RATIONALIZATION OF LOGISTICS PROCESSES WITH THE USE OF MAPPING AND MODELLING IN BPMN NOTATION

STAJNIAK Maciej[1], KONECKA Sylwia[2], SZOPIK-DEPCZYŃSKA Katarzyna[3]

[1]*Institiute of Logistics and Warehousing, Poznan, Poland, EU, Maciej.Stajniak@ilim.poznan.pl*
[2]*The Poznan School of Logistics, Poznan, Poland, EU, Sylwia.Konecka@wsl.com.pl*
[3]*The University of Szczecin, Szczecin, Poland, EU, kasiasz@wneiz.pl*

Abstract

A company is like its processes and process awareness is half the battle in case of implementing modern IT tools for process mapping and modelling. Thanks to modelling the processes can be seen in a very realistic way taking into account many real limitations and also including random parameters which illustrate random factors. The tool for process mapping and modelling is the BPMN notation which lets us model very complex processes, analyse and constantly improve logistics processes on the basis of analysed costs, time, bottlenecks, resources and relationships with other processes.

Keywords: Processes mapping, modeling, logistics process

1. INTRODUCTION

The constant quest for new ways of providing and maintaining a competitive advantage in the rapidly - changing economic and social environment resulted in careful analyses of business processes of companies. They not only analyse the course of these processes but also look at them from different angles. Process improvement is difficult and complicated so wrong decisions are often taken. However, analysing individual operations of a process minimises the risk of making mistakes and accelerates effective changes. The growth of effectiveness can be achieved by implementing process management in company logistics. Process maps, factual descriptions of their course and actions provide a better understanding of processes. Individual people (organization units, departments) start to realise that they are a part of a larger entity and the effectiveness of logistics systems depends on the effectiveness of individual system units. The way logistics processes are organized in a company reflects its cooperation with other business entities. Being aware of the interactions between company departments you can understand the interaction between links in a supply chain. The better companies cooperate, the higher effectiveness of the whole supply chain is. There is also another consequence: the quality of service which is of a qualitative nature (very hard to measure) may become more of a quantitative nature thanks to making the service process similar to a production line [1].The longer the supply chain is, the more time it takes to describe it but the more improvements, advantages and even savings it brings.

2. PROCESS MAPPING

Process mapping is a tool facilitating the improvement of existing processes and the implementation of a process structure in an organization. What is more, it enables a more complete comprehension of existing processes and elimination / simplification of those which require modifications [2].

Generally speaking, a process map is a tool which provides visualization of a set of tasks, an assessment of structures of all processes and subprocesses in the present stage [3]. It depicts all the functions in an organisation to produce the final product (or products). A map is a sequence of activities or tasks that present a work flow [4]. It is an organised presentation of the structure of processes, their relationships and connections. A process map takes into account the order of individual activities in a process. A well - produced

process map identifies the main connections of a process, the time needed to perform given tasks in a process as well as indicates any illogical, unnecessary and / or inefficient activities. A process map is a dynamic depiction of a company, unlike the organisation structure scheme which is static [5].

One of the most effective ways to understand current processes is marking them in a diagram. Its aim is a graphic presentation of processes in such a way which lets us follow and understand their course. Maps should be a "living' document prepared by teams responsible for the processes. Work flow diagrams ought to be a point of reference in a discussion about the employees' work and stimulate understanding of the action models [6].

The main aim of creating process maps is describing business processes so that they can be simplified, eliminated and improved while products and services can become cheaper, better and achievable quicker [7].

Proper process mapping serves several purposes [12]:

- it enables careful understanding of the process components - activities, results and those who perform individual tasks,
- it defines the limits of a process,
- it is a point of reference (thanks to it process improvements can be measured).

As soon as the company managers understand the current process structure they can start identifying the areas that need to be improved. In process mapping the following procedure is often used:

- identifying the main process by means of relationship mapping,
- creating a detailed process map including all the process activities.

However, in many cases process activities must be considered more carefully. A process map identifies some activities which influence material, information and financial flows of a process. Thanks to such diagrams of sequences of activities quite often it is the first time managers are provided with a complete picture of the way the process takes place [12].

Here are some of the advantages of process mapping [6]:

- process mapping often tell more than words, therefore they should be commonly used in organizations and let us assess the work flow, the range of losses and situations to be improved,
- while creating maps the units that cooperate begin to understand tasks and problems of others and other workers' contribution to the whole process. The process of creating maps often makes workers look for some improvements while imperfections of organizations are revealed and get eliminated.

3. LOGISTICS PROCESS MODELLING

Modelling is a process reflecting the most important features of an object (process, system) in a simple manner. Models illustrate the work flow and a value added, which stimulates a better comprehension of functioning of an organisation. Logistics process modelling involves describing the functional architecture of individual subprocesses by symbolic reflection of the reality [9].

By modelling we look for the final shape of processes that should be conducted as well as possible. Logistics process modelling can take place thanks to redesigning the existing process which helps us find the answer concerning the unity of actions, costs, using the resources, etc. The problem may be discussed in a broader sense and after creating a model it can be verified paying special attention to its potential implementation. However, it must always start with identification and analysis of processes [10].

Process modelling involves complicated processes and going into details at different levels. It establishes connections and relationships between processes so that one can focus on a chosen level without going into

subject in greater depth and allocate resources to logistics processes. Models reflect real systems that are studied to find out more about them [1].

When the desired model solutions are found they are compared to the existing processes paying special attention to modifications and improvements.

Models can be verified using information technologies to stimulate processes, which are very useful because making process maps is time - consuming.

Modelling can be treated in two ways:

1. diagnostic - focus on depicting the actual state, analysis of current solutions and making a diagnosis,
2. predictive - presenting a newly - adopted model process corresponding to the conditions of a company.

Models treated in a predictive way which uses processes based on many attempts, experiences and implementations of IT systems are called reference models. They take advantage of business solutions without creating new processes from the beginning. Such models usually refer to functional, organisation and information areas of logistics.

In practice in case of logistics process modelling, depending on the range and subject of works, either the diagnostic or the predictive approach can be used or even both of them (e.g. when the predictive approach is limited only to the design stage of logistics processes).

As for detailed rules in the stage of process modelling, we should follow the general rules. In literature there is a set of rules to obey during process modelling [11]:

1) Each process starts and finishes for a specified customer (receiver) who determines requirements and takes advantage of the effects of processes (process individualisation).
2) Each process consists of subprocesses, operations and other basic components (process structuralisation).
3) Each process has a party responsible for the process, its own “owner” (determining process responsibility).
4) In each process one object is transformed / produced (determining a process object).
5) Process components that do not provide a value added are eliminated (focus on creating a value).
6) For each process the best structure (taking time and other resources into consideration) is determined (shaping the course of a process).
7) Each process must be properly protected by the supplier (the input arrangement with the supplier).

While modelling there is a rapid transfer of information about performing a part of a task because it is the start of another part that determines the effectiveness of operations (eliminates unproductive time wasted on waiting for an order and the periods between tasks). It is easy to get statistics concerning how long individual tasks were performed and also a statistical analysis of the length of a work cycle. Process models not only make designing organisation structure easier but also provide a graphical visualization and simulation of the real process [12].

The results of process modelling must be documented. That is why, the name of a process, its starting and final points, aims, criteria, party responsible for a process, object of a process, input with a supplier, output with a receiver and other additional information should be provided on special templates. You cannot include too much information about a process because it may make the description illegible [13]. However, you can always distinguish 10 basic stages of creating a model, using it for simulation and implementing the results (**Figure 1**).

Many details of the logistics process management require the use of information technologies. In the market there are not fully-integrated tools dedicated to the needs of logistics process management. There are some IT tools facilitating a process analysis of a company and they serve well in improvement processes on a large scale and in the long term [16]. They are a part of the rapidly - developing concept called Business Process Modelling (BPM) and provide a graphical presentation of logistics processes.

Process modelling tools can be divided into three groups [15]:

- programs for creating diagrams are used in visualizations, process mapping by means of diagrams and documentations, e.g. MS Office Visio 2007, iGrafx FlowCharter (Corel), cheap and easily operated,
- CASE tools (Computer Aided Software Engineering) - for process modelling especially when they are to be integrated with IT solutions, e.g. Designer / 2000 (Oracle), Select Enterprise (Select Software),
- advanced tools for designing and improving processes, for advanced analyses and simulations, such as iGrafx Process / iGrafx Process for Six Sigma (Corel), ARIS Toolset (IDS Scheer) [16], Adonis (BOC GmbH), Workflow Analyzer (Meta Software) or process modelling tools in ERP systems (built in these systems), e.g. IFS Business Modeler. They are relatively expensive and difficult to operate.

Although there is a wide range of available IT tools facilitating process mapping and many consulting companies, MS Word and Visi still remain the most commonly used tools.

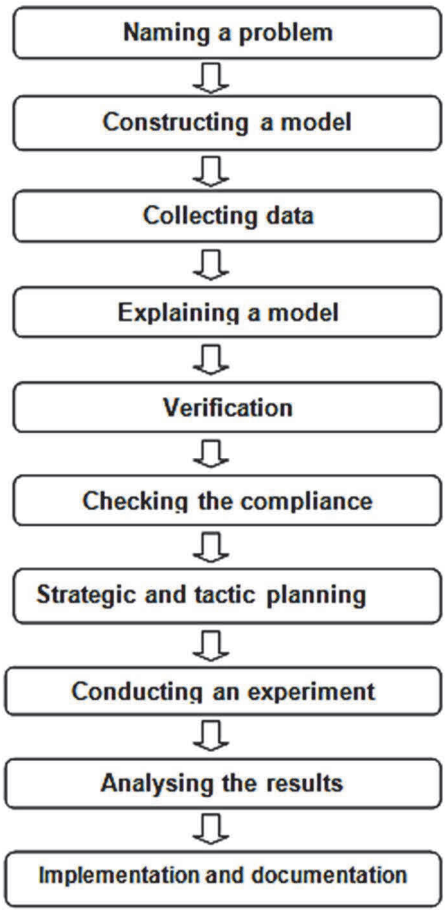

Figure 1 Stages of creating a model and implementation of its results

4. BPMN AS A TOOL FOR MAPPING AND MODELLING LOGISTICS PROCESSES

Transport, forwarding and logistics oriented processes gained popularity and intensified the search for efficient tools for process modelling, analyses, optimization and automatic creating of applications stimulating these processes in IT environments [10].

An example of a tool that got recognition is Business Process Modelling Notation, usually known as BPMN. It is accompanied with a special language BPEL (Business Execution Language for Web Services) based on XML (Extensible Markup Language) which creates a code of a program that stimulates a process described by BPMN.

BPMN became a graphical standard for business process modelling and a standard for service description. It offers semantics and syntax of a language of diagrams that describe processes. BPMN offers a range of advantages in business process modelling in comparison to UML (Unified Modelling Language). First of all, BPMN offers the technique of modelling process flows and workflows. The technique is adjusted better to modelling ways used by business analytics. Secondly, reliable mathematical basis provides direct transformation into the execution languages of business processes while UML does not offer it. BPMN may be transformed to UML and a process model can be a starting point for designing systems via UML tools.

Generally speaking, BPMN is process mapping and provides a graphical notation of a process or a complex of processes / operations and their interrelations [20,21]. There are some special graphical symbols used to describe elements of a process map. The advantages of BPMN in logistics process mapping are:

- a user - friendly way of describing a logistics process helps experts and other users understand it better,
- symbols used in process mapping are well-known in many countries which makes it easier to compare standards between companies from many various countries,
- identification of key operations in a given process and specifying necessary inputs and outputs in a given operation,
- identification of unnecessary operations (that do not provide a value added) such as storing semi-manufactured products between operations, internal transport etc.

BPMN diagrams can be unambiguously translated to other standards - BPEL and XPDL (Process Definition Language). It is helpful in migration between tools of process implementation.

BPMN provides a detailed description of one business process diagram called BPD (Business Process Diagram) which was to serve two purposes. Firstly, it can be easily understood and used. It may be used for quick and easy logistics process modelling since even users without technical abilities will comprehend it. Secondly, with BPMN you can model complicated complex logistics processes and transform it into any execution language of business processes.

In logistics process modelling one has to model only operations starting the process, then operations which carry out the process and finally potential results of the process. Decisions and branched processes are modelled by means of decision nodes regardless of the kind of tool that models the process - the emphasis was put on a comprehensive description for all users irrespective of the used tools. However, to achieve the best possible results an approach should be supplemented by simulation of a process [10].

There are also plenty of limitations and drawbacks of BPMN [19]:

- can be used only for business process modelling,
- does not model data flow but only control flow (data can be additionally described),
- does not inform users about a structure and access to data (especially in a safety section),
- hardy describes dynamic groups and the hierarchy of users,
- the organisation of a company is poorly presented.

However, in spite of all the mentioned drawbacks BPMN remains the best tool for logistics process mapping, modelling and simulation.

5. CONCLUSION

Logistics process mapping and modelling in BPMN notation is essential to comprehend and connect logistics processes with the business ones in the whole company and provide firm support for other modelling techniques like entity- relationship modelling, designing systems and application by means of UML, designing XML schemes and designing network architecture. All these methods of modelling help a company understand and work out functional architecture in such a way that it accelerates responses to changes in a safer manner. Due to the careful verification of efficiency and effectiveness before logistics process implementation there would not be expensive mistakes any more.

Thanks to using BPMN notation, mapping and modelling let us improve existing processes, implement a process structure in an organisation, understand existing processes better and eliminate or simplify the ones that need to be modified.

REFERENCES

[1] JACYNA M., Modelowanie i ocena systemów transportowych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2009, pp. 85.

[2] CIESIELSKI M., (red.), Instrumenty zarządzania łańcuchami dostaw, PWE, Warszawa 2009, pp. 216.

[3] LISIECKA K., Kreowanie jakości. Uwarunkowania, strategie, techniki. Wydawnictwo AE, Katowice 2002, pp. 243.

[4] ŚLIWCZYŃSKI B., Controlling w zarządzaniu logistyką, WSL, Poznań 2007, pp. 72.

[5] NOWOSIELSKI S. (red.), Procesy i projekty logistyczne, Wyd. UE we Wrocławiu, Wrocław 2008, pp. 83.

[6] PEPPARD J., ROWLAND P., Re-engineering, Gebethner & Ska, Warszawa 1997, pp. 210-211.

[7] HUNT V.D., Process Maping, How to Reengineer Your Business Processes, John Wiley & Sons, New York 1996, pp. 192.

[8] BOZARTH C., HANDFIELD R. B., Wprowadzenie do zarządzania operacjami i łańcuchami dostaw, Wyd. HELION, Gliwice 2007, pp. 86.

[9] SUSSAM J. E., Logistics modelling, Pitman, London 1995, pp. 3.

[10] STAJNIAK M., GUSZCZAK B., Analisys of logistics processes according to BPMN methodology, in: P.Golińska, M. Fertsch, J. Marx-Gomez, Information Technologies In Environmental Engineering. New Trends and Challengers, Springer - Verlag Berlin Heidelberg 2011, pp. 540 - 544.

[11] SCHMELZER H.J., SESSELMAN W., Geschäftsprozessmanagement in der. Praxis. Hanser Wien 2003, pp. 81.

[12] KASPRZAK T. (red.), Modele referencyjne w zarządzaniu procesami biznesu, Wyd. Difin, Warszawa 2005, pp. 15.

[13] TOSUN I., Modelling in transport phenomena, Elsevier Science & Technology Books, Ankara 2007, pp. 14.

[14] MANAGANELLI R.L., KLEIN M.M., Reengineering, PWE, Warszawa 1998, pp. 327.

[15] GRUCHMAN G., Rysować czy modelować, „ComputerWorld" 1998, nr 43, pp. 14.

[16] SCHEER A. W, Architecture of integrated information systems, Springer Verlag, Berlin 1992, pp. 41.

[17] STAJNIAK M., GUSZCZAK B., Analisys of logistics processes according to BPMN methodology, in: P.Golińska, M. Fertsch, J. Marx-Gomez, Information Technologies In Environmental Engineering. New Trends and Challengers, Springer - Verlag Berlin Heidelberg 2011, pp. 540 - 544.

[18] HOLLINS B., SHINKINS S., Zarządzanie usługami. Projektowanie i wdrażanie, PWE, Warszawa 2009.

[19] PIOTROWSKI M., Notacja modelowania procesów biznesowych, Wyd. BTC, Warszawa 2007, pp. 10.

[20] ALAN A., BRITSKER B., Introduction to simulation and SLAM II, A Halsted Press Book, John Wiley& Sons, New York, Chichester, Brisbane and Systems Publishing Corporation, West Lafayette, Indiana 1989, pp. 10-14.

[21] STAJNIAK M., KOLIŃSKI A., The impact of transport processes standardization on supply chain efficiency, LogForum 2016 nr 1, p. 42.