Efficient supply chain management is crucial for survival and success in a turbulent world. Current economic crisis increases its importance even further. The paper reviews latest findings in the most relevant areas, namely the importance of a proper supply chain strategy that is a pre-condition for business process renovation and mitigation of supply chain connected risks. Performance measurement is also a pre-condition for proper management. Supply chain frameworks and standards that provide guidelines in facing those challenges are reviewed. Finally, the benefits of supply chain informatization are shown.

**Key-Words:** Supply chain management, business renovation, IT, supply chain risks, supply chain frameworks

### 1 Introduction

It has often been claimed that in the modern world the competition is no longer between single companies but between supply chains [1], [2]. Anecdotic evidence also supports this claim (e.g. the problems in automotive industry due to supplier failures or the infamous Nokia-Eriksson-Phillips example [3]). However, most of the papers are focused on mathematical methods for supply chain optimization instead of an overview of business-related challenges connected to supply chains. The challenge for firms today is namely not just to take up a supply chain management (SCM) initiative but to implement it successfully. An informatics perspective is vital since information flow is an integral part of SCM and material flow is closely dependent on information flow. But SCM initiative can be a failure unless one is aware of the issues that may arise during its planning or implementation [4]. However, SCM is, at best, still emergent in terms of both theory and practice [5], therefore both further research and classification of previous research efforts is needed. This paper mainly contributes to the second purpose; namely it presents several important issues in SCM.

### 2 Current issues in SCM

#### 2.1 Strategic insights

Earlier purchasing was wedded to routine in many companies. For the last two decades though, no company can allow purchasing to lag behind other departments in adjusting to worldwide changes [6]. The recognition of the SCM as a key and vital area, both in the private and public sectors, has focused attention on its effectiveness. In a number of organizations, cost-effective supply chain is a matter of survival as purchased goods and services account for up to 80 per cent of sales revenue [7], while in the public sector there is an ever-increasing demand for savings in the procurement process [8]. However, there is (in line with the contingency theory) no single best way of organizing/leading the supply chain that is effective in all situations and there is no universal set of choices that is optimal for all SCs (adapted from [9], [10]). In order to optimize the SC the following five configuration components are critical: operations strategy, outsourcing strategy, channel strategy, customer service strategy and asset network [11]. The four main approaches towards production are make to stock, make to order (see e.g. [12] for a comprehensive review of make to order SC challenges), configure to order and engineer to order [11] – they considerably affect the correct strategy. According to Aberdeen Research the top challenges facing the modern supply chains are the lack of communication across departments, lack of communication with external partners and lack of alignment between business goals and information technology [13]. Our paper will deal with each of those challenges.

#### 2.2 Business renovation in SCM

After successful strategy preparation, companies have to identify areas of possible improvement in quality of product or service, lead times or operational costs. This step takes an integral view of all organisations involved into the supply chain in order to renovate their operations towards supply chain excellence. Business Renovation (BR) or business process renovation and informatisation efforts integrate the radically strategic method of Business Process Re-engineering (BPR) and...
more progressive methods of Continuous Process Improvement (CPI) with appropriate IT infrastructure strategies. BPR is a thorough re-engineering strategy that critically examines current business policies, practices and procedures, rethinks them and then redesigns the mission-critical products, processes and services [14]. BPR seeks improvements by elevating efficiency and effectiveness of the business process that exist within and across organizations. On the opposite, CPI refers to minor and specific changes that one makes in an existing business process [15]. CPI relies on building a fundamental understanding of customers’ requirements, process capability, and the root cause of any gaps between them by developing culture of continuous improvement in the areas of reliability, process cycle times, costs in terms of less total resource consumption, quality, and productivity. Six Sigma and Total Quality Management (TQM) are examples of approaches to CPI. BR argues for a balanced approach between radical changes and continuous improvements. According to Jacobson [16], we view business renovation as an umbrella concept for strategic IS planning, and both BPR and CPI since thorough and effective renovation should combine both, radical shifts (BPR) with those that permanently increase business efficiency and effectiveness (CPI).

Since direct changes can have a detrimental result, companies develop business models [17]. A business 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. There are several reasons producing business models [18]:

- A business model helps us understand the business: one of the primary goals of business modelling is to increase understanding of the business and to facilitate communication about the business.
- A business model is a basis for creating suitable information systems: descriptions of the business are very useful in identifying the information systems necessary to support the business. Business models also act as a basis for engineering requirements when a particular information system is being designed.
- A business model is a basis for improving the current business structure and operation: as it shows a clear picture of the business current state, a business model can be used to identify the changes necessary to improve the business.
- A business model provides a polygon for experiments: a business model can be used to experiment with new business concepts and to study the implications of changes for the business structure or operation.

- A business model acts as a basis for identifying outsourcing opportunities: using a business model the core parts of a business system can be identified. Other parts considered less important can be delegated to external suppliers.

The main purpose of developing and analysing business models is to find revenue and value generators inside a reversible value chain, or a business model's value network.

2.3 Supply chain risks

The risk of disruptions caused by both factors within SC and outside environmental forces is a topic of increased importance. Supply chain risk management is therefore a field of escalating importance and is aimed at developing approaches to the identification, assessment, analysis and treatment of areas of vulnerability and risk in SCs [19]. Various trends that enhance exposure to risks, such as the increased use of outsourcing, globalisation, reduction of the supplier base; reduced buffers, increased demand for on-time deliveries or shorter product life cycles [20] are increasing the importance of SCRM. The recently developed model ([21], shown in Figure 1) sheds more light on the prediction of suppliers’ connected risks. It is based on the premise that different suppliers (and their second and third tier suppliers) operate in different markets and environments; therefore their turbulence and the forces influencing a supplier also differ. While a certain supplier strategy (e.g. ordering large batches to decrease procurement costs or single-source suppliers with long contractual commitments) may be acceptable in a non-turbulent environment, it may be detrimental in a more turbulent one (e.g. in the presence of quick technological advances such as microprocessors or large commodity price swings). Considering all of this, the same supplier attributes, strategy and structure may pose considerably different risks of disruption. Therefore, a comprehensive approach to SCRM has to include supplier-associated turbulence as well as various sources of uncertainty due to supplier attributes such as strategy, structure and performance.

In order to distinguish between the different kinds of risks, the sources of uncertainty were separated into two different constructs [21]:

- Endogenous uncertainty: the source of uncertainty/risk is inside the SC and can lead to changing relationships between focal firm and suppliers, the most notable kinds are market and technology turbulence. Market turbulence is likely to arise from the heterogeneity and rapid changes in the composition of customers in the market and their preferences [22]. It means continuous changes in customers’ preferences/demands, in
price/cost structures, and in the composition of competitors [23]. Technological turbulence refers to the degree to which technology changes over time within an industry and the effects of those changes on the industry [24]. Technological turbulence arises from changes in the underlying technologies of products or services and their rates of obsolescence [22]. Technical dynamics includes how fast the related technology is changing, as well as breakthroughs in the manufacturing process, and mass production techniques [25];

- exogenous uncertainty: the source of uncertainty/risk is from outside the SC. These risks are further divided into the two most notable kinds; namely discrete events (e.g. terrorist attacks, contagious diseases, workers’ strikes) and continuous risks (e.g. inflation rate, consumer price index changes).

The current approaches only offer a limited estimation of the risk of supplier non-performance. The proposed approach (see [21] for more details) enables the estimation of the risks and helps the company to make a more informed decision as to how much risk it is willing to take and which risks will it mitigate (either with dual/multiple sourcing or with the change of supplier). Dual sourcing is namely an important topic – while it may increase the costs due to activities connected with supplier search and qualification it can considerably decrease the costs of supplier non-performance or even bankruptcy (see e.g. [26, 27]).

### 2.4 Supply chain frameworks and standards

In order to streamline businesses and bridge the supply chain risks, different frameworks and standards (SCOR, GS1, MMOG/LE, ISO 9001, ISO 14001, BS OHSAS 18001, BS 25999, ISO/IEC 27001, etc) have been developed. The organizations are facing the challenge which one to implement and to what extent. The adoption of frameworks and standards causes standardization of business operations that is in contradiction with agile supply chain strategies and lean business models. From the business model point of view the most relevant is the Supply-Chain Operations Reference (SCOR) model that was developed by the Supply-Chain Council (SCC) to assist organisations in increasing the effectiveness of their supply chains, and to provide a process-based approach to SCM [28]. The SCOR model (Figure 2) provides a common process oriented language for communicating among supply-chain partners in the following decision areas: PLAN, SOURCE, MAKE, DELIVER and RETURN.

Figure 2: SCOR framework

![SCOR framework](Image)

Source: [www.supply-chain.org](http://www.supply-chain.org)

Researching the link between frameworks or standards and supply chain performance is scarce. Lockamy & McCormack [29] have studied the link between SCOR planning practices and supply chain performance and shown that the supply chain planning practices related to process integration, collaboration, teaming, process measurement, process documentation and process ownership have been shown to be important to supply chain performance, but lack broad implementation by supply chain partners. This suggests that integrated supply chain management may be more difficult to operationalize in practice than the popular supply chain press or consultants would have one to believe. This study also suggests that some of the best practices proposed as mechanisms for improving overall supply chain management performance may not have the degree of impact often presented in the literature. Some
best practices help to improve supply chain performance only in specific decision areas.

### 2.6 Performance measurement in SCM

A well-known saying is that: ‘You Can’t Manage What You Can’t Measure’. Therefore all frameworks and research efforts emphasize the importance of performance measurement. The starting point for performance measurement is that the metrics should:

- be directly related to the manufacturing strategy,
- primarily use non-financial measures,
- vary between locations,
- change over time, as needs change,
- be simple and easy to use,
- provide fast feedback to operators and managers,
- be intended to foster improvement rather than just monitor[30].

Performance measurement focuses on two connected but still separable areas, namely the measurement of performance of each supplier and the measurement of supply chain as a whole. The classic metrics for supplier performance measurement are replenishment lead time, on-time performance, supply flexibility, delivery frequency, quality, viability, information coordination capability etc. [31]. According to the recent survey the most important measures are quality of delivered goods, on time delivery and flexibility of supply [32]. Since balanced scorecard [33] is in general one of the most widely used models for performance measurement its application to supply chain area has also been proposed. Such an example is presented in [34] who derived the objectives for SCM from financial, customer, business process (both internal and external) and learning and growth perspective. As shown performance measurement is closely connected with process renovation outlined in the previous section (see e.g. [35] as an example of performance metrics for each of the supply chain processes.

Different performance measures can also be used at various decision areas of the SCOR model; for example supplier delivery performance and purchase order time are suitable metric for “SOURCE” while utilization of resources or percentage of defects are more relevant for “MAKE” phase (see e.g. [32] for more details). The review of customer and internal facing metrics is also shown in figure 3.

One of the increasingly popular approaches for both measurement of effectiveness and prediction of changes due to renovation of supply processes is the use of simulations. They enable the preparation of the models of current and desired state [36] and can be used to estimate the risks of different events [37]. In connection with business process modeling (see chapter 2.2. of this paper) they can be used to compare different configurations of business processes [38].

#### Figure 3: Main metrics for supply chain performance measurement

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<thead>
<tr>
<th>Supply chain process</th>
<th>Measurement criteria</th>
<th>Performance indicators</th>
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<td>Customer facing</td>
<td>Supply chain reliability</td>
<td>Delivery performance</td>
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<td>Order fulfillment performance</td>
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<td></td>
<td>Flexibility and Responsiveness</td>
<td>Supply chain response time</td>
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<td>Production flexibility</td>
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<td>Internal facing</td>
<td>Costs</td>
<td>Total logistics management costs</td>
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<td>Value added productivity</td>
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<td>Return processing cost</td>
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<td>Assets</td>
<td>Cash to cash cycle time</td>
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<td>Inventory days of supply</td>
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<td>Asset turns</td>
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Source: [43]

### 2.7 Supply chain informatization

Final issue in SCM is supply chain informatization which is by far an easy task. Information technology is an important enabler of effective supply chain management. Much of the current interest in SCM is motivated by the possibilities that are introduced by the abundance of data and the savings inherent in sophisticated analysis of these data (see e.g. [39] for several successful case studies). The innovative opportunities coming to the fore with e-business have also increased the interest in IT. From technological perspective SCM spans over internal as well as external systems, which facilitates information transfer between various organizations. In addition, SCM typically includes many functional areas within an organization and is affected by the way the various groups communicate and interact.

According to Simchi-Levi [40] ultimate goals (Figure 4) of IT are to collect, access and analyze information. In practice that SCM systems have to:

- collect information on each product from production to delivery or purchase point and provide complete visibility for all parties involved,
- access any data in the system from single-point-of-contact,
- analyze, plan activities, and make trade-offs based on information from the entire supply chain.

In order to achieve these goals major issues (Figure 4) in informatization are standardization, infrastructure e-business, supply chain components and integration. Standardization is vital for IT since it allows systems to work together and is a key feasibility factor of SCM implementation. Infrastructure is a basic component of system capabilities without which some of the goals
cannot be achieved. E-business is an emerging area of business conduct that provides cost-effective way of SCM. Supply chain components are various systems that are involved directly in supply chain planning. These are typically systems that combine short-term and long-term decision support system elements.

**Figure 4: Goals and means of SCM – an IT view**

![Diagram of supply chain management goals and means]

Source: [40]

The goal of SCM software is to increase flows through collaboration. However, increasing collaboration is not merely a matter of making a tool available. Participants must be encouraged to use the tool share information to make its use effective. Ruppel [41] compared adoption of three information technologies (i.e. group decision support systems, EDI and e-business) that can be used to improve information flows and the factors that affect their adoption and use. Comparison indicates that the decision to adopt one of these technologies does not guarantee its effective use. Those who wish to champion the use of tools have a complex task to perform not just to foster adoption, but also to encourage successful implementation.

### 4 Conclusion

The paper has tackled a vital challenge to provide a comprehensive review of several inter-connected challenges in supply chain management. Only continuous efforts in each of the mentioned areas assure the efficient and successful. Nevertheless, optimal decision making is not possible since the choice set is too complex and generally unknown, for due to the large number of possibilities and uncertainties. Therefore SCM «optimization» involves a small number of choices at each step of exploration [42]. We hope that our paper is a small but significant contribution in this quest.

**References:**


