TO IMPROVE QUALITY VALUE STREAM MAPPING /COMMERCIALIZATION WITHIN ADVANCED MANUFACTURING

[1]Rajendra Kumar Yadav ,[2]Jogendra Choudhary
M. Tech. Scholar, Assistant Professor
Department of Mechanical Engineering
Rajasthan Institute of Engineering & Technology, Jaipur, India

Abstract: *Due to the increase in oil prices and high environmental dynamism, organizations delivering in affected markets need to identify ways to reduce time to market (TTM) and cost of non-quality (CONQ) of their commercialization processes, in addition to pursuing and developing new markets. In order to survive over time, organizations need to manage knowledge for exploitation and exploration, utilizing existing competencies and acquiring new ones. Companies in the manufacturing industry today are faced with increasing challenges with respect to cost effectiveness, lead time and quality of the production system. Dealing with these contradictory goals, an important task is the selection of suitable solutions for the integration of inspection processes in the industry within the process chain, which are necessary to ensure the required production quality and quantity. Value Stream Mapping (VSM) is a state of the art tool which is very often used for this by professionals. Value stream mapping (VSM) is used to analyses the lead times, work in progress levels (WIPs) and non-value added time. From the current state VSMs of bar-cutting/bending and column processes we have significant lead times, idle times Improvements are done by identifying the wastes and eliminating them and reducing the non-adding value. Therefore, in this article an innovative approach called Quality Value Stream Mapping (QVSM) is presented. Based on the design elements of VSM, it provides a suitable tool for the visualization, analysis and design of quality assurance measures within process chains in manufacturing. The implementation of the developed approach is exemplarily shown for Value stream in the process industry.*

Index Terms—Lean thinking, Value Stream Mapping (VSM), Waste, Variability. **Commercialization, exploration**

INTRODUCTION

Nowadays due to changing customer requirements, there is an increase in product varieties and fluctuating order volumes. These challenges are accompanied by shorter product life cycles, intensified cost pressure and rising quality requirements Quality Value Stream Mapping (QVSM) is introduced which combines the method of classical Value Stream Mapping with the field of quality management. A decisive part of an innovation is the commercialization or industrialization process of the product or service. The time where organizations could invest and build *technology fortresses with high barriers of entry* are gone. This stress organization is to reduce their *time to market* (TtM) and their *cost of non-quality* (CONQ) of *new product introduction* (NPI). Organizations need to continuously improve and design their products and services for service ,cost and manufacturing. This stress organization is to reduce their *time to market* (TtM) and their *cost of non-quality* (CONQ) of *new product introduction* (NPI). Organizations need to continuously improve and design their products and services for service, cost and manufacturing.

1. Methods of Process Analysis and Quality Management in process industry

1.1 Process Analysis

A business process is a collection of activities taking one or more kinds of input and creating an output that is of value for the customer Nowadays, despite the increasing concerns of using the most appropriate strategies for implementing Lean methodologies capable of enhancing sustainability within enterprises, there are also major concerns related with the scarcity and high cost of raw materials and resources, i.e., concerns with the resource efficiency, in particular with energy, raw material and water efficiency.

1.2 Value Stream Mapping

Value Stream Mapping (VSM) is a state of the art tool which is often used for this by professionals in a process industry. It, however, is not capable of addressing the issue of a suitable integration of testing processes within the process chain. Yet, this provides valuable potential to facilitate the identification of effective testing equipment, testing strategies and quality control tools. Therefore, in this article an innovative approach called Quality Value Stream Mapping (QVSM) is presented. Based on the design elements of VSM, it provides a suitable tool for the visualization, analysis and design of quality assurance measures within process chains in a process industry. The implementation of the developed approach is exemplarily shown for a complex value chain of a manufacturer in the electronic industry. Value Stream Mapping (VSM) is a simple but effective method used for the illustration and redesign of value streams. The method originates from the Toyota Production System and consists of two main phases: value stream analysis, in which the current value stream is visualized, and value stream design, in which sources of waste within the production process are uncovered and reduced.

1.3 Process Mapping analysis

A Process Mapping is a graphical and analytical process that shows a sequence of activities using flowchart symbols. A further objective of a Process Mapping is to identify output variables (customer critical features) and input variables (impact on critical features) of each process step. Additionally, controllable factors (e.g. rotational speed) and disturbance variables (e.g. vibrations) are also regarded Process Mapping is an established tool for the visualization of processes. In comparison to process models of Business Process Analysis, Process Mappings contain considerably more details. Process Mapping is a very valuable method for the visualization of process flows taking into account the aforementioned key figures. Yet, it does not cope with the quality-related aspects of defect rates, inspection processes, quality control loops or quality related costs.

1.4 Stream of Variations for quality

Stream of Variations (SOV) is an effective measure to improve quality by means of variation reduction. Stream of Variations (SOV) is a generic math model for the analysis and performance prediction of multistage manufacturing processes in which product geometry and dimensional variation are of critical importance. SOV integrates key processes, product characteristics represented in CAD/CAM models, information on the process layout, the sequence of operations and the production system observability into a unified framework it is mathematically very complex and does not focus on process visualization. Furthermore, quality related costs are not analyzed in detail.

2. METHOD FOR QUALITY VALUE STREAM MAPPING (QVSM)

The method of Value Stream Mapping addresses this issue. QVSM is a procedure model, complementing classical Value Stream Mapping with specific quality related elements to systematically visualize, analyze and improve quality issues within a process chain. In addition to the processes and flow of materials, present quality standards, quality inspections and quality control loops are considered. Based on this, the status of the quality control along the process chain is evaluated in terms of key indicators with regard to quality and quality-related costs. Similarly to conventional VSM, in the concept of QVSM the term “value” is defined as the opposite of Non value added processes. However, due to the special focus on quality control in QVSM, the reduction of defects as a type of waste and the identification of suitable measures for this are emphasized. The presented method of QVSM consists of four phases: preparation, quality value stream analysis (QVSA), quality value stream design (QVSD) and implementation. In the following, these phases are elucidated in detail.

3. Preparation

Similarly to conventional value stream mapping analysis, QVSM starts with a preparation phase providing a basis for further recording and analysis of the value stream. The preparation phase consists of three steps. First, a product or product family to be analyzed is selected to reduce complexity as far as possible. Second, fundamental process knowledge of the process chain to be considered is obtained, e.g. by means of a SIPOC analysis. Third, the quality targets of the analysis are defined, i.e. a reduction of defects or a decrease of the quality-related costs.

4. Quality Value Stream Methodology (QVSM)

On this basis, the quality value stream analysis is carried out in several phases. This phase and the following phase of quality value stream design are the core parts of the QVSM methodology. QVSM is divided into five steps. First, all relevant processes within the value stream of the considered production line are visualized similarly to the procedure of classical VSM. However, in contrast to VSM quality-related processes such as quality inspections, rework processes and scrapping processes are additionally mapped for inspection processes a specific symbol is introduced. Thus, all inspections made by a manufacturer according to a present inspection plan can be comprehensively included into the value stream visualization. Second, relevant quality performance indicators are calculated and noted into an information box below the respective inspection process in the value stream visualization. Important indicators are those that include amount of inspected parts respectively the scope of inspection of each inspection process and the respective inspection characteristics. At inspection station parts are inspected, having inspection characteristics, and defects are detected. Based on this, the defects per million opportunities rate with respect to inspection process n can be calculated.

5. Conclusion

The developed method of Quality Value Stream Mapping is capable of visualizing, analyzing and optimizing multistage manufacturing processes from a quality assurance viewpoint. The process model consists of four consecutive phases: preparation, quality value stream analysis, quality value stream design and implementation. The method enables the visualization of inspection processes, quality key indicators and quality control loops within the process flow. Moreover, the quality-related costs of the production line are illustrated. QVSM, furthermore, integrates common quality management tools such as Ishikawa analysis in a process way. The advantages of QVSM were demonstrated by means of an exemplary application of the method in a process industry case study. In this example both the rate of non value added work and the quality-related costs were reduced.

6. References

[1] Koren, Y. The Global Manufacturing Revolution: Product-ProcessBusiness Integration and Reconfigurable Systems. John Wiley; 2010.
[2] Hammer, M. et al. Reengineering the Corporation. A Manifesto for Business revolution. 1st ed. Harper Business; 1993
[3] Panagacos, T. The Ultimade Guide to Business Process Management. CreateSpace; 2012
[4] van der Aalst, W.M.P. et al. Modeling Business Processes: A Petri NetOriented Approach. MIT Press; 2011.
[5] Allweyer, T. BPMN 2.0: Introduction to the Standard for Business Process Modeling. 2nd ed. Books on Demand; 2010.
[6] Pfeifer, T. et al. Masing Handbuch Qualitätsmanagement (engl. Masing Quality Management Manual). Hanser; 2007.
[7] Ōno, T. Toyota Production System: Beyond Large-Scale Production. Productivity Press; 1988.
[8] Rother, M. Learning to See: Value Stream Mapping to Add Value and Eliminate Muda. Lean Enterprise Institute; 2003.
[9] Nash, M.A. et al. Mapping the Total Value Stream: A Comprehensive Guide for Production and Transactional Processes. CRC Press; 2011.
[10]N. N. VDA Volume 4: Chapter Product and Process FMEA. 2nd ed. VDA; 2012. [11]McDermott, R. et al. The Basics of FMEA. 2nd ed. Productivity Press; 1996.
[12]Harry, M. et al. The Practitioner's Guide to Statistics and Lean Six Sigma for Process Improvements. John Wiley; 2010.
[13]Kumar, D. Six Sigma Best Practices: A Guide to Business Process Excellence for Diverse Industries. J. Ross Publishing; 2006. Competition in Multistage Manufacturing: