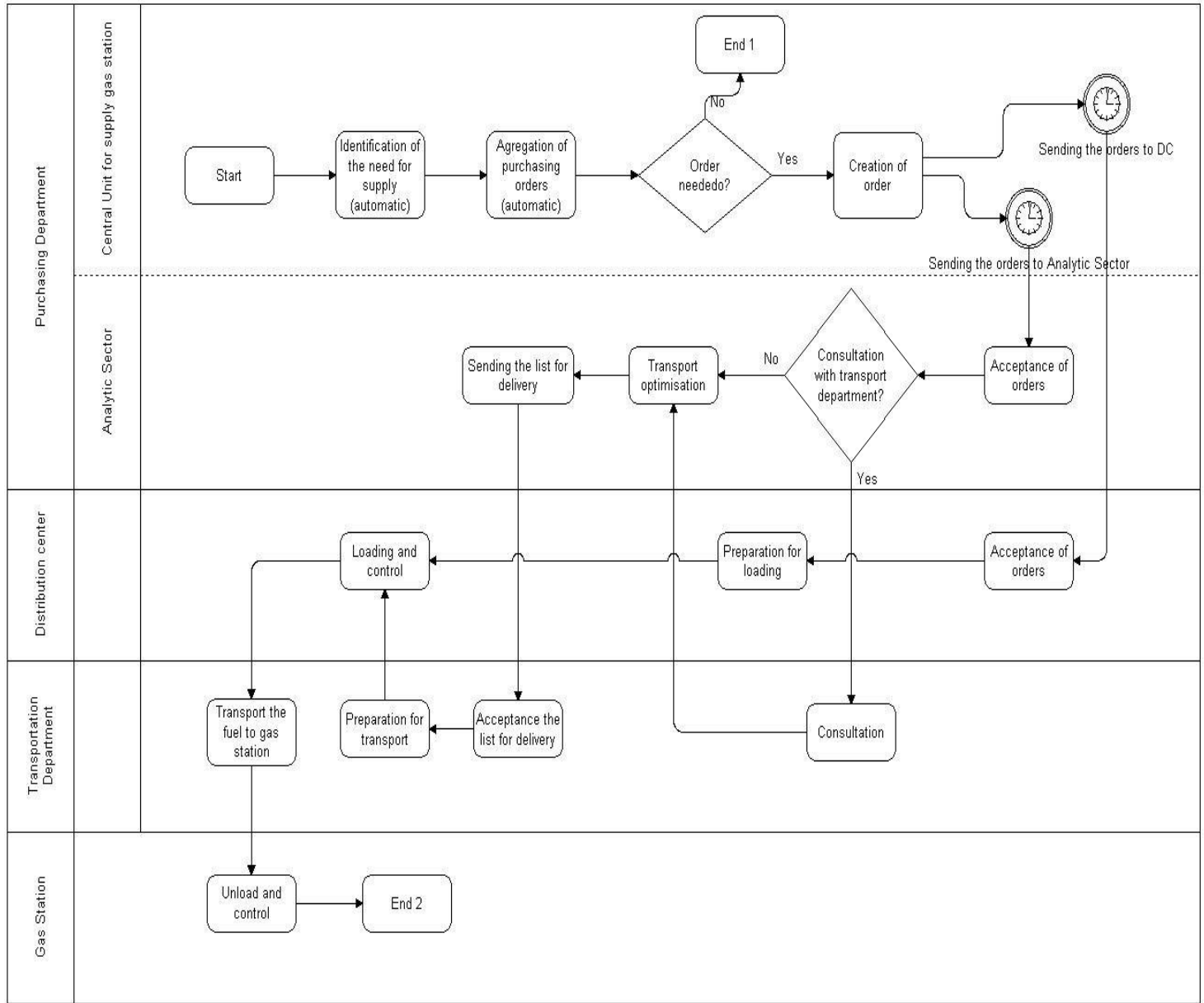


Figure 3. TO-BE 2 model of the process.

replenishment; the predicting of 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.

Measuring the effect of re-engineering

The effect of the changes can be estimated through simulations. We simulated business processes to investigate the impact of BPR on the information sharing value, and value-adding activity, measured by lead times and process execution costs. 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 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 average process costs are reduced by almost 50%, while the average lead time is cut by 62% in the case of the TO-BE 2 business model. A time-based process map shows that BPR will be contributed to the reduction of the non-value adding activities during the average lead time (Figure 4). Decreasing non-value

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

Transaction	Number	Average lead-time (h)	Average work (h)	Average wait (h)	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	27.12	10.26	16.86	56.74
No (TO-BE 1)	1489	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)	1489	0.00	0.00	0.00	0.00

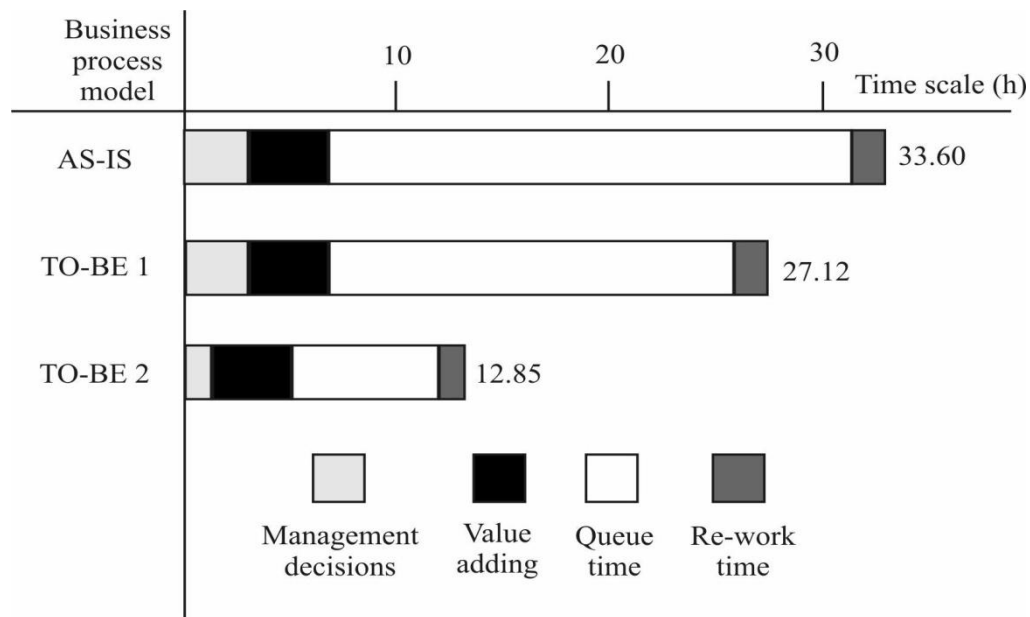


Figure 4. Time-based process map.

adding activities imply increasing competitiveness of the supply chain.

From this it is clear that this renovation project is justifiable from the cost and time perspective. The results in Table 1 and Figure 4 show that a full improvement and effective supply chain management are only possible in the case of implementing both IT which enables efficient information sharing and the re-engineering of business processes. The mere implementing of IT without structural and organizational changes in business processes would not contribute to realising the full benefit.

Conclusion

This paper has investigated the potential of using BPR for improving supply chain performances and competitiveness. A definition of SCM, BPR and relevant issues was presented, together with an overview of the role of IT in supporting BPR. There followed a brief overview of business process modeling methods, with a case study providing an example of its use in oil downstream supply

chain in one developing country. The results of the case study served to illustrate the potential benefits of BPR for improving supply chain performances and establishing competitive supply chain. Effective SCM is critical advance for supply chain competitiveness. Not surprisingly, IT sits at the heart of this advance. Specific technologies may vary from company to company, but the underlying principles remain the same: to create seamless pipeline where product is handled minimally but moves at maximum velocity. The results is a supply chain that can be managed according to approach where the customer order is a starting point, and works down the rest of the chain are such to eliminating waste and trimming processes that do not add value along on the way.

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