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## Re-Engineering the Supply Chain: a Systems Approach for the Electronic Commerce Age

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Saint-Petersburg State University  
**School of Management**

**New Models of Business:  
Managerial Aspects and Enabling Technology**

Proceedings of the International Workshop  
St. Petersburg State University, St. Petersburg, Russia  
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The present volume includes papers submitted to the International Workshop “New Models of Business: Managerial Aspects and Enabling Technology”, St. Petersburg, June 28-19, 2001. The papers cover a wide range of topics pertinent to the interplay between new information technology and business processes.

The volume is published without publisher editing.

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## **Preface**

The present Proceedings includes about thirty papers submitted to the International Workshop “New Models of Business: Managerial Aspects and Enabling Technology” organized by the School of Management at St. Petersburg State University in cooperation with the Institute of Management, Innovation, and Organization at Haas School of Business, University of California, Berkeley. The purpose of the Workshop is to provide a forum for participants from academia, government, and industry involved in research and practice in the area of business processes transformation based on advanced information technology. Considering an interdisciplinary character of the topic, the Workshop is particularly aimed at bringing together specialists in both management and technology to exchange ideas and present their research results.

The papers included in the Proceedings cover a wide range of topics, which reflect the interplay between emerging information technology and business processes. The Proceedings consists of the following parts: “New Management Trends”, “New Models of Business”, “Market Transformation”, “Business Process Re-engineering”, “Integration of Business and Technology”, and “Modeling and Analysis Tools”. Both research papers and presentations in the case study format are presented.

All the papers are published in the form presented by the authors through electronic submission process. In some cases, slight modifications have been made to bring the text into a common format.

I would like to thank all the colleagues who contributed to this volume. I am especially grateful to Viktor Taratoukhine for his assistance in organizing the meeting.

Nikolai Krivulin

# Re-engineering the Supply Chain – A Systems Approach for the Electronic Commerce Age

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## **Abstract**

Recent advances in electronic commerce have provided businesses of all types and sizes with the potential to improve competitive advantage. The potential benefits associated with the embracing of these new technologies include potential access to new markets on a global basis, more effective integration of upstream and downstream supply chain partners and better streamlining of internal and external business processes. In short, the technological potential exists to simultaneously improve customer service levels and to reduce supply chain costs.

However, if this potential is to be realised in practice there is a need to re-evaluate current supply chain configurations. A mismatch currently exists between the technological capability and the supply chain or logistical reality. This mismatch has sharpened the focus on the need for robust approaches to supply chain re-engineering. Traditional approaches to business re-engineering have been based on manufacturing systems engineering and business process management. A recognition that all companies exist as part of bigger supply chains has fundamentally changed the focus of re-engineering. Inefficiencies anywhere in a supply chain result in the chain as a whole being unable to reach its true competitive potential. This reality, combined with the potentially radical impact on business and supply chain architectures of the technologies associated with e-commerce, requires organisations to adopt innovative approaches to supply chain analysis and re-design.

This paper introduces a systems approach to supply chain re-engineering which is aimed at addressing the challenges which the new electronic business environment brings with it. The approach, which is based on work with a variety of both conventional and electronic supply chains, comprises underpinning principles, a methodology and guidelines on good working practice, as well as a suite of tools and techniques.

The adoption of approaches such as that outlined in this paper helps to ensure that robust electronic supply chains are designed and implemented in practice. This facilitates the removal of the major obstacles which many organisations have encountered in attempting to capitalise on the potential benefits of emerging electronic commerce solutions.

Keywords: e-commerce, systems, re-engineering, business processes, methodology.

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## **1. Introduction**

Companies have long realised the need for company-wide approaches to organisation design and redesign. The development of systems engineering approaches to manufacturing system redesign in the 1970s and 1980s (Hitomi, 1996) was followed by the focus on organisational re-engineering, often based on business processes, in the 1980s and 1990s (Macdonald, 1995). A common feature of all of these approaches is a recognition that “the whole is greater than the sum of the parts”. In other words, optimising subsystems (whether those subsystems are functional departments, production sites or individual processes in the manufacturing cycle) can result in a sub-optimised total system. Lack of efficiency and/or effectiveness is often a result of the poorly designed interfaces between subsystems rather than any inherent subsystem weaknesses. There are numerous examples of companies who have generated significant improvements in competitive advantage as a result of the application of this “total systems” thinking.

It must be recognised that a product is delivered to the ultimate customer through a complex interaction of several companies on the way. The manufacturer’s ability to give the customer what they want, when they want it, at the price and quality that they want, is not just determined by the efficiency and effectiveness of the manufacturer’s own operation. Inefficiencies anywhere in the supply chain will reduce the chances of the manufacturer successfully competing against other suppliers. Without a proper focus on total supply chain management, therefore, a company will never achieve true competitive advantage (Christopher, 1999). The increasingly international nature of markets and companies has resulted in many companies becoming part of large and complex global supply chains. In addition, the potential benefits associated with emerging electronic commerce technologies provide the potential to simultaneously improve customer service levels and to reduce supply chain costs. These factors have sharpened the focus on the need for improvements in all aspects of supply chain performance.

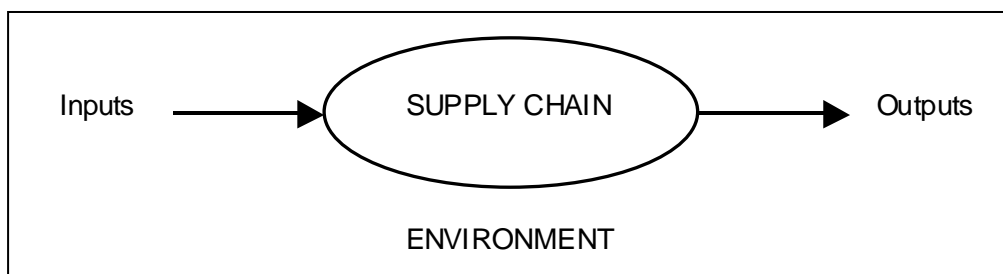
## **2. Elements of The Systems Approach**

The systems approach to analysing supply chains and improving their performance recognises that the process of re-engineering supply chains needs to be carried out in a logical and systematic manner. The approach has been developed based on the experiences of a range of companies in a range of different business sectors. This paper describes the four distinct constituent elements of the systems approach. The principles summarise the underlying thinking and concepts. The methodology is the series of steps to be followed in analysing and improving a typical supply chain. The guidelines on good practice summarise the main relevant elements of world class operating practice. Finally, the tools and techniques support the implementation of the methodology.

### **2.1. Principles**

The Oxford English dictionary describes a system as, ‘a set of connected things or parts; an organised group of things; orderliness’. The italics are those of the author because they highlight those aspects of the definition which provide some pointers to problems which

exist in supply chains and, hence, to the type of change which might be required. Any finite system will have a boundary and anything outside that boundary can be regarded as the environment. An important aspect of the study of systems involves examining the interaction between systems and their environments. Indeed, the way in which a system interacts with its environment will largely determine the usefulness or degree of success of the system. If the supply chain under consideration is regarded as the system then the environment is the business environment in which that supply chain operates. The business strategy of firms is concerned with the interaction between supply chain companies and their business environment (Porter, 1980). Essentially, the strategy formulation process defines the nature of this interaction.



**Figure 1: The supply chain as a system.**

The supply chain system could be regarded as shown in Fig. 1. The interaction of the system with its environment is represented by the system inputs and outputs. In practice, supply chain systems can be broken down into subsystems. This aids understanding of the operation of the system and facilitates systems analysis. Each of the subsystems should display the characteristics of a system; each subsystem will have inputs, outputs and a boundary. When considering a company's internal supply chain the subsystems can be regarded as the company's business processes (e.g. designing, buying, making, moving, selling). These business processes are multidisciplinary activities that cross traditional functional department boundaries. When considering a supply chain which comprises several companies the subsystems can be regarded as the individual companies or the business processes which cross company boundaries. Traditionally, efforts at improving supply chain or organisational effectiveness have focussed on making changes within the subsystems. This often resulted in optimal subsystems but sub-optimal total systems.

The systems approach to analysing supply chains and improving their performance is based on the need to consider the whole system rather than confining improvement efforts to particular subsystems. Developing the best solution requires the analysis, planning and implementation work to be carried out systematically (i.e. methodically, thoroughly and with proper attention to detail). This involves a far reaching investigation and radical reappraisal of the whole supply chain and often results in a complete redesign of supply chain organisation and operations.

## 2.2. Methodology

The systems approach to analysing supply chains and improving their performance involves the application of logical, structured methods rather than relying on making limited improvements in particular areas of the system. The methodology provides guidance on how to address this process in an organised manner, proceeding in logical stages to develop a solution. Fig. 2 shows an outline of the methodology.

STAGE	STEP
INITIATION	<ul style="list-style-type: none"> <li>• Set project scope, objectives and time plan</li> <li>• Create project team or task force</li> </ul>
DATA COLLECTION	<ul style="list-style-type: none"> <li>• Determine structure of supply chain and objectives of each element</li> <li>• Supply chain audit: detailed data collection concerning the companies and their competitors, markets, currently available resources and future resource requirements</li> </ul>
ANALYSIS	<ul style="list-style-type: none"> <li>• Preliminary analysis of supply chain</li> <li>• Identification of key supply chain business processes</li> </ul>
PLANNING/DESIGN	<ul style="list-style-type: none"> <li>• Realignment of organisation and operations in line with key business processes</li> <li>• Detailed design of organisational structures</li> <li>• Detailed design of operational procedures</li> <li>• Develop business plans</li> </ul>
IMPLEMENTATION	<ul style="list-style-type: none"> <li>• Development implementation plans</li> <li>• Implementation of change</li> <li>• Performance measurement</li> <li>• Continuous improvement</li> </ul>

**Figure 2: Methodology for supply chain re-engineering.**

There are a number of features of this methodology which are worth highlighting. The data collection, analysis and planning stages are carried out by a project team or task force. Such a team is multi-company (multidisciplinary in the case of internal company supply chains) and possesses the knowledge and skills necessary to carry out the tasks required. It should have the commitment of management and be dedicated to its task for the duration of the project. Once the overall structure of the supply chain has been determined and the strategic objectives of each element identified, the task force carries out a supply chain audit. This audit involves collection of detailed data concerning all aspects of the supply chain. The

general classifications of data to be collected are: general company and competitor data; market and customer data; data concerning currently available supply chain resources; and, data concerning future resource requirements. The supply chain audit is one of the most important parts of the methodology and it results in a considerable volume of data. The next stage of the methodology involves analysing this data with a view to identifying the key supply chain business processes. The planning/ design stage involves (top-down) realignment, and (bottom-up) detailed design of supply chain organisational structures and operational procedures. Business plans for each element in the realigned organisational structures are also required. Detailed implementation plans define how the required change will be put into place. An effective performance measurement system forms the basis of the continuous improvement process.

### **2.3. Guidelines On Good Practice**

Every supply chain is unique. It has unique products, processes, people and a lot more besides. Hence, there is no universal solution which can be applied which will automatically result in a supply chain achieving its optimum competitive potential. The methodology helps to identify the most suitable solution for a particular supply chain but there are approaches which appear to exist in the majority of world-class companies (Schonberger, 1996).

These approaches include employee involvement, total quality management, JIT, (total) preventive maintenance and a philosophy of continuous improvement. The key is not to blindly copy the approaches used by successful companies but to learn from their experiences. Education and training of project team members plays an important role in this.

### **2.4. Tools and Techniques**

A potential problem when analysing supply chain organisation and operations is that there are few (if any) established analytical tools which can be employed. The lack of such tools can result in practitioners failing to apply a methodical, scientific approach and instead relying purely on experience, intuition and iteration. However, there are many techniques in use in other fields which are relevant to supply chain analysis. Such approaches include financial analysis, strategic planning techniques (e.g. SWOT analysis, the Porter model), Pareto analysis, systems analysis techniques (e.g. input/output analysis, flowcharting), IDEF0 and process mapping. These techniques can be used to support various stages of the methodology with many being particularly useful at the analysis stage.

In addition, computer-based tools, which assist in the application of the techniques, are also available. Many of these tools are useful in managing the data collected during the supply chain audit. Useful tools include spreadsheets, databases, visual interactive simulation and project planning software.

## **3. Conclusions**

The systems approach (to analysing supply chains and improving their performance) provides a basis for achieving world class standards for supply chains operating in all types

of industry. The approach involves considering the whole supply chain and avoiding a situation where subsystems are optimised but the whole supply chain is sub-optimal. To apply the approach requires a methodology, a recognition of what constitutes good working practice and the use of tools and techniques to perform the required analysis. The process of supply chain analysis and improvement is complex – it requires total management commitment and dedicated resources. With this commitment and the necessary resources, the use of the systems approach can result in significant improvements in supply chain performance. It is only in this way that the mismatch between the electronic commerce technological potential and the logistical supply chain reality can be addressed in any meaningful way.

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