

NEW TOOLS FOR MULTI-STAGE SUPPLY CHAINS

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Tapping into rationalisation potentials requires a greater focus on customer-supplier relationship. Problems lie in the lack of clarity of both inventory data and delivery deadlines. Results are not only high inventories in the supply chain, but also a risk of insufficient supply, inadequate response to short-term changes and the late recognition of supply bottlenecks. To support the exchange of information in the supply chain, IPA developed the Supply Chain Information System (SCIS), an Internet tool based on Java for multi-stage supply chains. Thus, each partner in the Supply Chain can independently carry out data analyses on a regular basis. Moreover, deadlines and quantities between companies can be controlled, enabling the precise and systematic co-ordination of contingency plans.

1. FRAMEWORK CONDITIONS OF SUPPLY CHAIN MANAGEMENT

Customer-supplier relationships have gained importance through the tapping of rationalisation potentials. The latter bearing great significance for all those involved in the supply chain's information flow. The key problem in this information flow lies in the lack of transparency in inventory data and delivery deadlines. Results are not only high inventories in the supply chain, but also a risk of insufficient supply, inadequate response to short-term changes and the late recognition of supply bottlenecks.

The Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) has gained much experience in this field through many projects concerning business process optimisation and Supply Chain Management. This experience also includes specific knowledge acquired from numerous research and consulting projects in mid-sized firms as well as in the automobile, consumer goods and aircraft industries. From this experience, IPA established that there exist many definitions for the term Supply Chain Management depending on the approach of the respective firm or branch. IPA defines Supply Chain Management as the integrated planning, handling, co-ordination and management of material and information flows in single-level or multi-level supply chains. In this context, Supply Chain Management requires the

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extended co-operation of all partners in the supply chain in the following areas: ordering, forecasting, transport, material requirements planning, resource planning and scheduling. This co-operation can be achieved through the process-oriented reorganisation of the supply chain and the introduction of the appropriate IT infrastructure, control system or other management principles.

2. BASIS FOR EFFICIENT SUPPLY CHAIN MANAGEMENT

Weak points in the supply chain occur through the adaptation of new processes to existing structures and through local supply management i.e. each individual partner's customer supply. The latter meaning that there often exists no transparency regarding inventories in the supply chain as there is no universal process modelling of operative supply concepts available. In many cases, information flows between the manufacturer and supplier are unclear and therefore prevent a targeted exchange of information. As a result, the supplier-specific demands (for example: order data, material requests, planning scope) within the framework of an equal partnership cannot be fulfilled.

For the fore-mentioned reasons, it will become increasingly important to have simple tools at hand in the ever-complex supply chain. These tools will facilitate not only the quick and reliable exchange of information but will also recognise a supply bottleneck in due time.

3. THE SUPPLY CHAIN INFORMATION SYSTEM (SCIS)

To support the exchange of information in the supply chain, IPA developed the Supply Chain Information System (SCIS), an Internet tool based on Java for multi-level supply chains. With this software tool, the data exchange concerning inventory, delivery deadlines and needs between partner companies can be supported. SCIS analysis the supply situation in any given supply network basing the analysis on the existing demand and stock. SCIS guarantees partial supply, but also provides for less stock, short length of run and increased flexibility.

SCIS provides the possibility of regarding as many companies as necessary in as many steps as necessary, starting from the final product through to the raw material. The keeping of the data is performed on a central database which can be accessed by all participants of the supply network by internet. Often a customer gets the same product from different suppliers. SCIS also comes up to this task of multisourcing. The supply is distributed by percentages among the appropriate suppliers. Suppliers who participate seldomly can also be included.

The circumstance that pieces are used at several stages of the supply network can also be administrated by SCIS. SCIS computes the resulting total demand, for which the availability is determined based on the existing stock. Because of SCIS's flexibility a quick enter into the system is possible. Data capturing, for instance, can be started with the most important pieces and then be extended step by step according to the demand. Changes concerning the frame of examination can be carried through without any problems, concerning the lists of pieces as well as the suppliers. This becomes necessary, for instance, when there is a change of suppliers

of a piece or when a further product is added. Ordering without using paper becomes more and more a common procedure. EDI (Electronic Data Interchange) meanwhile has become standard in many branches. The necessary hardware is rather expensive. SCIS provides a platform for ordering without having to use paper by using the Internet. Additional hardware is not necessary.

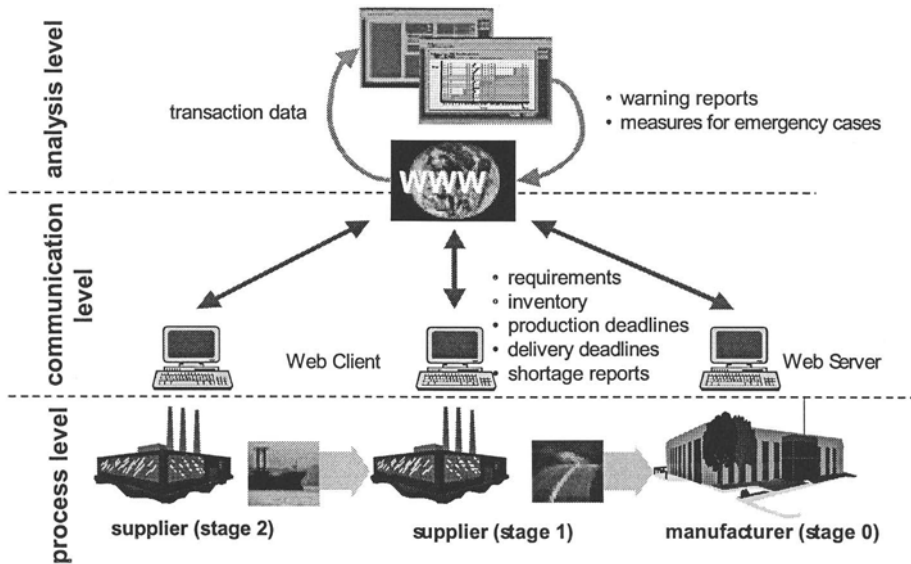


Figure 1- SCIS Process Diagram

However, the supply chain cannot be solely optimised through such a system. Therefore, the development of innovative applications for the alignment of the information and material flows in the supply chain is necessary. This alignment allows alternative solutions to be developed from, for example, the co-ordination of key cost factors and current problem points. These solution approaches include:

- consumer-driven purchasing strategies (Kanban, refill management, etc.)
- order-related decentralised planning
- supplier logistics centre
- Warehouse-on-Wheels, direct delivery
- Just-In-Time etc.

For such a realignment of the supply chain, IPA developed a tool that analyses the existing supply chain and then quickly identifies its weak points and information breaks. In addition, a dynamic evaluation and cost calculation will be carried out in complex supply chains with the help of simulation.

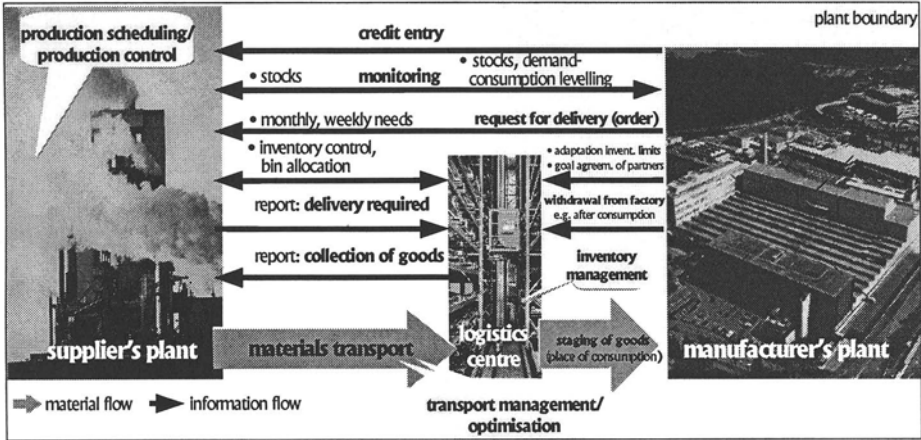


Figure 2 - An example of a complete "external warehouse" process chain

User-friendly input masks make it easy for the partners to enter the inventory data of pre-defined production stages into the SCIS. Moreover, the production and delivery dates and the requirements of particular components are entered into the system. The data volume and input effort are minimised by pre-selecting a number of components to be monitored and classifying their relevance for the supply of the system. The decision on which components are critical for the first stage in the supply chain is made by the person responsible for the product. The critical components for other stages are determined by the preceding stages of the supply chain. Entering and exchanging data among partners occurs via web clients on the Internet. All partners are able to access a central www-server through the use of a password. This allows for the quick, flexible, and unproblematic integration of new partners into the supply chain.

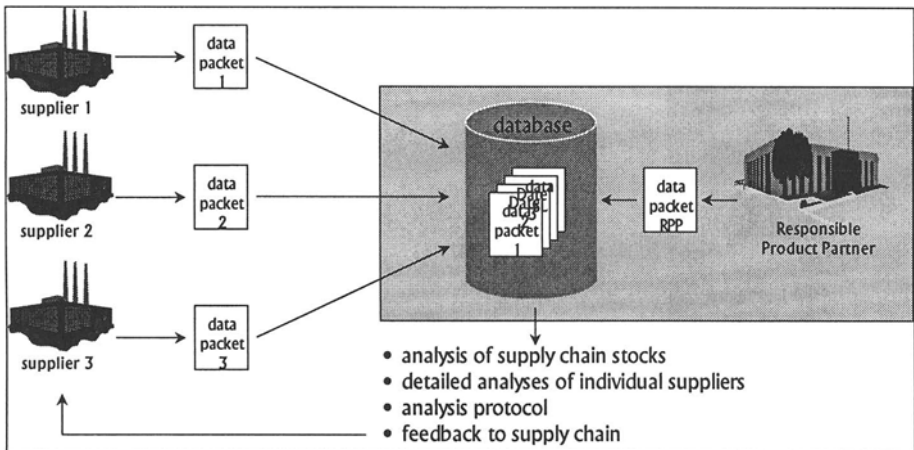


Figure 3 - EDV-based SCIS

SCIS-analysis examines the future supply situation, whereby it includes the completely depicted chain of supply. SCIS determines, which demand can be covered and where supply could become difficult. The data are analysed referring to production-, transport- and waiting times. SCIS enables the producer to tell the customer at once about delivery dates. The supply situation is depicted graphically. At first look it can be determined if a total covering is reached and if not, who is responsible for the lack. A so-called crash report reveals the responsible person or party, the lack, the date at which the lack occurs and the next possible delivery date. Through analysis of data imminent shortages are recognized in time. SCIS reacts immediately to shortages and generates specific suggestions for solutions for the user.

Beside the standardized suggestions for solutions SCIS provides the possibility to deposit measures which can be configured individually according to specific shortage situations. Through this SCIS feature the experience of the employees is accessible for the whole company. This knowledge management is especially helpful for new employees or replacements.

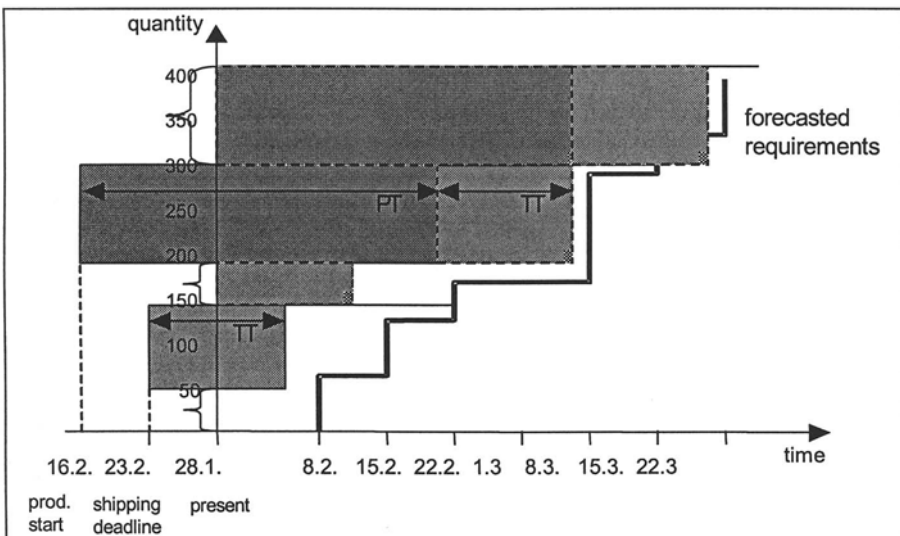


Figure 4 - SCIS-based Chain Analysis

4. INNOVATIVE SOFTWARE TECHNOLOGY

In every delivery network there exists a heterogenic ERP environment (different operating systems, applications, etc.). The use of the object-oriented programming language JAVA and of the communication architecture CORBA provide for the possibility of connecting all participating companies. The data transmission works through Internet technology. The precondition for being able to integrate suppliers

into the SCIS supply chain is a standard PS with access to the Internet and a standard browser (MS Internet Explorer or Netscape Navigator). This infrastructure for communication is mostly already existing and therefore no additional cost factor. Basis of the conception of SCIS is the central data keeping. In order to guarantee an actual data stock the database is managed centrally by the SCIS server. Thus redundancies are being avoided. The SCIS server can also be applied in the service sector. Consequently, each company of the depicted chain has to fulfill only the SCIS client requirements. Security is guaranteed by the use of cryptographical coding procedures according to latest standards. Password protection controls the rights of the users referring to sights and possibilities for changes.

5. CONCLUSION

Through this information system, transparency throughout the whole logistics chain is created. This transparency makes it possible to improve the planning of production and inventory of each partner in the supply chain because potential bottlenecks can be identified in due time. The advantages of such a system exist especially for the system initiator but also for the individual partners of the supply chain.

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