



## RULES FOR MODELLING AND REDESIGNING SUPPLY CHAINS

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**ABSTRACT.** This paper's goal is description of modeling and designing terms for supply chains. The most efficient method is the application of the supply chain permanent improvement rule. This rule was defined 1993 by T. Davenport and based on the evolutionary approach to the redesigning/reengineering of economic processes. The application of this rule for planning purposes is facilitated by the W. Deming's PDCA (Plan-Do-Check-Act) rule adapted later by J.B. Ayers for supply chains design. The supply chain reengineering rules are executed in three stages: design concept stage, detailed design stage, execution stage. The paper's last part regards the selection of evaluation criteria for the supply chain variant chosen to be redesigned.

**Key words:** Supply Chain Modeling, Supply Chain Redesign.

### INTRODUCTION

Logistics has added greatly to the European economy growth already. Despite being a relatively young knowledge area, logistics gains in significance together with efficient methods for supply chain modeling and redesign.

The supply chain management is understood as processes carried out for designing and maintaining the reliability and operating activity undertaken in order to satisfy the end user [Ayers, 2001].

The basic supply chain management (SCM) rules are as follows [Christopher, 2000]:

- the supply chain should be treated as an organization, entirety, and not as a group of separate subjects bearing responsibility for separate activity areas they operate within,
- the SCM requires the strategic approach to the decision making,
- the SCM requires an approach based on the integration of separate links thereof, and not only on the co-ordination thereof,
- in the SCM area, product/material stocks only play an auxiliary instrument role in the chain link integration activities, and not the basic role.

## THE PERMANENT SUPPLY CHAIN IMPROVEMENT RULE AS THE BASIS FOR MODELLING SUPPLY CHAINS - APPLICATION OF THE DEMING CYCLE

The supply chains modeling is applied for designing new supply chains and redesigning old ones. The supply chain redesign can be executed as a radical restructurisation, which was proposed 1993 by M. Hammer and J. Champy in the shape of the Business Process Reengineering (BPR) method, or as an evolutionary process reconstruction based on the incremental rules as proposed 1993 by T. Davenport.

The supply chain restructurisation process is based on the permanent improvement rule resulting from the **Deming cycle: Plan - Do - Check - Act (PDCA)**. The Deming cycle consists of stages as follows (Deming 1993):

**Stage 1 - "Plan"** - set a goal for each process. Meeting the goals will provide with compliance of processes with customer requirements and with the general enterprise policy. In the context of making the supply chain more able, this means the determination of strategy for the entire chain, such strategy including: the vision, goals, mergers and fusions, product development plans, organization improvement plans.

**Stage 2 - "Do"** - processes should be implemented as planned. With regard to the supply chain improvement, this stage should include the development of an operating plan consisting of strategy components, i.e. initiatives, and activity proposals. As well, separate teams should be organized for: the strategy execution - Steering Committee (SC); processes - Supply Chain Design Teams (DT); activities - Front Line Teams (FLT). The teams carry out the tasks assigned to them in the three-stage implementation process. The implementation process includes:

1. Project concept;
2. Detailed project and pilot tests;
3. Full implementation.

Work division: the Steering Committee (SC) is responsible for the 1st stage work (project concept); the Design Teams (DT) supervises the 2nd stage work, whereas the Front Line Teams (FLT) are representatives of supply chain users. The teams support the redesign of supply chains.

**Stage 3 - "Check"** - this stage consists of metering and monitoring significant parameters of processes and products. Then, the actual parameters are compared against the set parameters obtained from product-related strategies and goals as well as from product requirements. When the supply chain is reengineered, this means that changes are proposed, and the change implementation experiment is monitored.

**Stage 4 - "Act"** - is the undertaking of activities related to the permanent improvement of processes and their results. The change proposals should be evaluated in the context of supply chain redesign, and executed.

The project concept execution procedure for the supply chain improvement includes 5 stages: description of the supply chain current status, i.e. description of the chain supply major processes (As - Is); determination of strong items and weak items of the current supply chain status (As - Is); development of a new final vision of the supply chain; definition of required process statuses (To - Be); determination of gaps between the starting status and the required final status of the supply chain component processes, such determination being the basis for the formulation of the design concept and activity plan.

Within **the Stage 1**, a process map is made to be the basis for the identification of process structures. The process list includes: new product research and development; supplies, internal logistics; production planning and control; manufacture and product picking; sales; customer orders; external logistics; customer service and after-sales services support [Handfield, Nichols, 2002]. The mapping process executes numerous tasks:

- facilitates a better understanding of processes: activities, results, and structure of responsibility for individual stages,
- determines the process areas and limits,
- provides with methods for improving processes for future.

The following activities should be carried out in order to find out the current status of As-Is processes:

1. Processes defined and described in quality terms, using the relation mapping. Such work will facilitate obtaining answers to the questions: who is the process user; what is the process outcome; who are the suppliers; what is put into the process; what are the requirements for the input data and output data; what flows through the process.
2. Flow map produced to show all activities as a detailed map.

The process mapping provides with information with regard to: [Ayers, 2001,]:

- register of process activities and stages, and of people responsible for the execution thereof,
- definitions of characteristic parameters describing the processes, relating to the work time, leisure time, and costs,
- determination of process customers. Customer groups are divided in segments, with a division in external customers and internal customers,
- process results, depending on information collected from interviews and by different methods.

**Stage 2** facilitates assessing weak points and strong points of the starting situation, and then making the SWOT analysis. The assessment of weak/strong points of the current chain processes facilitates a better assessment of the process usefulness. This assessment is made based on: quality meters, benchmarks, comparison of design rules, e.g. for supplies (As-Is), and facilitates determining how good the processes are and whether processes can be improved by application of: the best practice, the customer value-added evaluation, interviews-assessments obtained from customers or users, identification of narrow throats, application of quality house analysis, or SWOT assessment. The assessments allow specifying new processes and are collected by Design Teams (DT). The process specifications have attachments with assessments that allow determining the competitive edge of these processes as the starting pointy for the definition of a new vision in Stage 3.

**Stage 3** consists in the development of a new vision target for the supply chain; this new vision should be dramatically different than the starting point. The Design Teams should use expert opinion while creating the new vision. The following changes should be carried out in order to create this vision:

- flow processes revised,
- organisation adapted to support these processes,
- changes made within the supply chain,
- infrastructure (equipment, assets) adjusted,
- meters developed for redesigned processes,
- costs decreased - receipts increased,
- to-do-tasks specified,
- steps proposed for Stage 5 - detailed design, pilot program implementation.

**Stage 4** consists in the definition of required process statuses (To -Be). This stage is executed by numerous meetings, in three sequences: presentation of numerous required process statuses that create the new vision for the supply chain; a number of sessions for preparing variants for the new vision; and, in the end, by the final decision on the final process (To-Be) as set in the required vision.

**Stage 5** - consists in the preparation of detailed design with the target vision of the improved supply chain and of the pilot implementation, in three form of a detailed documentation. The proposed

solutions undergo tests; the to-be-implemented solutions are accompanied by change proposals regarding the organization of new supply chains. Figure 1 shows the location of five groups of tasks selected to be carried out.

## TASKS REGARDING THE SUPPLY CHANGE REENGINEERING

Within **Stage 1**, the Design Concept, or the task no 1, is carried out: *Designing Supply Chains for Strategic Advantage*, where segments are redefined - this is the area (domain) for the chain activity, new products development coordination and management.

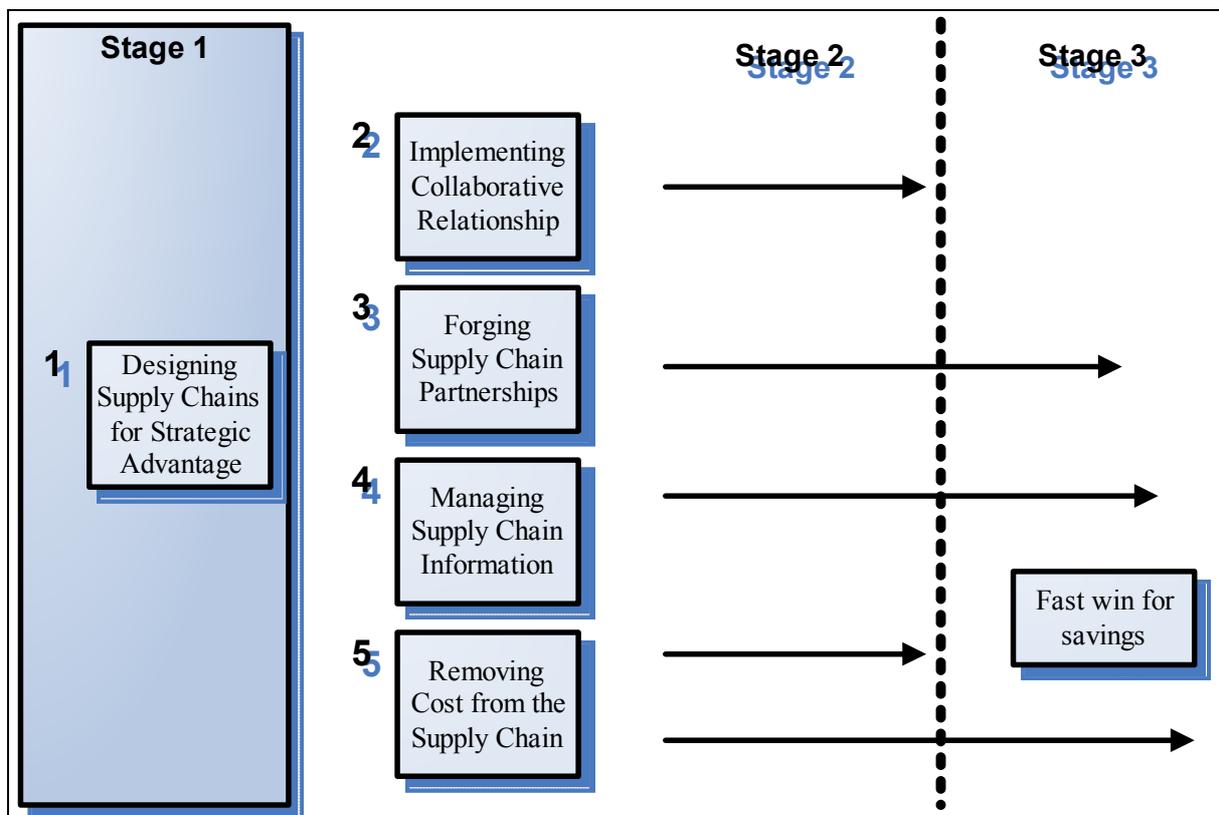
**Stage 2** - *Detailed design and pilot solution tests* - **Task number 2** is carried out. - *Implementing Collaborative Relationship*. This task includes: organization structure changes for specified functions within the supply chain reorganization procedures; determination of activity evaluation meters, new positions for management functions in the supply chain organization.

**Stage 3** consists in the execution of **tasks 3, 4, and 5**.

**Task 3** - *Forging Supply Chain Partnerships* includes: determination of competencies for chain links; forging partnership structures in the supply chain; forging motivation systems.

**Task 4** - *Managing Supply Chain Information* includes: determination of system components; selection of technological innovations and software solutions; determination of barriers.

**Task 5** - *Removing Cost from the Supply Chain* includes: cost removal sources; factors supporting cost removal; weak points of product design procedures; incorrect information in decision making; weaknesses of partnership rules within the supply chain (see fig. 1).



Source: J.B. Ayers: Handbook of Supply Chain Management, St. Lucie Press, 2001, p. 289.

Fig. 1. Supply chain design method  
Rys. 1. Metoda projektowania łańcucha dostaw

## SELECTION EVALUATION CRITERIA FOR VARIANTS OF THE REDESIGNED SUPPLY CHAIN

When working according to the permanent supply chain improvement method and while doing Task 5, the cost reduction is executed in three dimensions at the same time: cost, execution time, and quality achieved for the analyzed supply chain processes. A multi-dimensional problem is created, which only can be solved using the M. Porter value-added analysis.

Unlike the efficiency analysis executed by T. Kasprzak in "*Modele referencyjne w zarządzaniu procesami biznesu*" ("Reference models in business process management"), the metering rule and evaluation analysis for logistic processes was based on three criteria: quality of the product, logistic services, and customer service; order execution time; logistics costs [J. Twaróg, 2003].

While creating the added value for customers, the achievement of an optimum between the level of services executed for the customer and the costs thereof is the major issue. The selection of logistics system variant should facilitate minimizing the total logistics costs for the execution of logistics services' level as assumed.

The VCA (*Value Chain Analysis*) method (approved by the ECR Europe Council) is commonly used for distribution processes. This method is defined as the integrated set of tools and processes for the determination of running costs and for the evaluation of proposed improvements' impact on the entire supply chain. This method facilitates the chain actors to evaluate financial effects of their own and of their partners. The VCA method applies various solutions, including standard solutions such as: the ABC (*Activity Based Costing*) method facilitating the supply chain actors to examine the cost structure over the entire value chain for individual product groups; logistic efficiency indicators KPI (*Key Performance Indicators*) used for the benchmark-based determination of current potential in comparison to leaders; determination of non-financial targets. The non-financial targets include: promotion efficiency; supply reliability; stock rotation; order coverage; product program complexity. For the execution of strategic goals and for the supply chain efficiency evaluation, a set of logistic criteria was proposed as follows: improved production and sales planning; flow time minimization for materials and products in the network; stock reduction and optimization for all supply chain links; cost reduction to a customer-accepted level; improvement and assurance of high customer service level [J. Twaróg, 2003,].

## SUMMARY

The main goal of the paper is presentation of circumstances for supply chain modeling and redesign. The most efficient approach for modeling business processes is the Business Process Orientation developed 1993 by T. Davenport. This approach was adapted for planning processes using the W. Deming PDCA method. Then, the supply chains redesign principles as defined by J.B. Ayers are presented. The redesign process is divided in three stages: design concept, detailed design, and implementation. The goal of the last part of the paper is: forging the supply chain partnerships and mapping the supply chain information, as well as removing cost from the supply chain as part of the detailed design.

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## ZASADY MODELOWANIA I PRZEBUDOWY ŁAŃCUCHA DOSTAW

**STRESZCZENIE.** Podstawowym celem powyższego artykułu jest prezentacja uwarunkowań modelowania i przebudowy łańcucha dostaw. Najbardziej efektywnym podejściem do modelowania procesów biznesowych jest podejście BPO (Business Process Orientation) sformułowane w 1993 roku przez T. Davenporta. To podejście zostało adoptowane dla procesów planowania z wykorzystaniem metody PDCA stworzonej przez W. Deminga. Następnie zaprezentowane zostały zasady przebudowy łańcucha dostaw sformułowane przez J.B. Ayersa. Proces przebudowy podzielony został na trzy fazy: projektowanie koncepcji, projektu szczegółowego oraz wdrożenia. Celem ostatniej części artykułu było określenie zasad partnerstwa oraz diagnozowania systemu informacyjnego, a także redukcji kosztów związanej ze szczegółowym projektem określonego łańcucha dostaw.

**Słowa kluczowe:** modelowanie łańcucha dostaw, przebudowa łańcucha dostaw.

## GRUNDÄTZE DER MODELLIERUNG UND DES REDESIGN DER LIEFERKETTE

**ZUSAMMENFASSUNG.** Das Hauptziel dieses Beitrags ist die Darstellung der Prämissen für die Modellierung und das Redesign der Lieferkette. Der effektivste Ansatz für die Modellierung der Geschäftsprozesse ist das 1993 von T. Davenport formulierte BPO (Business Process Orientation). Dieser Ansatz wurde adoptiert für die Planungsprozesse unter Anwendung der von W. Deming entwickelten PDCA Methode. Im weiteren wurden Grundregeln für das Redesign der Lieferkette, die J.B. Ayers entwickelt hat. Das Redesign-Prozess wurde in drei Phasen aufgegliedert: Entwicklung des Konzepts, Erarbeitung des detaillierten Projektes und Implementierung. Das Ziel des letzten Teils des Beitrags ist die Aufstellung der Grundregeln für eine Partnerschaft und die Ermittlung des Informationssystems und der Kostensenkung, die mit dem detaillierten Projekt der jeweiligen Lieferkette verbunden sind.

**Codewörter:** Modellierung der Lieferkette, Umgestaltung der Lieferkette.

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