PRACE NAUKOWE AKADEMII EKONOMICZNEJ WE WROCŁAWIU
Nr 1057 2005
Integracja procesów logistycznych

Libor Kozubek, Radim Lenort
VŠB – Technical University of Ostrava

e-SCOR, THE TOOL FOR DESIGN, ANALYSIS, OPTIMALIZATION AND MANAGEMENT OF THE SUPPLY CHAIN

Department of economics and management in metallurgy cooperates on a Grant project called „Application of Artificial Intelligence in Logistics of Metallurgical Enterprises of the North-Moravian and Silesian Region" number 106/02/0487. One of the outputs of this Grant project is to consider the capability of utilization software based on the artificial intelligence in praxis. Department started to cooperate with ADAM company, which represents the GENSYM corporation (USA) in the Central and East Europe. The GENSYM corp. is the distributor of the software products focused on artificial intelligence, specifically expert systems in combination with simulation tools.

e-SCOR is a dynamic decision support and management tool for supply chains. It is used for design and analysis of current supply chain and to model alternative supply chains. It enables monitor, compare and report the performance of various alternative supply chains, thanks to „what-if" analysis. e-SCOR is created on the methodology of „Supply-Chain Operations Reference" (SCOR) model.

1. Supply-Chain Operations Reference model

SCOR has been developed and endorsed by the Supply Chain Council, an independent not for profit corporation – SCC (established in 1997). The model originate was motivated by the need of general standard, that should be utilized for the supply chain management with no branch diversification. The basic idea is to draw up the real, complicated supply chain into the standard model, that should enable: clear, comprehensive supply chain description, the supply chain evaluation, management and control, optimalization of existing supply chain or designing of the new one.

The model includes:

- Standard process definition running in supply chain and its relations.
- The metrics for the measuring of the process performance.

SCOR was created to be able to model whole supply chain from the supplier's supplier to the customer's customer. SCOR identifies three levels of abstraction:

1. Top Level

The Top Level identifies the scope and content of the overall supply chain. This level is configured by five key **SCOR Processes** and by the **Performance Metrics.**

SCOR Processes:

- ***Plan*** – plan supply and demand cycles.
- ***Source*** – obtain materials from suppliers for manufacture, distribution or consumption.
- ***Make*** – produce manufactured products.
- ***Deliver*** – distribute ordered products, manage orders and ship products.
- ***Return*** – processes associated with returning and receiving returned products.

Performance Metrics:

- Customer facing: reliability, responsiveness, flexibility,
- Internal facing: cost, assets.

2. Configuration Level

In this level, the SCOR Processes are defined by the three Process Types:

- ***Planning*** – a process that aligns expected resources to meet expected demand requirements.
- ***Execution*** – a process triggered by planned or actual demand that changes the state of material goods.
- ***Enable*** – a process that prepares, maintains or manage information or relationship on which planning and execution processes rely.

The outputs of this level are **Process Categories**, that enable configure the particular supply chain.

For illustration: the **Process Category** of the **Make** SCOR process.

P3: Plan Make – the production planning based on the available resources and customer requirements.

M1: Make-to-Stock – fills orders for stock products from inventory and replenishes inventory based on inventory levels or forecast.

M2: Make-to-Order – fills orders for make-to-order products from inventory and replenishes inventory only when a buyer places an order.

M3: Engineer-to-Order – fills orders for engineer-to-order products by engineering and manufacturing custom products for a particular customer.

EM: Enable Make

Similarly are defined the Process Categories for **Plan, Source, Deliver** and **Return** processes.

3. Process Element Level

Each Process Category is decomposed on the **Process Elements**, which means the particular process flows, the process inputs and outputs, the performance metrics etc.

For illustration: the Process Elements of the **P3: Plan Make** Process Category:
P3.1: Identify, prioritise and aggregate production requirements.
P3.2: Identify, assess and aggregate production resources.
P3.3: Balance production resources with production requirements.
P3.4: Establish production plans.

The third level in the SCOR modelling is considered for the last level of decomposition. Anyway there is a chance to decompose the elements into the lower detailed levels. The above-defined SCOR Processes, Process Categories, and Process Elements enable to model the supply chain, which includes arbitrary amount of the supply chain component – the suppliers' supplier to customer's customer (see figure 1).

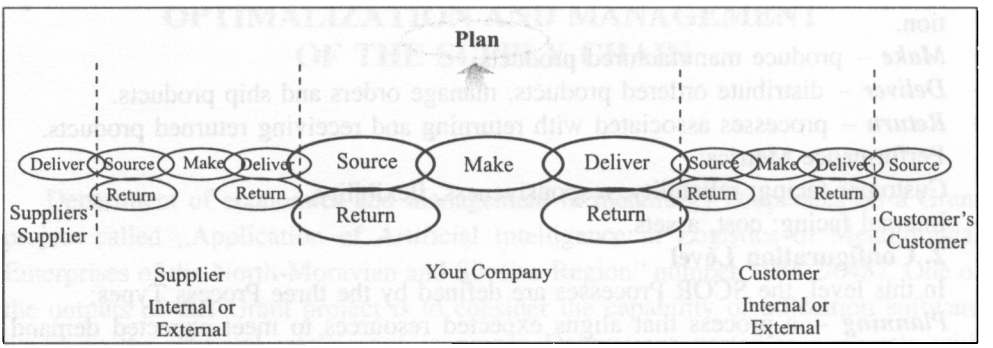

Fig. 1. SCOR model
Source: SCOR 6.0 Overview Booklet. Supply-Chain Council, 2003.

e-SCOR

e-SCOR provides an implementation of the SCOR model by providing an interactive modelling environment that allows organizations to proactively identify the needs of their supply chain processes. e-SCOR have implemented the SCOR methodology with couple differences. It uses selected Process Category from the SCOR Configuration Level to define four basic roles in the supply chain (**Level 1 Roles**):

- **Base Manufacturer role** – initiate the overall supply chain by providing raw materials to downstream buyers.
- **Distributor role** – sources components or finished products from upstream suppliers and delivers those products to downstream buyers.
- **Manufacturer role** – manufactures finished products.
- **Consumer role** – initiates the acquisition of the consumer products in the supply chain.

For illustration: the **Distributor role** is created by following Process Categories:

- **ES: Enable Source** – determinates how the role chooses its suppliers.
- **S1, S2 or S3: Source** – sources the composites or final products from upstream suppliers.

- **P2: Plan Source** – determines the frequency with which the role sources components or final products from upstream suppliers and computes how much to order.
- **D1, D2 or D3: Deliver** – deliver the components and final products to the customer.
- **ED: Enable Delivery** – manages contracts with buyers.

2. Creating the supply chain model in e-SCOR environment

The supply chain modelling in e-SCOR environment involves the creation of the supply chain model including the parameters settings, and simulations and their evaluation.

2.1. The creation of the supply chain model and its parameters setting

The particular supply chain model creation is done by choosing roles that corresponding to the real supply chain and by configuration of the relation among these roles. The next step is to assign the products specification to roles. To manufacturer roles are assigned also the sources the role work with and which defines its capacity. For the sample of the e-SCOR model that includes two base manufacturers, distributor, manufacturer and consumer see figure 2.

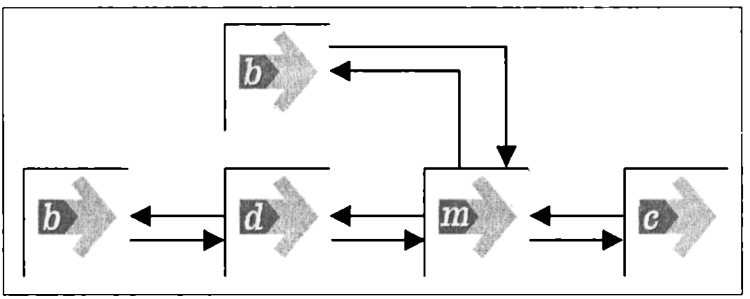

Fig. 2. Sample of the supply chain model
Source: e-SCOR User's Guide, Version 4.0. Gensym Corporation, 2002.

Configuration of the model parameters proceeds on two levels. Firstly are set up the parameters concerning the particular roles, products and sources (**Level 1 Roles**) and then are set up the detailed parameters on the level of process categories and products (**Level 2 SCOR**).

The parameters configuration for each role on the **Level 1 Roles**:

- financial parameters that the role uses to compute financial metrics,
- planning mode parameters that determine whether the role uses pull or push planning to source and deliver its products,
- the time period for computing time weighted statistics, such as averages and standard deviations.

The sample of the **Level 2 SCOR** parameters settings is illustrated on the Process Category **D1: Deliver Stocked Product.**

D1: Deliver Stocked Product includes following parameters settings:

- ***Order*** – the time it takes from when the category receives an order to when it enters the order, the criteria that determines how to sort orders for.
- ***Fulfilment*** – the time it takes from when the category enters an order to when it picks material from inventory for packing.
- ***Transportation*** – the time it takes from when the category packs a container for shipment to when the buyer receives the container.
- ***Cost*** – the costs associated with entering, fulfilling, distributing, shipping and invoicing an order.

Parameters setting for the **Source Products:**

- ***Inventory*** – it indicates the starting and maximum inventory.
- ***Source*** – the desired amount of time from when a buyer role places customer orders for its source products to when the buyer receives a shipment, if the roel must receive complete or partial shipments.
- ***Planning*** – it indicates the replenishment threshold, minimum reorder quantity, maximum threshold etc.

2.2. Doing the simulations and their evaluation

Now can be started the model simulation and can be analysed the whole supply chain using different input data. The evaluation of the particular simulations is done by sets of indicators that are computed for each role, process category and product.

3. The capabilities of the SCOR model and e-SCOR software in enterprise praxis

The SCOR model application into the praxis offers a lot of benefits to organizations. It enables to evaluate the supply chain, to identify the organization gaps, to find the improvements and to quantify its effects on existing supply chains as well as on projected ones. It enables also to model the real existing supply chain and compare it with the best supply chains in branch.

The SCOR model implementation into e-SCOR software makes the process application faster and more effective. The simplicity of the real supply chain model creation, its configuration and evaluation through the SCOR indicators and interactive simulation environment are the biggest benefits of the e-SCOR modelling.

In spite of the high potential of the above-mentioned benefits is the e-SCOR accepted with disbelief by the Czech Republic praxis. In the Czech Republic there exists no application and the reasons, according to authors' opinion, are followings:

1. The supply chain management signify the highest level of the logistics principles application in praxis – minimum of the Czech Republic enterprises achieve this level.

2. SCOR and e-SCOR works with the high level of the abstraction, that enables analysis, evaluation and optimalization the whole supply chain (from the suppliers' supplier to customer's customer) – unfortunately this facts can cause into fears, that the simulation results will not respond to the real situation.

According to the continuous process of the world market globalisation there can be expectation of the changing situation.

References

[1] SCOR 6.0 Overview Booklet. Supply-Chain Council, 2003.
[2] e-SCOR User's Guide, Version 4.0. Gensym Corporation, 2002.

e-SCOR – NARZĘDZIE DO PROJEKTOWANIA, ZARZĄDZANIA ORAZ DOKONYWANIA ANALIZ I OPTYMALIZACJI ŁAŃCUCHA DOSTAW

Streszczenie

Artykuł przedstawia doświadczenia autorów po przeprowadzeniu testów programu komputerowego e-SCOR służącego do projektowania, zarządzania oraz dokonywania analiz i optymalizacji łańcucha dostaw. Pokrótce został scharakteryzowany SCOR model łańcucha, który stanowi podstawę dla programu e-SCOR. W artykule przedstawiony został również sposób modelowania w środowisku e-SCOR i zarys stanu i możliwości wykorzystania programu w realiach czeskich przedsiębiorstw.