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Research Article

Usage of Process Models for Quality Management System: A Case Study of Energy Company

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Abstract

Business Process Management is the most important part of nowadays management. It ties company employees to work together towards a common business goal as well as dismantle existing business connections if they do not work properly. Thus, it is important to understand the dynamics of processes in the context of employees and assessment of risk during the execution of processes. The current article describes the possible usage of process models in the sense of quality management based on performed case study. The aim of this paper is to describe how process modelling approach facilitates to manage elements of a Quality Management Systems (QMS) such as organizational structure and responsibilities, business processes, information management and control of documents.

Keywords: Quality management; Business process management; Risk; Process modelling; Employee awareness

Introduction

For businesses performance improvement it is mandatory for companies to increase customers and other stakeholder's satisfaction through establishing of rational goals, minimizing expenses, extending productivity and improving business processes. It is obvious today that quality, which can be defined as fulfilment of customer needs is one of the most important assets for enterprises in market competition. Along with quality, risk assessment and its identification play a vital role to maintain and execute secure business processes. Total Quality Management (TQM) and related topics like risk management are the primary management tools nowadays. The approach for assessing risk is to identify potential severe failures that could occur and have an impact on product quality and business processes. The TQM meaning is much wider than the creation of product or service quality, or it is a management philosophy, which companies use for improvement in internal and external organizational aspects. This paper aims to illustrate the rules of process modelling approach and its facilitation to manage aspects of a Quality Management Systems (QMS) such as organizational structure and responsibilities, business processes, information management and control of documents.

Review of Literature

In this section, the authors discuss the literature review of the topic that comprises of quality management system, business process management and its background. Moreover, researchers also included business process re-engineering and risk assessment into this section. There are several ways of quality management system (QMS) like TQM, ISO series, Lean Six Sigma, Heijunka, Jidoka, Poka-yoke, Kaizen, Hoshin, Andon Cord, Tsukurikomi, Toyota Production System etc [1-5]. These approaches are similar regarding how to define the quality and how to consider it in all aspects of organization. A company should plan and manage the quality at regular basis while QMS are effective quality planning and management tools on a regular basis.

Today's organizations broadly accept Business process management (BPM). BPM supports businesses by providing a set of tools, methods, and techniques to identify and discover business processes, also to analyse these processes to find opportunities for improvement, to implement the improved processes, and to monitor and control their execution. A business process typically involves different organizational aspects, ranging from human resources to business documents and technology [6]. Business process re-engineering (BPR), also known as business process redesign, business transformation, or business process change management, is a business management strategy focused on the analysis and design of workflows and business processes within an organization. BPR help organizations to rethink fundamentally the way they act today, to improve efficiently customer service, to cut operational costs, and to become worthy competitors. BPR emphasized a holistic focus on business objectives and how processes related to them, encouraging full-scale recreation of processes rather than iterative optimization of sub-processes [7].

Risk identification can proceed with the help of risk assessment approach. Risk assessment is a prescribed and systematic approach to figure out risks related to equipment and supporting systems [8] which affect business processes. Risk can also be identified during process modelling, the integration of BPM and risk management facilitates an organization to sustain and accomplish secure business processes. It can also enhance the ability to reduce risk in business process by design and to mitigate such risks at run time [9]. Moreover, proper process modelling deals with the problem of uncertainties that organizations face in their daily operations, such as malfunctioning of any process that happens due to the following causes:

Software (IT infrastructure) -Failures may occur due to the software associated a system. The software may not be obtained from a well-established supplier or the system owned by reliable and pre-validated supplier having good same software history.

User (worker)-The worker error indicates human errors during operation, such as negligence. System/Components-The cause type deals with the hardware used in that equipment. Any component that malfunctions during the operation will be included in this type.

These uncertainties and their impact on organizations are commonly known as risks; risks are defined in terms of a combination of their consequence and likelihood of occurrence. They can be identified and addressed during process modelling, risk assessment and determination would be helpful for employees' workplace effectiveness as well [10].

Methodology

There are only few research papers written about process models' implementation in a way, which regular employees can use afterward. Mostly they are focusing toward process analysts or quality engineers or discuss the process maturity models. [11] In the following paper, the authors share practical experience how to implement process-based models and to make them attractive for employees. For this paper, a case study [12] is used and the data is collected for three months project, conducted in one of the energy sector company of Estonia.

Problem Formulation

The case company, which operates internationally offers a wide selection of modern technological project solutions and builds metal constructions, power engineering supplies, and industrial equipment. The technological solutions developed by company are mostly used in power plants and oil plants. The company goal from a quality management perspective was to bring its quality management system to the more advanced level, where also the regular employees are involved. There are several motivations: firstly, the company working languages are Russian, Estonian and English, the process documentation must be kept up-to-date in all languages, and thus the company should make considerable effort to keep these documents synchronized and the customer's request current process documentation. Secondly, as the company has previously managed employee's job descriptions separately from processes, there was a slight mismatch between processes and staff job description. Thirdly, as the company has kept process documentations on the "paper", there were no process models supporting tools in use. This caused the situation when after several document revisions, the process inputs and outputs hasn't fit together. Lastly, company has several processes with multilingual documentations. If the same employee has participated in several operations, it caused the situation when one should read a lot of documentation, even if his participation in process was very narrow. Therefore, the employees were not motivated to observe the documents change log and to read updated documents. To solve the previously described problems, the company has initiated ISO 21500 project. The authors have gathered the information for this research through interviews followed by process modelling. The company has planned to disseminate the results through the company intranet. The Software AG toolset ARIS was selected for this purpose [13,14].

Process Modelling Rules

Authors suggested the novel modelling approach, which enables to document the organizational structure considering the corresponding roles and processes with inputs and outputs, which are associated with certain documents if exists. For this purpose, the research team has performed test, to determine the most readable notation for business users. From process modelling perspective, ARIS is a software tool that supports several processes modelling notations including Business Process Modelling Notation (BPMN), Event-driven Process Chain (EPC), Value Added Chain (VAC), etc. There was a consideration between BPMN and EPC/VAC. From a business perspective, the BPMN remains too complicated for business users, and it was considered too much IT related to model then all aspects needed to describe. Also, the authors have suggested swim-line type models are, but customers elected approach, which is not swim-line based. Thus, the authors have selected EPC/VAC based as a process modelling approach.

Different companies have different approaches in ARIS, but they haven´t previously developed rule-set for building up models in ARIS, the authors proposed to use the developed modelling approach. The modellers present the first and second modelling levels as Value-Added Chain (VAC) diagram models, which show process sequences with inputs, outputs and responsibilities or guarantor of process operation, to document the process landscape in the first modelling level. The high-level model is oriented for the company board members to determine their direct responsiveness. In the case study, architecture has documented that consist of process owner and process managers, with process outcomes, interconnections, and goals. Document process phases/sub-processes with their inputs/outputs and sub-process owners/managers are on the second modelling level. The focus groups for these models are department managers, and it can be seen in Figure 1. In the case study, the goals and related KPI-s were assigned to the processes. To read first and second level models, the end users should understand the various type of visual object before the modelling of first and second levels that can be found in Table 1. All these objects also include a description, validation information, etc.

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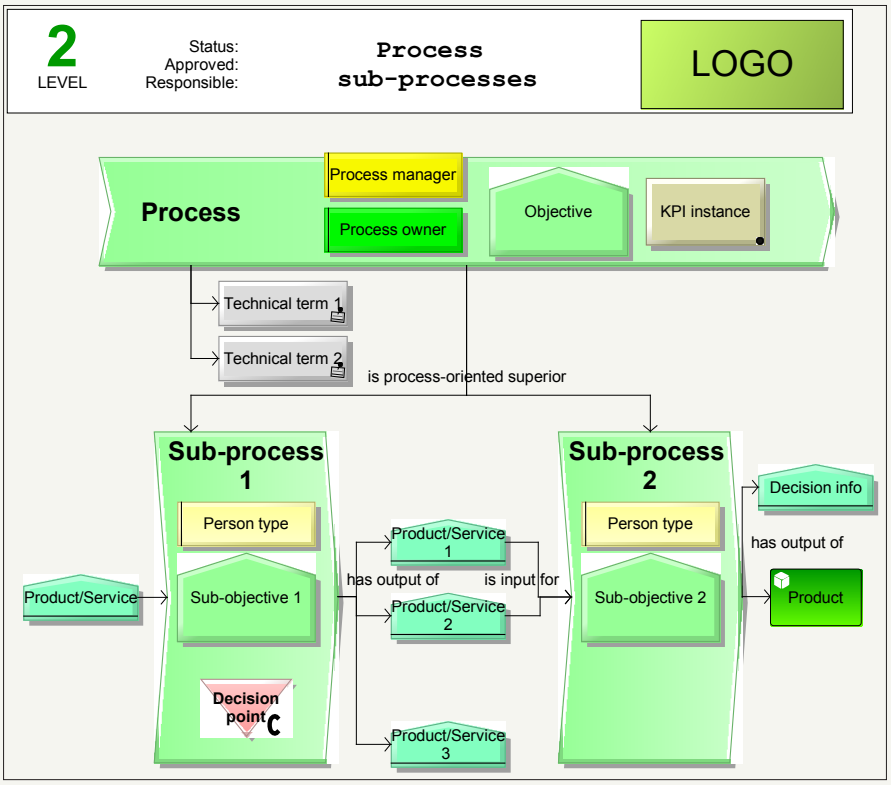

Figure1: Sample of level 2 sub-processes value chain.

Table 1: VAC level 1 and 2 objects.

Symbol	Name / Description
Product/Service	Product/service-illustrate process inputs and outputs
Product	Product-illustrates the outcome which will be sold to customer and brings money to the company
Person type	Role or Person type-describes the responsible role
Sub-process	Sub-process-name of sub processes
Objective	Objective-objective of the process or sub process
KPI instance	KPI (Key Performance Indicator)-KPIs related to the process or sub-process
Technical term	Technical term-terms which is required to understand the process documents

The third modelling level is used to document sub-process steps to determine the sequence of steps and to show where the process value is generated and where the external inputs are used. From an auditing perspective, it is quite easy to show process steps where auditing actions should take place (tollgates). Each sub-process step assigned to certain role, to identify the managerial responsibility as shown in Figure 2. That level is modelled through EPC modelling approach.

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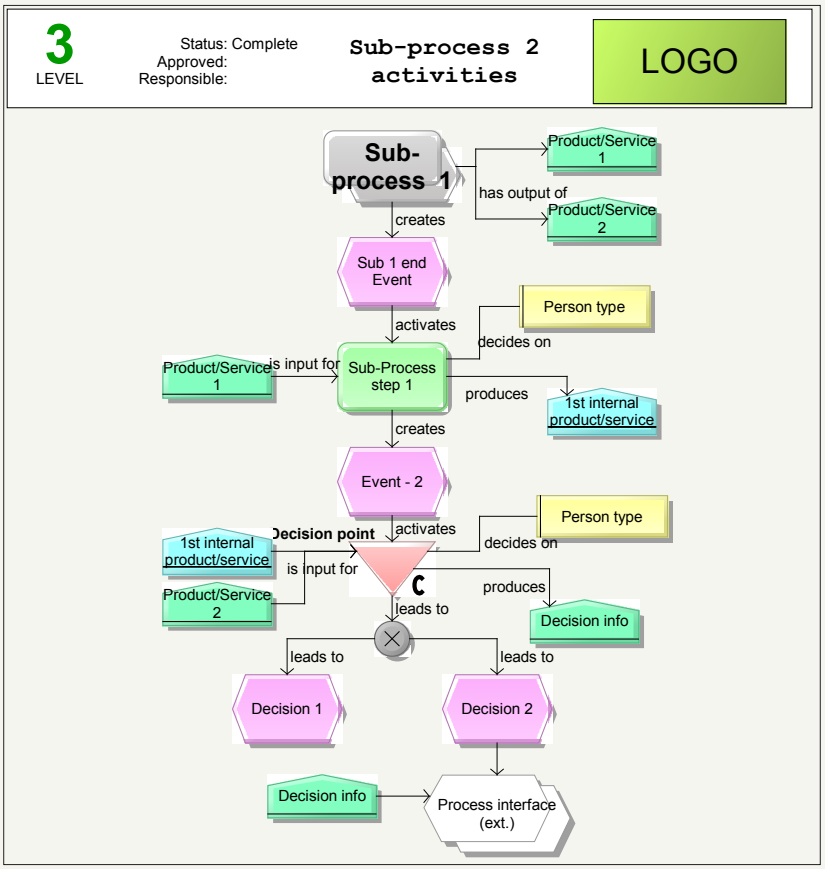

Figure2: Sample of level 3 sub-processes steps chain.

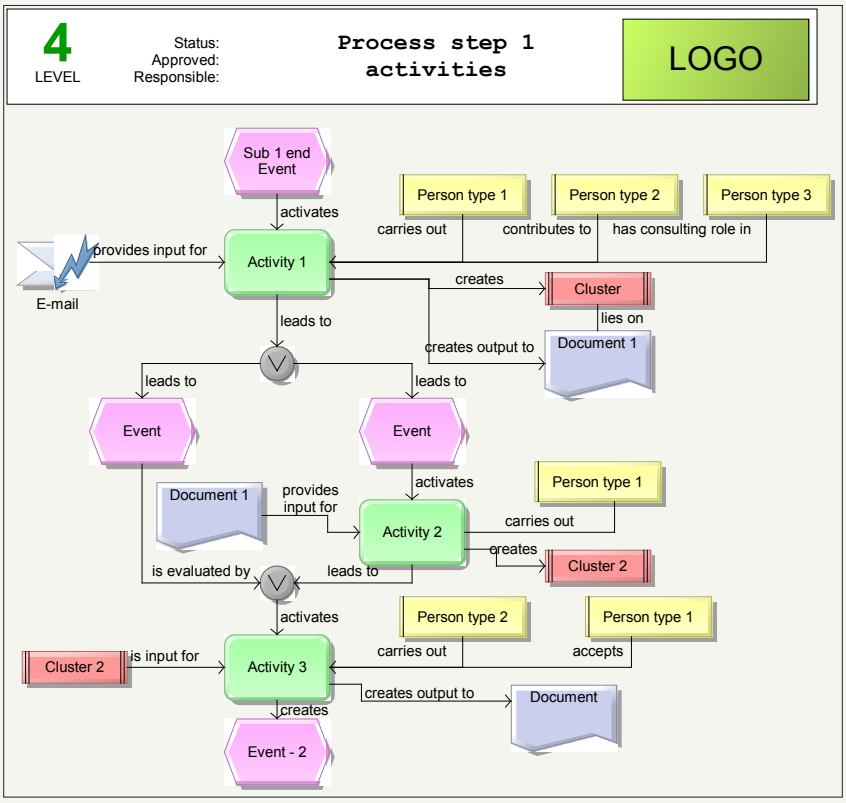

Figure 3: Sample of level 4 sub-processes steps activities chain.

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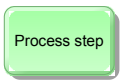
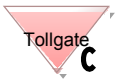
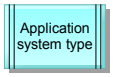
Table 2: Level 3 and 4 objects.

Symbol	Name/Description
	Event-occurs before and after process steps and activities
	Process step (function)-describes set of activities, which will be performed
	Process interface-reference to previous or following sub-processes, which will be activated by process step
	Business rule-describes rules that must be followed performing process step activities
	AND, OR and eXclusive OR (XOR) predicates
	Tollgate-defines process step where control activities must be performed and which results must presented to managers
	Risk-defines process risks that may occur performing process step
	Activity-activity which is performed to archive process step objectives
	Document-document which could be used by activity or created/ improved/approved etc by activity
	Operating resource-resource which supports activity
	Application system type-IT system which supports activity
	Cluster-group of data which could be considered as a part of service

The fourth modelling level covers activities and their sequences. It shows how particular sub-process steps are performed, which are inputs and outputs, documents, products, services modelled, related business rules, process participants, resources and IT applications needs, etc. Thus, this layer is quite an information intensive. Frequently, if processes are not very critical, this modelling layer stays out of the scope of modelling, but if the modeller needs to add job descriptions for the positions, then it is mandatory to model this level as it is shown in Figure 3. Third and fourth layers describe sub-processes interconnections and have logical predicates such as OR, exclusive OR (XOR) and AND. The end users should understand the different type of visual object before modelling of the third and fourth level that are presented in Table 2.

The organizational view model is built up according to managerial levels, where the first level shows managers and their direct subordinate positions with the name of organizational unit as depicted in Figure 4. Thus, the three-level process models enable to model the organization managerial responsibility, and the fourth level is used to describe the contribution of responsibilities.

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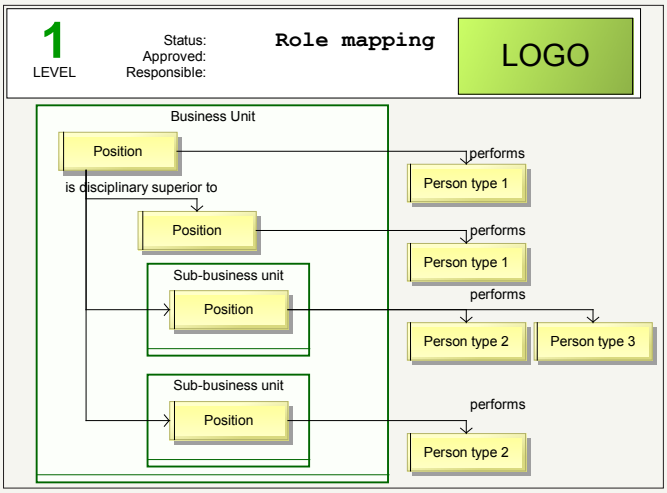

Figure 4: Managerial organizational structure.

Information Collection

The authors organized the information collection for documentation in three phases – the overall process landscaped documentation, followed by the detailed level process view documentation and then, information publication and process workshops. In the first phase, the authors suggest conducting the interviews for moving from C-level managers down through all managerial levels. In the case study authors have analysed the original material about business processes and employees job descriptions, which enabled to define the departure point for the interviews. Also, the questionnaires have used to collect initial information beforehand. After interviewing of managerial level key personnel, the initial process model has built. This model included sub-process descriptions and its steps with descriptions of their interconnections and events. Based on the model, the researchers have generated the original documentation and sent it out for validation. After validation, the process introduction workshop for the customer was organized. During the process introduction workshop, the processes risks were identified and analysed.

In the second phase, the authors have described the sub-processes steps in detail. All activities, their input/output documents /normative document/ e-mails/data, related business rules, application systems, resources, and participants were described. Lastly, the information publication via intranet was completed, before it, the missing elements were identified, the modelled and brainstormed steps were minimized, and finally the process changes have implemented.

Findings

The project has performed accordingly to the schedule. The only delay was caused by the vacation period, which influenced the software development required to publish the project output into the company intranet. From modelling perspective, the proposed methodology is successfully elected. The first level of processes has described the company board members responsibilities. Besides, board members have requested a further poster with second level processes.

In order to motivate employees to read the modelling results, the company has developed the personal view into the intranet. Moreover, the company has created quality documentation directly from ARIS model via script, which allows keeping documentation synchronous in a multilingual environment. In such way, employees can be involved in the project, as they feel that company care of their everyday personal duties. Presenting information in that approach made information attractive for employees, as the information is accessible for all company employees; thus, it raises discussions, which is already a significant progress.

To sum up, the key novelty outcomes from project to company were:

a. Single source of truth about processes, related inputs/outputs, supporting IT systems, roles, resources, business rules, etc.

b. Value based processes approach implementation, which is documented inside IT system as a model (ARIS system)

c. Business term glossary is related to processes

d. Processes mapping following standards (ISO 21500, 9001, 14001, 18001)

e. Model-based normative document generation supported by multilingual demands

f. Position based managerial carrying responsibilities and reporting through the corporate intranet

g. Mapped process and job objectives with KPI-s, where KPI´s measurement and risk points are clearly identified in processes

h. Clearly stated and visualized decision points in processes

i. Easily accessible process value chain based on position and managerial level

j. Top and middle managers are trained to use the system and training plan exists for end-user training;

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k. Employees are trained based on model outcomes

l. Existing plans to perform process audits, which includes feedback for process owners

m. There is high potential to extend the designed model into the following domains

n. Qualification management - all works require a certain skill, which is the constraint for the positions. Precise planning of qualifications could lead to more optimal employment

o. Competence management - based on position competencies the process bottleneck (related with HR) can be analysed and controlled

Relevance of Process Modelling

A production process has selected to analyse through process modelling, VAC and EPC models have developed on ARIS and simulated. The following results regarding AS-IS (before process modelling) and TO-BE (after the process has modelled) can be seen in the Table 3:

Table 3: Process activities with respective costs and times.

Process Activities	Functional Cost (€)		Processing Time(min)	
	AS-IS	TO-BE	AS-IS	TO-BE
Collect technical information for production	2,95	2,95	5	5
Search technical documents to produce production order	6,25	0,41	15	1
Collect information about production order fulfilment steps in production process	8,20	4,10	20	10
Prepare and send information to the customer about production order fulfilment	2,05	0,41	5	1
Collect information about available capacities	12,30	6,15	30	15
Prepare and send information about available capacities	10,25	0,41	25	1
Sum	42,00	14,43	100	33

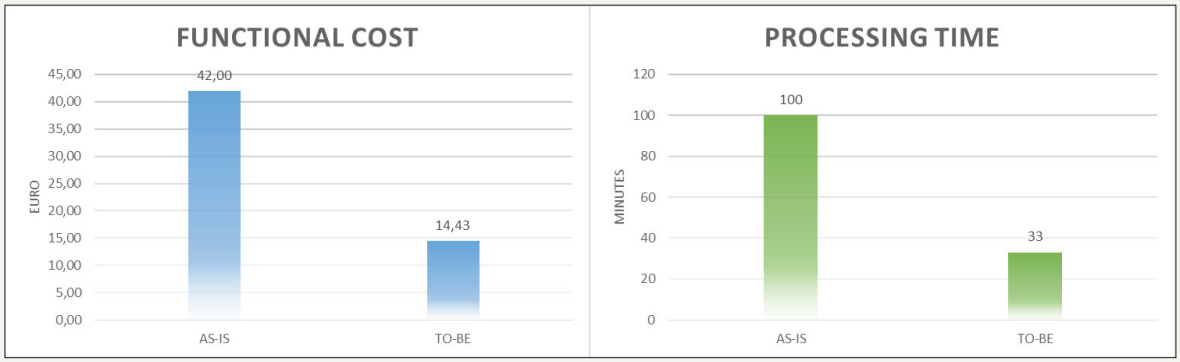

Figure 5: Comparison of AS-IS and TO-BE processes by means of cos and time.

The improvement has been observed both in cost and time, as functional cost and processing time reduced quite significantly. From Figure 5 it can be depicted that functional cost has reduced by 66 % and 67 % decrement in processing time has been noted.

Conclusion

After completing the study, the company has clear responsibilities, extensive discussion about processes and its outcomes, automatic normative documentation generation, personalized view for employees, risk identification, continuous process improvement practice, which all together supports the further improvements of projects process. Firm maturity has risen remarkably, compared to the previous years. Through that project companies' employees understood what organizations are doing to create value for its customers. They realized that processes are combined the flow of activities and information, which moves through business functions. Organization management realizes that process framework gives several benefits like more focused objective settings, a different view for cost management, quality management, process observability, better waste management. Moreover, business process security can be achieved through risk detection and its assessment during process modelling.

From process management perspective we can conclude that every process must have system to collect performance data, every collected data must be analysed, each analysis must finish with decision and each decision must be followed by an action. To motivate the employees, authors suggest to using the personalized approach, where an employee could recognize herself/himself into an organization system.

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