

APPLICATIONS OF INFORMATION TECHNOLOGY TO SUPPLY CHAIN MANAGEMENT

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1. SUMMARY

The free flow of capital and goods makes the competition global. This impact has resulted in the construction of global supply chains; the competition of companies has been replaced by the competition of supply chains. Gaining and maintaining competition advantages require new business solutions; in principal, these new solutions depend on the methods and conditions of information technologies. Due to length restrictions, the study does not cover all the IT applications related to SCM.

2. INFORMATION TECHNOLOGY SUPPORTING SUPPLY CHAIN MANAGEMENT

2.1 Definitions of Supply Chain Management

Supply Chain Management (SCM) is a business strategy that aims to gain and maintain competitive advantage by optimising the whole supply chain including extraction of raw material, shipping of finished products to customers and all linked services (maintenance, waste disposal, recycling, etc.).

The definition implies the following

- (A) Typically, SCM is realised through the integration of the logistic systems of production companies, suppliers, buyers and logistic service providers.
- (B) The scope of the definition contains strategic aspects as well as the implementation. Therefore we distinguish between analytic and operative SCM.
- (C) The operative SCM is an extension of logistics and overlaps with Resource Management systems.
- (D) The supply chain includes the contact with end users and customers, therefore there has to be a connection between SCM and Customer Relationship Management (CRM).

2.2 Identification systems and techniques

The importance of tracking & tracing – one of the tasks of the operative SCM – was recognised long ago by the participants of the supply chains. Projected on SCM, tracking & tracing is the ability of monitoring the qualitative and quantitative changes of a product item in time and space. The product, the particular item, its present and past location all can be identified. The origins can be specified and all the necessary information can be linked.

The principles of tracking & tracing

- (A) Unique id.
- (B) Data transmission
- (C) Data connections
- (D) Communication

Monitoring product items is possible if all participants possess internal and external tracking & tracing systems. Many operations – that are essential for the effectiveness of trading goods and for optimising supply chains – depend on the precision of the identification of the products, services and locations playing part of the trade. Improving this precision, standards have been worked out that support the national and international communications and the electronic trading processes – including the complete tracking and tracing between the participants of supply chains.

These standards are applied on the following fields.

- (A) Identification keys that make possible the globally unique identification of goods (products and services), locations, legal entities, documents, objects, shipping entities, service partners.
- (B) Barcode: mapping the data of identified items and for quick and automatic data collection.

- (C) Electronic Product Code (EPC) Global Network and Radio Frequency Identification (RFID): identifying items and communicating tracking information.
- (D) Global Data Synchronisation Network (GDSN): supporting data harmonisation between business participants.
- (E) Electronic Data Interchange (EDI), Electronic Communication (Ecom): supporting quick and precise global data traffic.

The standard systems listed above support the efficient management of global, industry-independent supply chains and the unique identification of products, shipping units, objects, locations, legal entities, documents and services. These applications are based on data structures that make possible the identification of every relevant item and their data. The digits are crucial for accessing the data base and for the definite identification of goods handled during transactions. Every piece of information that describes a product or a service and its properties can be found in databases.

- (A) The types of identification keys are
 - Global Trade Item Number (GTIN)
 - Global Location Number (GLN)
 - Global Document Type Identifier (GDTI)
 - Serial Shipping Container Code (SSCC)
 - Global Service Relation Number (GSRN)
 - Global Returnable Asset Identifier (GRAI)
 - Global Individual Asset Identifier (GIAI)

(B) Code systems
In order to quickly enter data into information systems without errors, an automatic data collection tool is required. The practical tools applied for this purpose in logistics are: barcode, and EPC the RFID technology. Automatic data collection is implemented via digital or alphanumerical code, manual or automatic scanners whenever an item leaves or arrives to a location, transformed (built in, extracted), or passed between participants of the supply chain.

(C) EPC, RFID technologies
Radio Frequency Identification is a technology that makes possible the unique and automatic identification and tracking of items without visual contact. The logistic processes can be optimised by the consequent implementation of the RFID technology to a part or to the whole supply chain.

- (D) GDSN – external data communication, data synchronisation

The harmonisation of core data is realised by the agreement between participants on the data sets describing a product and on the specification and measurement of data. After harmonisation, each participant store the same data relating to the same item. This practice is supported by the Global Data Synchronisation Network (GDSN). The GDSN is a network formed by cooperating databases linked through the internet and by a global registration, that can be used by companies to interchange standardised and synchronised supply chain data with their partners.

The purpose of the global registration is to store the unique identification keys of the items, to report which database contains the complete product information, and to transfer the queries of the recipient database to the source database.

- (E) EDI – Communication standards
In external relations, the paper based mailing system was replaced by electronic communication. Electronic communication combined with the standardised tools of product identification can realise the quick, fail-safe end effective relation between management and product/supply. The Electronic Data Interchange implements the standardised transfer of structured data between information systems with minimal human assistance.

2.3 Information Systems

It is the business partners' own responsibility to support their internal processes by information systems built on data and methods that connect the input of the production process with its output, and the source of the moving process with its destination. For this purpose, companies are widely using Enterprise Resources Planning (ERP) systems that integrate and automatise the business processes related to operations and productions including internal tracking.

Applications integrated at the level of network cooperation are capable of supporting internal as well as external tracking. Integrated Enterprise Application (IEA) integrates executive, operative and strategic management covering forms and processes of network-wide cooperation. E-business (B2C, B2B) processes and the support of operative SCM and CRM are all part if IEA.

2.4 Positioning Systems

The Global Positioning System (GPS) is a satellite system supported by complex positioning technology that is built of a space segment, the customer segment (reception tools and services), and the operating system.

The functions of GPS

- (A) determining location of static points or moving objects
- (B) navigation
- (C) real time tracking
- (D) tracing

Automatic cargo tracecare systems implemented on the GPS network provide the possibility of the continuous and automatized tracing of the location and the state of products being shipped, and the automatic transfer of the collected data to the information systems.

2.5 Decision Support Systems and Simulation Applications

Since beyond the operative function the SCM has strategic components as well, it is essential to mention the following IT applications that effectively support the tasks arising under the analytic functions of SCM. The Decision Support System (DSS) is an application that helps the strategic planning and management, supports the collection and analysis of information (data and rules) related to the problems to be solved, generates decision alternatives and their outcome, and presents the results to the management in a structured and transparent form.

The services of DSS applications: reporting functions, pre-defined or ad-hoc reporting; statistical analysis; simulations based on stochastic models; goal-seeking; optimisation; communication and presentation.

2.6 Simulation programs

Simulation programs that imitate the behaviour of real processes can be used for planning the tasks of SCM. The typical applications are:

- (A) General logistics planning: simulating warehousing strategies; analysis of stores and warehouses.
- (B) Structuring production logistics systems: production chains, warehouse operations; general queuing systems.
- (C) Determining operating parameters: business process re-engineering, solving re-organising tasks.

3. CONCLUSIONS

The combined use of the best business practices and the most advanced technologies is crucial for improving the competitiveness of global supply chains. The number of available applications supporting the tasks of SCM is already large; nevertheless, due to the constant IT development, new applications are being released. Efficient and active supply chains require the ability to share the relevant information at the right time between the participants of supply chains. This is made possible by the most recent information technologies and by the cooperation between business partners.

4. LIST OF REFERENCES

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