Increasing Effectiveness of Supply Chains Using SCM Applications

Pavol Jurík
University of Economics in Bratislava
Department of Applied Informatics, Faculty of Economic Informatics
Dolnozemská cesta 1
Bratislava, 852 35 Slovakia
e-mail: pavol.jurik@euba.sk

DOI: https://doi.org/10.15414/isd2022.s5-2.06

Abstract
We are currently witnessing a sharp rise in prices, not only in Slovakia but throughout Europe. This price increase is caused by rising prices for many basic commodities on world markets, such as wheat, oil and natural gas. Energy prices, transport costs, as well as the prices of basic raw materials are rising, which must naturally be reflected in the increase in the prices of products intended for the final consumer. However, the prices of many products can also be affected by the efficiency of the supply chain that ensures their production. By clarifying all flows and relationships in the supply chain and optimizing its operation, we can reduce the price of the product. An SCM (supply chain management) application can be a useful tool to plan, record, evaluate and optimize the operation of a supply chain and facilitate mutual cooperation among the subjects that make it up. According to a survey, which we have done, there is not a single company using an SCM application in Slovakia today. The aim of this article is to point out the benefits and possibilities of such applications as one of the possible ways to mitigate the effects of inflation on the population.

Keywords: business processes, costs reduction, SCM, supply chains, supply chain management

JEL Classification: D23, D24, L22, L23

1. Introduction
In a world of fast-growing information society and growing competition, companies must strive to be part of efficient and reliable supply chains. Otherwise, they may not be able to compete in the global market against other competitors in the market, which may lead to their absorption by other companies or complete extinction. Many companies would not be able to carry out all the activities related to the production and distribution of their products to the final consumer on their own, so the existence of supply chains is the only way for them to establish themselves in the market. Supply chains can consist of a large number of subjects and can be quite complicated in terms of their structure. The larger and more complex the chain, the easier it is to lose track of what exactly is going on in it. To solve these problems SCM (Supply Chain Management) applications may be used, whose task is to clarify all relationships and flows in a supply chain and thus to contribute to streamlining its operation. The initial goal of this article was to find out the experience of Slovak companies with supply chain management applications. In a survey, which we have done, we have found out that there is not a single company using an SCM application in Slovakia today. This finding may seem like a failure, but it is valuable information. After this finding we have had to change our goal. Thus, the actual goal of this article is to highlight the meaning of SCM applications for supporting the cooperation of subjects in a supply chain based on the data in literature and experience of companies abroad.

A supply chain is a system created by business processes of all organizations that are directly or indirectly involved in meeting the requirements of customers of a particular organization. It may consist of the following subjects in particular: manufacturers, suppliers, subsuppliers,
carriers, storage space providers, assembly companies, wholesalers, retail stores and customers. La Londe and Masters proposed that a supply chain is a set of firms that pass materials forward. Normally, several independent firms are involved in manufacturing a product and placing it in the hands of the end user in a supply chain—raw material and component producers, product assemblers, wholesalers, retailer merchants and transportation companies are all members of a supply chain (La Londe & Masters, 1994). Göpfert (2013) divided the definitions of SCM into two groups. The first group includes definitions of SCM identical with logistics based on rule 7R (i.e. right product, right place, right customer, right time, right condition, right quantity) (Coyle et al., 2002), while the second group includes definitions close to the explanation presented by the CSCMP (Council of Supply Chain Management Professionals, 2018), where SCM is not directly identified with logistics but treated as intra-organizational process management, i.e. the management of the connection networks and cooperation, and, thus, as a new concept (Dobroszek, 2018). Many definitions of supply chain were cited by Mentzer et al. (2001).

The process of products creation and their distribution to the final consumer contains a large number of sub-processes such as procurement of primary and secondary raw materials needed for production, production sub-processes, transport sub-processes (transport of raw materials to the place of production, but also transport of finished products to a warehouse and their gradual distribution to stores), assembly sub-processes, storage-related sub-processes, customer feedback acquiring sub-processes, etc. Thanks to the existence of supply chains, not all of these sub-processes need to be provided by a single company, but several companies specializing in specific sub-processes may be involved in their provision. As a result of the cooperation among the businesses and the interconnection of the activities they carry out, specific products are then available to the final consumer. Stadtler states that „competition has shifted from single companies to supply chains. Obviously, to convince an individual company to become a part of a supply chain requires a win-win situation for each participant in the long run, while this may not be the case for all entities in the short run. Alternatively, a firm may increase its competitiveness by fulfilling a prespecified, generally accepted customer service level at minimum costs.“ (Stadtler, 2008).

SCM (Supply Chain Management) is a label for „systems, means and procedures that serve to coordinate materials, products, services, information and finance from raw material suppliers through processors, manufacturers, wholesalers and retailers to consumers” (Križko, 2002). On-line dictionary BusinessDictionary.com defines supply chain management as: „managing material and information flows in the supply chain so that the customer achieves the highest level of customer satisfaction with the chain's outputs at the lowest possible cost“ (BusinessDictionary.com, 2022). Another definition notes a supply chain is „the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer“ (Christopher, 1992).

In terms of systems theory, a company can generally be considered an open production system that receives inputs from its surroundings, transforms them into outputs, and then surrenders them to the environment. The supply chain as a whole can also be considered as an open production system. However, it is a system made up of separate business entities that seek to harmonize some of the activities they carry out so that such cooperation benefits them as much as possible.

According to Tomek and Tomková, the success of a company in the conditions of globalization and interconnection of companies using information technology becomes a question of success of all companies who are involved in creating the final product. The competition of entire
companies thus changes to the competition of entire supply chains formed by suppliers, manufacturers, carriers, distributors, retailers and other entities up to the final consumer (Tomek, Tomková, 2007). The importance of supply chains is also increasing due to the shortening of the product life cycle and increasing customer expectations regarding product quality, reliability and speed of delivery, flexibility in production and additional service provided after their purchase.

In every supply chain, material, financial and information flows flow in both directions among companies that make it up:

- **Material flows** – it is the distribution of products in the direction from manufacturers to customers or the distribution of materials and raw materials from suppliers to manufacturers. The products are moved in the opposite direction for service, recycling or disposal.
- **Financial flows** – various types of payments, loans, fees
- **Information flows** – transmission of information among companies forming the chain (orders, invoices, different kinds of requirements and documents).

A supply chain can be represented either from a structural or a process point of view. From a structural point of view, it is a network of separate companies with different positions in the chain. The process point of view, in turn, expresses the fact that the whole business process that takes place in the supply chain consists of many sub-processes that follow each other (the outputs of one process are inputs into another) generating the final value for the customer. Individual processes can be modeled using appropriate modeling methodologies and standards, which include for example the ARIS methodology (Architecture of Integrated Information Systems) or BPMN (Business Process Model and Notation) and UML (Unified Modeling Language) standards.

### 2. Data and Methods

Initially, the main goal of this article was to find out if there are any companies using an SCM application in Slovakia and, if so, what experience and results do they have using it. In January 2022, we conducted a survey in which we asked large companies in Slovakia if they used or are using an application for relationship management in their supply chain and, if so, which one. We included 100 large companies in the survey. We did not include small and medium-sized enterprises in the survey. We consider a large company to be a company with at least 250 employees and an annual turnover of more than 50 million EUR, which is in accordance with the document *Aid to determine the size of the company for state aid for the programming period 2014-2020* issued by the Ministry of Environment of the Slovak Republic in 2015 (Ministry of Environment of the Slovak Republic, 2015). According to the report on the state of the business environment in the Slovak Republic published by the Ministry of Economy of the Slovak Republic on 12 April 2021, 642 large enterprises were registered in Slovakia in 2020 (Ministry of Economy of the Slovak Republic, 2021). Therefore, we can consider a sample of 100 randomly selected companies in our survey to be statistically significant.

The questionnaire contained a single question only, namely whether the company in question used or is using an application for relationship management in their supply chain and, if so, which one. We sent the questionnaire by e-mail and received 62 answers of the total number of 100 addressed companies. Subsequently, we planned to send another questionnaire to the companies that used or use an SCM application, which would contain more questions, and in
which we would intend to find out what experience these companies have with the application and whether they feel any real benefits from its use. However, this second questionnaire was never done, because we found out that none of the addressed companies in Slovakia uses or used any SCM application. All 62 responses were negative. Based on personal interviews and contacts, we know of one company in the Czech Republic and another company in Austria that uses an SCM application, but we have not been able to find any company in Slovakia with such an experience. This finding may seem like a failure, but it is valuable information. Due to this finding, we could not analyze the experience of Slovak companies in terms of their supply chain management. So we had to change our goal and collect data published on the Internet and in the literature originated from companies abroad and analyze their experience. We hope that this will motivate and inspire some companies in Slovakia to look for new ways of making their supply chain more transparent and effective.

3. Results and Discussion

Supply chains can consist of a large number of subjects (companies) and can be quite complicated in terms of their structure. The larger and more complex the chain, the more easily we can lose track of what exactly is going on in it. Unnecessary lengthening of individual processes, inefficient use of funds, overpricing of the final product and other problems may occur. The task of SCM applications is to clarify all relationships and flows in the supply chain and thus contribute to streamlining its operation. The SCM application shall support the following activities in particular (Martiško, 2005):

- joint planning of deliveries of all suppliers and subcontractors in the chain in connection to the production plan,
- support and evidence of information flows and exchange of relevant documents in both directions in the chain,
- management of physical realization of deliveries and their coordination,
- integration of information systems of companies participating in the supply chain,
- supporting other processes that are specific to individual industries and companies can also be an advantage.

Initially, the need for planning and control of material flows in supply chains was emphasized, but in the era of the growing information society, in which we live currently, the rapid and efficient exchange and evidence of information is also very important. The right information must be available to the right subject (company) at the right time. This fact reinforces the need to connect subjects in the supply chain with a quality information system that will facilitate and streamline communication among them. When managing the supply chain, it is necessary to work with information from inside the chain (in other words, with internal information), but also with information from its surroundings (with external information). External information is e.g. information on competition, information on technological innovations in the world, information on the current state of financial markets, information on changes in the legislation of individual countries in which the supply chain operates, etc. Internal information includes in particular:

- *Purchasing information* – information on what materials, products or semi-finished products need to be purchased in order to produce the final product of the supply chain, information on their prices, delivery times, required delivery points, payment terms, etc.
- *Production information* – information on what products and in what quantities are to be produced, what technologies, production machines and equipment are to be used in their
production, in which production plant the product is to be produced, what is the order
of production of individual products and other information.

- **Distribution information** – information on what shall be transported and where, at what
  transport costs and under what transport conditions,

- **Storage information** – information on what materials, semi-finished products and
  products there are in which warehouse, in what quantities, where they come from, etc.

- **Sales information** – information on customers and their requirements. In other words,
  who demands what, at what price, at what time, in what quality and quantity, and what
  is the history of the requirements of the individual customer.

According to the SCOR (Supply Chain Operations Reference) model, a comprehensive and
effective supply chain management should focus on five basic areas, including planning,
purchasing, production, shipping and handling of complaints (Basl, Blažiček, 2012; APICS,
2012). Let's focus on these areas individually:

- **Planning** – all resources in the chain need to be managed in order to meet the customer’s
  requirements and expectations related to the final product of the supply chain.
  Therefore, metrics shall be defined to monitor and evaluate the performance of the
  whole chain so that it generates a high value for the customer at lowest cost possible.
  The degree of efficiency of a chain can be measured, for example, by its throughput,
  which represents the number of products produced by the chain per unit of time, but
  also by the degree of customer satisfaction regarding purchased products.

- **Purchasing** – a part of the purchase is not only monitoring the movement or flows of
  materials, raw materials, products and semi-finished products from one subject in the
  supply chain to another and records of related documentation, but also the selection of
  the optimal supplier with regard to current production requirements. It is not just about
  the selection of suppliers of materials and raw materials, but also the services needed to
  create the final product for the customer (e.g. assembly, independent testing,
  warehousing, etc.). It is necessary to take into account not only the price conditions of
  individual suppliers, but also their delivery, quality and payment conditions.

- **Production** – this area includes not only activities within the processing of materials and
  raw materials and their transformation into the final product, but also activities related
  to the temporal and spatial scheduling of all activities that are part of the production
  process. E.g. product testing (we distinguish between continuous testing of selected
  parts of the unfinished product and final product testing), product packaging and
  preparation for shipment. These parts of the supply chain are the most demanding in
  terms of requirements for measuring output quality as well as productivity of employees
  involved in production.

- **Dispatching** – the term dispatching includes mainly the preparation (e.g. packaging) of
  a certain shipment for dispatching and its subsequent sending to the addressee.
  However, the storage of materials, products and semi-finished products at the level of
  various subjects (companies) in the supply chain and their consistent evidence are also
  part of the the dispatching process. Transport shall be optimized so that all items are
  transported to their destination, while minimizing shipping time and/or minimizing
  shipping costs.

- **Complaints handling** – i.e. solution of problems related to the receipt and registration
  of damaged or incorrectly delivered (unwanted) goods returned by the customer and the
  handling of customer complaints. Complaints are not necessarily bad because they are
  a valuable source of information for individual subjects in the supply chain about the
  various shortcomings that need to be addressed.Therefore, it is important to pay
  adequate attention to the evidence of complaints and their proper handling.
The purpose of introducing SCM applications into supply chains is to strive for improvement, especially in the following areas (Jurík, 2016; Martiško, 2005):

1. **Minimization of supply chain operating costs.** In particular, cost reduction shall be achieved through:
   - increasing the transparency of relations in the supply chain,
   - increasing productivity of the supply chain by increasing productivity of the relationships of the individual subjects in the chain,
   - minimization of warehouse stocks, which shall also reduce the costs of warehouse operations,
   - reducing the costs of material procurement,
   - reducing production and distribution costs.

2. **Creating opportunities to increase company turnover.** This can be achieved in particular in the following ways:
   - increase the throughput of the supply chain (quantity of products produced per unit of time),
   - acceleration of the responses to market demands (i.e. flexibility increase),
   - acceleration of the response time related to serve specific, unexpected requests,
   - more detailed and accurate information on the current status of processing individual orders shall be obtained.

3. **Return on corporate assets.** In particular, the following factors may contribute to its increase:
   - shortening of the duration of the various sub-processes in the supply chain
   - inventory turnover acceleration,
   - capital investment requirements decrease,
   - improvement and increased transparency of the "cash flow" of the company
   - obtaining fast and accurate information on actual demand (it is an evaluation of how sales are developing compared to previous periods, which allows the volume of output from the chain to adjust to the expected market demand),
   - decrease of the stock of materials and raw materials.

From the point of view of the subjects involved in creating value for the customer there are also other benefits of using SCM applications. These are in particular:

- transparency of the whole process taking place in the supply chain and all its sub-processes provided by the individual participants,
- reduction (in ideal case we mean a complete elimination) of unnecessary delays in the interconnection of individual sub-processes and to some extent also internal delays within sub-processes,
- the possibility of planning the procurement of individual types of materials, raw materials, products and semi-finished products based on the evaluation of historical data, taking into account current market developments and customer requirements,
- the ability to automate purchasing activities using electronic data interchange (EDI) standards,
- support for determining the optimal location and form of the supply chain in a specific case (Basl, Blažiček, 2012),
- the possibility to process material requirements using electronic procurement (so-called e-procurement) or purchasing using an electronic marketplace (so-called e-marketplace) in
order to obtain an offer from several suppliers. Based on the evaluation of the obtained offers it is possible to choose the one that seems most appropriate (Basl, Blažiček, 2012),

- making information on requirements and their current fulfillment available to all members of the chain,
- expanding opportunities for cooperation and communication among members of the chain.

*From the point of view of the customer*, there are also several benefits of using an SCM application in the supply chain:

- possibility to formulate and enter customer requirements regarding the final product,
- the possibility to be informed continuously at any time about the status of processing the entered order,
- reducing delivery delays, as well as reducing the fact that deliveries are incomplete or incorrect (i.e. incorrect goods shall not be delivered) as a result of the transparency of the whole product creation process and its distribution to the customer,
- the possibility to participate in solving unexpected situations electronically regardless of which supply chain subject the situation arose on,
- the possibility of reducing the final price of the final product due to more rigorous monitoring of processes within the chain and optimization of their implementation.

The top 10 SCM applications in terms of their overall ranking from the perspective of their users who voted in a poll are listed in table 1. The overall ranking in this table is an aggregated indicator calculated as an average of the following partial indicators: inventory management, logistics and transportation, mobile capabilities, procurement and supplier management, purchase order management, supply chain analytics, supply chain planning, warehouse labor management, warehouse management, integrations and extensibility (SelectHub.com, 2022).

**Table 1: The top 10 SCM applications in 2022**

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Application</th>
<th>Overall ranking (max. number is 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle</td>
<td>Oracle SCM Cloud</td>
<td>92/100</td>
</tr>
<tr>
<td>BlueYonder</td>
<td>BlueYonder</td>
<td>89/100</td>
</tr>
<tr>
<td>SAP</td>
<td>SAP Supply Chain</td>
<td>88/100</td>
</tr>
<tr>
<td>Microsoft</td>
<td>Microsoft Dynamics 365 SCM</td>
<td>86/100</td>
</tr>
<tr>
<td>IFS</td>
<td>IFS Applications</td>
<td>80/100</td>
</tr>
<tr>
<td>Epicor</td>
<td>Epicor SCM</td>
<td>79/100</td>
</tr>
<tr>
<td>Sage</td>
<td>Sage Business Cloud X3</td>
<td>77/100</td>
</tr>
<tr>
<td>Manhattan</td>
<td>Manhattan Supply Chain</td>
<td>74/100</td>
</tr>
<tr>
<td>Infor</td>
<td>Infor Supply Chain Management</td>
<td>74/100</td>
</tr>
<tr>
<td>Oracle</td>
<td>Oracle NetSuite</td>
<td>71/100</td>
</tr>
</tbody>
</table>

*Source: SelectHub.com, 2022*

In 2020, the SAP SCM software was the most commonly used and it covered 18.8% of the revenues in the global SCM software market. Oracle’s SCM application came in second, covering 12.4% of the revenues SCM software market. The third most commonly used SCM
application on the global market was Blue Yonder SCM, which covered 3.6% of the revenues (Statista.com, 2022).

According to Appsruntheworld.com SAP SCM was the leader on the global SCM software market with 14.1% of the total revenues in 2020. On the second place was the Oracle SCM followed by the Blue Yonder SCM (Appsruntheworld.com, 2021).

Now, let’s focus on the costs reduction problem in a supply chain. We will present three case studies of large companies that successfully managed to reduced their costs by optimizing their supply chain:

- **John Deere** – it is a large American company with diverse product range, which includes a mix of heavy machinery for the consumer market, and industrial equipment, which is made to order. The company was replenishing dealers’ inventory weekly, using direct shipment and cross-docking operations from source warehouses located near John Deere’s manufacturing facilities. This operation was proving too costly and too slow, so the company launched an initiative to achieve a 10% supply chain cost reduction within four years. The company undertook a supply chain network-redesign program, resulting in the commissioning of intermediate “merge centers” and optimization of cross-dock terminal locations. John Deere also began consolidating shipments and using break-bulk terminals during the seasonal peak. The company also increased its use of third-party logistics providers and effectively created a network that could be optimized tactically at any given point in time. As a result the John Deere supply chain cost-management achievements included an inventory decrease of $1 billion, a significant reduction in customer delivery lead times (from ten days to five or less) and annual transportation cost savings of around 5% (LogisticsBureau.com, 2019).

- **IBM** – it is one of the largest high-tech companies in the world, which was founded in 1911. In 2010, IBM expanded its supply chain environmental management program to require all suppliers with whom IBM has a direct relationship to establish a management system that addresses their social and environmental responsibilities and to cascade these requirements to their suppliers. IBM strongly believes that sound social and environmental management can help suppliers maintain a competitive edge and contribute to more efficient and sustainable operations and aid in decreasing operational costs and improving margins (Epa.gov, 2018). As a result, in 2016, IBM met its 2020 goal of purchasing 20 percent of its electricity from renewable sources and its goal for 2020 of reducing operational CO2 emissions by 35 percent from a 2005 base year. In 2017, the Clean Energy Ministerial awarded IBM the Energy Management Insight Award for achieving cost and emission reductions through certifying its energy management program to the ISO 50001 standard for energy management systems. In 2018, IBM received a Climate Leadership Award in the Goal Achievement category, issued jointly by the Center for Climate and Energy Solutions and The Climate Registry (Epa.gov2, 2018).

- **Avaya** – Avaya is a global force in business collaboration and communications technology. The company was suffering from a range of supply chain maladies, including a long cash-to-cash cycle, an imbalance in supplier terms and conditions, excess inventory, and supply chain processes that were inefficient and wholly manual. To that end, the company put its trust in cloud technology, which was relatively immature at the time, and migrated all processes onto one platform, which was designed to automate non-value-added activities and integrate those critical to proactive supply chain management, namely:
point of sale analysis,
- procurement analysis,
- supplier communication,
- supply and demand planning,
- inventory planning.

By making a conscious effort to lead the enterprise into a new way of thinking, change business culture, and unify technology under a single platform, Avaya has improved inventory turns by more than 200%, reduced cash tied-up in stock by 94%, and cut its overall supply chain expenditure in half (SupplyChainChannel.co, 2020).

- **Sunsweet Growers** – it is the world’s biggest producer of dried fruits. The company needed to redesign the network in order to reduce the total costs. Sunsweet was using a manual forecasting approach, with spreadsheets being the only technology involved. After evaluating some 30 different software solutions, the company finally settled on a supply chain planning software. The aim was to reduce production costs, and although the company hasn’t published hard figures to quantify the total financial gain, it has claimed the following wins (O’Byrne, 2020):
  - forecasting accuracy was increased by 15 to 20%,
  - overtime was reduced from 25% to 8% in production facilities,
  - spoilage in finished-goods was reduced by 30%,
  - number of warehouses in the United States was cut from 28 to just 8.

4. Conclusion

The main goal of this article was to find out if there are any companies using an SCM application in Slovakia and, if so, what experience and results do they have using it. We have conducted a survey with 100 large companies in Slovakia and found out that there is not a single company using this kind of software in Slovakia. This finding may seem like a failure, but it is valuable information. After this finding, we summarized some data from the literature about the experience and results of large companies abroad. Hopefully, this will motivate and inspire some companies in Slovakia to look for new ways of making their supply chain more transparent and effective.

Acknowledgement

This article was created thanks to the support of EUNIS-SK.

References


