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Contents

IMPROVING PROCESSES SYSTEMATICALLY BY ENHANCING VALUE STREAM MAPPING AND PROCESS MANAGEMENT WITH A SHORT CYCLIC IMPROVMENT ROUTINE

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Abstract: *A Process Management System in general represents is a suitable approach to improve processes in the broadest sense. For this improvement a lot of established concepts and methods are applied practically and are depicted in literature. In most cases these improvement attempts between the different levels are not linked methodically. This paper presents and combines three – broadly practically applied and theoretically well described - approaches out of the broad variety of concepts and methods to improve value streams. Within this framework value stream mapping and the short-cyclic improvement routine are integrated into the organisational framework of process management in order to enable a methodically fostered improvement of value streams in different levels of detail. Therefore an advanced and sustainable continuous improvement process is enabled. Hence the objective of this paper is to link these industrially applied concepts for managing and improving value streams usefully, and to depict this linkage in an extended model and a practical assembly example.*

Key Words: *continuous improvement, value stream mapping, process management*

1. INTRODUCTION

Enterprises face the task of managing, designing and improving their processes in the broadest sense – so from the main processes down to the operative (work-) methods – on a daily base. For this purpose a lot of established concepts and methods are applied practically and are depicted in literature. In most cases these improvement attempts between the different levels are not linked methodically. For example, a consistent exchange of information and data between different improvement attempts does not take place.

Out of this the following questions respectively presentations of the problem are derived. How can different improvement attempts within different levels of a value stream be combined usefully? How can value streams be managed, designed and improved in a structured and repeatedly recurring way?

A Process Management System in general represents a suitable approach to improve processes in the broadest sense. This paper presents and combines three – broadly practically applied and theoretically well described - approaches (Process Management, Value Stream Mapping and a systematic routine to manage and improve processes) out of the broad variety of concepts and methods to improve value streams.

Hence the objective of this paper is to link these industrially applied concepts for managing and improving value streams usefully, and to depict this linkage in an extended model.

2. FUNDAMENTAL PRINCIPLES TO CHANGE PROCESSES

A process, that has once reached a certain level of performance, is likely to lose that level in a natural way. Improvements to push processes to a higher performance level can be achieved by innovation (volatile changes) and continuous improvement (short-cyclic changes) [1], [2].

Innovation usually means a radical improvement with crucial changes. Innovation leaps are discontinuous, often initiated by strategic decisions and are usually highly complex and interdisciplinary. Continuous improvement from a current-condition to a target-condition is characterised by a lot of small, short-cyclic (univariat; single-factor experiments) improvement steps in the specific processes. Both principles need a different amount of time and both should be utilised in organisations.

3. DEFINITIONS AND CONFINEMENT OF PROCESS AND VALUE STREAM

Processes have inputs and outputs that confine a process to the contiguous processes (upstream and downstream) and they fulfill the process purpose. The input (to be considered as an activated incident), the actual process flow and the required resources as

well as the output (outcome) are basic parameters to define a process. Processes are defined as timely and, with regard to content, completed sequence of activities [3] [4].

From a process-oriented point of view there is no fundamental difference in understanding of what a "process" or what a "value stream" is. In terms of this paper a value stream is in most cases a product-oriented flow or extract of processes on a higher level of detail. A value stream may contain different processes from the Process Map or main- as well as sub- processes from "deeper" levels of detail which affect the production of a product. The value stream itself consists of operative processes and the appertaining material and information flows. A value stream includes all activities, i.e. value adding, non-value adding and supporting activities that are necessary to create a product (or to render a service) and to make it available to the customer. This includes the operational processes, the flow of material between the processes, all control and steering activities and also the flow of information [5].

4. STANDARDISATION

A lot of companies are interpreting standards related to production processes often in a way to stabilise process conditions on the achieved level of performance, or to harmonise different processes. Based on this "best practice" definition standards remain static and they should last as long as possible [6]. This interpretation of a standard prevents a target-oriented advancement of processes [7] [8]. On the contrary innovative approaches are interpreting a standard as a target-condition to differ intentionally from the current-condition. This differentiation causes the fundament for target-oriented process improvements by reducing the difference between the current-condition and the particular standard (target-condition) [9].

5. TARGET-CONDITIONS AND ROUTINES TO SYSTEMATISE IMPROVEMENTS OF PROCESSES

The short-cyclic improvement routine proposes, starting from a current-condition, the specification of a target-condition, which should be achieved and is oriented to an ideal-state. The target-condition describes "how" a process should be performed in the future. It also can be considered as a milestone along the way to the ideal-state. The ideal-state is like a navigation point ("true north") or like an aid to orientation for the definition or specification of the several different target-conditions for the processes. [1], [7], [10].

The management is responsible either for defining the ideal-state as well as the several target-conditions as well as for coaching the operatives employees during aspiring and accomplishing the target-conditions. Examples for parameters describing an ideal-state are 100% added value, one piece flow, zero-defects, lack of impairment for the workers.

A particular target-condition is specified in detail by targets and parameters describing the process. Targets are for e.g. productivity (in terms of "performance/time unit") or quality ("failure-free parts/total parts"). The actual- and the target-condition of the process are specified for example by parameters or indicators like cycle times (customer takt), deviation, applied (work-) method, work in progress in the particular work system, or specifications considering the layout or organisational aspects. In order to formulate motivating target-conditions, for all engaged workers, they have to be realistically attainable and demanding [11].

Against the background of these principles Rother formulated ideas and procedures of the improvement- and the coaching-kata [12]. "Kata" describes a specified routine, a pattern or a habitual thinking and acting. These very often repeated routines of the improvement and the coaching kata are fundamental for the systematisation of improving processes. Figure 1 shows the routine to support process improvements and consists of the following steps:

1. Orientate towards the ideal-state and definition of target-conditions.
2. Compare current to target-condition.
3. Identify problems and obstacles systematically.
4. Formulate and try one action to solve the main problem (hypothesis and experiment).
5. Interpret and evaluate the results.

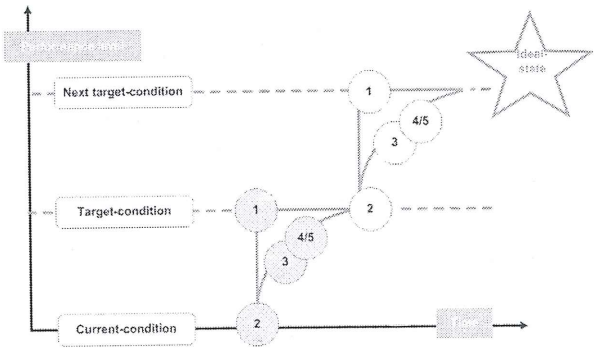


Figure 1. Routine to improve processes based on hypothesis and experiments [6]

6. VALUE STREAM MAPPING

VSM was originally developed as a method within the Toyota Production System. [13] [14].

It was first introduced as an independent methodology by Mike Rother and John Shook. VSM is a simple, yet very effective, method to gain a holistic overview of the condition of the value streams within an organisation. Based on the analysis of the current-condition, flow-oriented

target value streams are planned and implemented. [5] [15] [16].

By defining target-conditions, VSM uses a 4-Step-Method consisting of the steps "choose a product family", "draw a current-condition map", "develop a target-condition" and "implementation of target-condition" as well as an "action plan" to monitor the implementation, to describe necessary actions and activities (what, by whom, until when) to improve the value stream.

7. PROCESS MANAGEMENT

Process Management (PcM) causes a sustainable improvement of working procedures in the organisational structure.. Process Management is the combination of activities which include the planning and monitoring of a process. It also is the application of knowledge, skills, tools, techniques and systems to define, visualise, measure, control, report and improve processes with the goal to meet customer requirements. The core concept in the PcM concept is the Process Life Cycle (PLC) (see Figure 2).

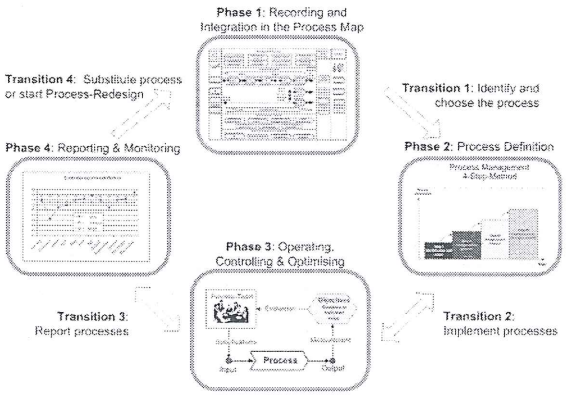


Figure 2. Basic principle of Process Life Cycle [4]

The Process Life Cycle indicates and determines each stage of the life cycle of a process within a Process Management System. It starts with the incorporation of the process into the process map and it ends with the shutting down of the process. The Process Life Cycle defines steps in the cycle of a process in the Process Management System in form of phases and phase transitions and is named the "large control-circuit" in PcM. Phase 1 "Recording and Integration in the Process Map" and phase 2 "Process Definition" represent the design and conception of processes. Phases 3 "Operating, Controlling and Optimising" as well as phase 4 "Reporting and Monitoring" specify the recurring ("daily") work of performing and improving processes.

In phase 2 the 4-Step-Method is a vital procedure to define new processes and to change and improve already existing processes. The 4-Step-Method of PcM is applied if a new process has to be defined based on identified improvement potentials. The 4-Step-Method (see Figure 2) is a general approach in PcM and it consists of the four steps "identification and scope", "analyse actual process", "design target process" and "implementation of improvements" [4]. (Wagner, 2010). The four steps are implemented by a series of – at least – four so-called Process Team Meetings (PTM). Each PTM represents a milestone during a step to ensure the systematic execution of the 4-Step-Method.

The so-called Process Jour Fixe (PJF) meetings are instruments for a continuous control of a process in phase 3 and during the transition to reporting and monitoring in phase 4. During phase 3 – representing the so-called "daily life of a process" – the focus is set on meeting the requirements and on identifying and realizing improvement actions, short-cyclically, towards a target-condition.

The reporting and monitoring of different processes and several process goals occur in phase 4. Thus, the information available in phase 2 and phase 3 is broadened by relevant, respectively strategic parameters and aspects. All relevant information and performance indicators as well as actual problems in the daily life of the process are conditioned prior to a Process Management Review (PMR). Therefore they are also available for the PJF and the PTM in order to accomplish successful decision making and to provide the basis for the deduction of necessary improvement actions [4].

8. VALUE STREAM ORIENTED PROCESS MANAGEMENT – THE SYSTEMATISATION OF VSM

Process Management provides the organisational framework for the systematisation of VSM. This is based on embedding and integrating a values stream into phases 2 to 4 of the PLC (see Figure 3).

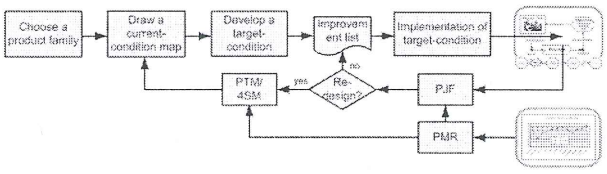


Figure 3. Procedure to systematise VSD[17]

The general approach in solving the systematisation of VSM is the conjunction of volatile and short-cyclic improvements of a value stream. This conjunction of continuous improvement and innovation can be found in the PcM-System, in phase 2 and 3 of the Process Life Cycle. The determination of target-conditions (during phases 2 to 3 utilising information from phase 4) endorses the PLC by setting clearly defined intermediate target-condition along the way to the ideal-state [17]. The following sections describes how a particular value stream is systematically comprehended, analysed, changed in great and short steps, operated and

controlled in this changeover of the phases (see Figure 4).

8.1. Volatile changes

Referring to the level of the value stream in phase 2, where the two 4-Step-Methods in PcM or VSM are applied, the current-condition at point in time t0 is recorded and a challenging target-condition is determined along the way to the ideal-state. This target-condition "target 1"is defined during step 3 of PcM's 4-Step-Method and is afterwards implemented and aspired in step 4.

The implementation is accomplished by realising improvement actions summarized in the LIP or the

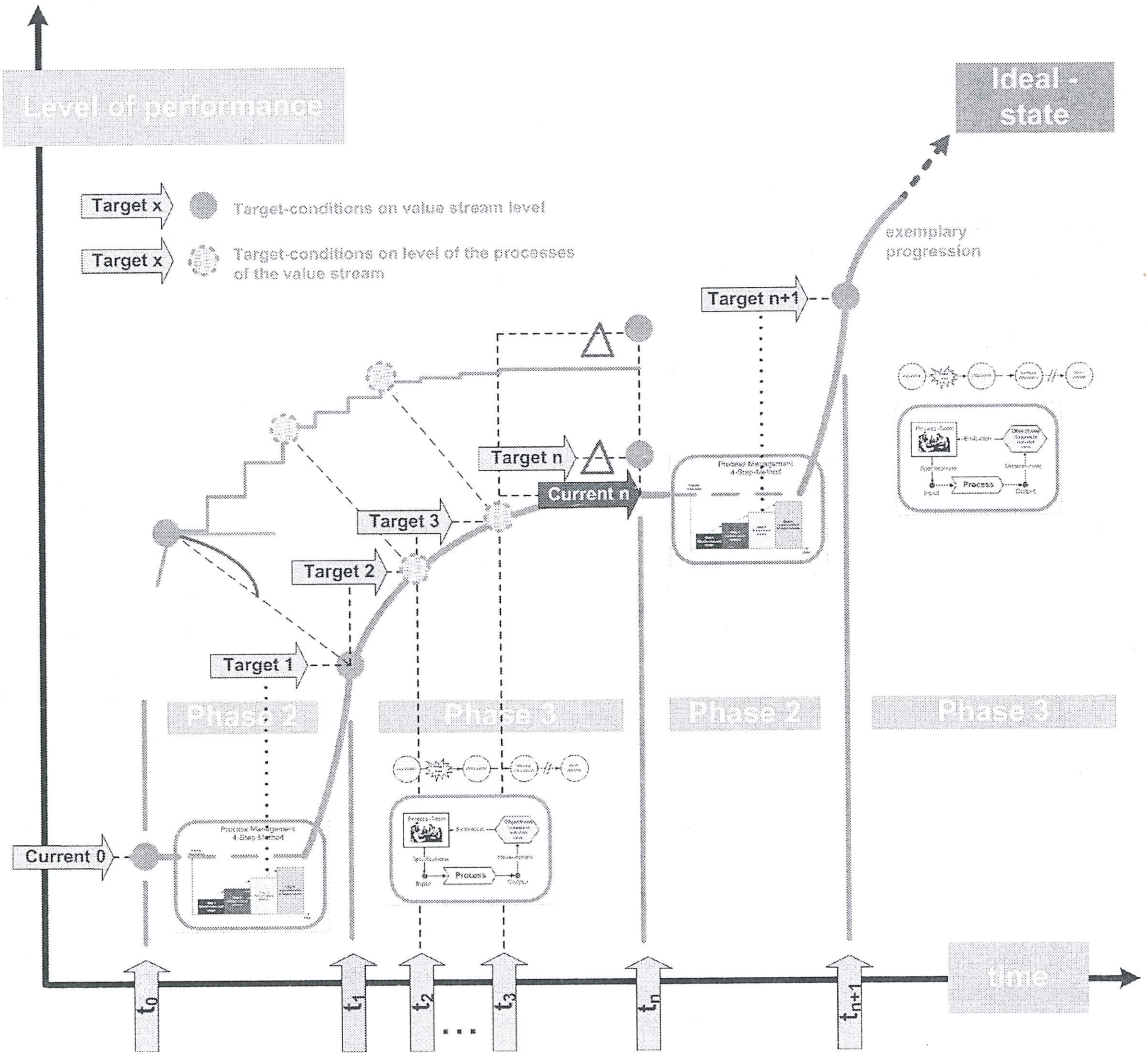


Figure 4. Systematic improvement of a value stream in the Process Life Cycle [17]

action plan taking economic, organisational and time-related constraints into consideration. In phase 2 of the

PcM volatile and conceptual changes occur on the level of the whole value stream. From a theoretical point of view the target-condition "target 1" of the now changed value stream is accomplished at point in time t1 at the end of step 4. This attained condition at point in time t1 becomes automatically the new current-condition at point in time t1 – independent of whether the desired level has been reached or not – for the following phase of continuous improvement (phase 3).

8.2. Continuous, short-cyclic changes

The most noted and practically applied method is the PDCA (Plan-Do-Check-Act)-method. The PDCA-method formalises an experimental procedure as a scientific method. Due to the complexity and variability of a system it is eminently important to establish systematic and steady elapsing procedures for improvement.

In order to establish and to maintain a short-cyclic improvement process in phase 3, it is necessary to implement a structured procedure within the business organisational structure. The short-cyclic improvement has to take place with a high frequency to implement and settle changes in the processes. Concerning this, the applied methodical approach of univariate experiments is therefore anchored as an integrated routine in the daily operation of the business. Due to the fact that the kata is an appropriate method of improving and coaching activities, this systematic routine for improving processes is introduced here as the basis for continuous improvement, and enlarges and consolidates the already applied approaches and concepts (e.g. LIP, PJF, PMR) in phase 3 of the PLC. The coaching routine aims to guide and to enhance the particular workers in applying the improvement routine (PDCA-cycles). Hereto the person has to be asked, guided and encouraged repeatedly to identify obstacles within the borders of the process and has to remove them by univariate PDCA cycles (rapid PDCA's) instead of trying to search for solutions at the processes' interfaces, or outside of the process as it is common practice. On the one hand the accompanying coaching ensures the compliance of the prescribed (work-) methods in the work systems by different workers, and on the other hand it ensures that all possible actions for improvement within a process are actually taken into consideration.

8.3. Stabilisation after volatile changes

Ideally and typically, the performance of a process respectively a value stream stabilises after reaching a new performance level. Nevertheless, a decline from this performance level is the reality. As a result it is more or less impossible to attain both a target-condition and a sustainable stabilization at the end of phase 2

8.4. Renewed volatile changes

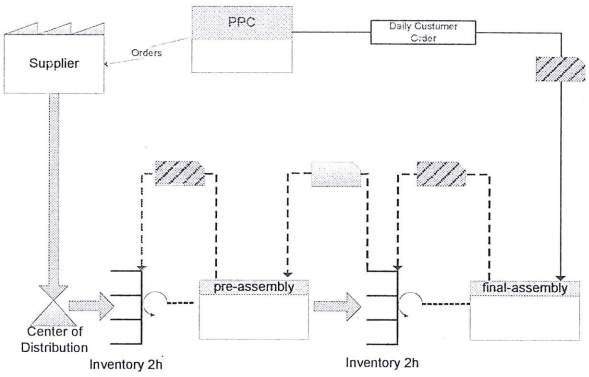
A long lasting continuous improvement usually leads to diminishing changing steps. Despite the coaching procedure and all the improvement endeavours it may occur that the target-conditions cannot be accomplished within the scope of the process borders. On the one hand this may be a reason for determining a too short a time frame for accomplishing "target n". In this case the frame may be extended and the improvement efforts in phase 3 within the process borders will continue. On the other hand in particular the non-attainment of the target-condition in phase 3 mainly occurs if the major, still existing, obstacle cannot be found between the processes or if it is beyond scope of action of the shift leaders. Hence it is imperative to initiate another innovation leap in order to improve the value stream in phase 2 across its process borders and to determine a new, challenging target-condition "target n+1" at point in time t_{n+1}.

8.5. Practical Example

A pump manufacturer with a high variant model-mix production is improving value streams and their operative processes covering a large part of the production using the improvement and coaching kata. Within the scope of the improvement routine the shift leaders in the production are responsible to improve the processes "pre-production", "pre-assembly" and "final assembly" within the determined borders of the processes. The processes have to be stabilised referring to customer takt (Cycle time) and the productivity has to be increased. An entire synchronisation of pre- and final assembly is not possible in the given situation due to technological framework conditions and cannot be realised based on a short-cyclic improvement procedure. This is why inventory is required between the processes in order to ensure delivery reliability.

At the time of the analysis of the current-condition the amount of inventory was directly dependent from the demand planning and had - during a longer period of time – an irregular inflow and outflow. The assignment of the material in the inventory area of the work system was not visualised and worked out only due to the experience of the workers. The total lead time for A-parts was more than 20 days and the value adding time was a few minutes only and theses parts were stored between pre- and final assembly between four to five days.

Based on the analysis of the current-condition a target-condition was worked out orientated towards 100% value adding and no idle times, elements of the already defined ideal-state. In the future the loading and removal of the parts will be organised based on the FIFO (First in First out) principle. In addition the target-condition was specified by a target-inventory of two hours (see Figure 5).



Product Typ	Quantity
Typ 1	104
Typ 2	88
Typ 3	232
Typ 4	20
Typ 5	136
Typ 6	9
Typ 7	63
Typ 8	2
Typ 9	19
Typ 10	3
Typ 11	24
Assumptions:	
20 working days per month	
2 shifts per day	
7,5 working hours per day	

Figure 5. Target value stream focussing the interface between pre- and final-assembly

These goals lead to several needs for action, which were figured out during the 4-Step-Method of PcM in phase 2 and were documented in the LIP. The improvements refer to the reorganisation of the inventory area of the work system including the visualisation, to the development of the control of the material and information flow between the processes from push to pull and also to an reduction of the cycle times of the adjacent processes. Each of these points for improvement confines an enclosed framework for action and a defined target-condition and each should be attained during phase 3. The defined target-conditions require both a short-cyclic improvement within the processes as well as a volatile change in the value stream. Within the processes the focus is set on a short-cyclic synchronisation of the cycle times. Within the value stream the volatile change is keen on implementing a new material and information flow.

8.6. Ongoing Monitoring

Phase 4 of the Process Life Cycle is crucial for the development of a value stream – no matter if there are small steps or innovation leaps. The actual performance data of the value streams and current information concerning the organization (e.g. key performance indicators) and the external influences are collected for the PMR. In this way the information is available for the PTM and PJF as well.

Process Management Reviews help to make the performance level of value streams assessable and controllable. They provide the basis to decide if a re-design of a value stream is necessary and to set certain targets for the improvement projects. This swinging back and forth between different conditions of a Process Life Cycle also represents the connection between volatile changes and continuous improvement steps.

9. SUMMARY AND OUTLOOK

This paper presents the linkage of these industrially applied concepts for managing and improving value streams in an extended model and equally it points out, that target-conditions for processes have to be derived from the target value stream. The short-cyclic improvement routines ensure an ongoing improvement of processes towards the ideal-state due to the determination and attainment of intermediate target-conditions. This determination and attainment of target-conditions based on short-cyclic improvement steps is recommended for the recurring ("daily") work of performing and improving processes in order to enhance phase 3 of the PLC. These "one-factor-experiments" develop processes towards their targets based on formulating hypothesis and performing experiments. Further research activities considering these issues are currently running. First practical experiences in applying the model show clear evidence to transfer the functions of real organisation precisely to those of the model.

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