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Value stream management (VSM)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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This document was prepared by Technical Committee ISO/TC 154, *Processes, data elements and documents in commerce, industry and administration*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The value stream management (VSM) method is an effective tool for the collection, evaluation and continuous improvement of product and information flows within organizations. The VSM methodology includes the analysis, design and planning of value streams. In consideration of an ideal state, the current state of the value stream is mapped according to the gathered data and subsequently analyzed to design a future state with less waste and a reduced lead time. Based on a variety of different VSM approaches, which have been developed in the framework of Lean Production primarily since the 1990s, there are communication and collaboration issues during the application of VSM in practice due to different value stream visualizations and associated calculation procedures. In particular, these challenges occur at the interfaces of departments, corporate groups or entire supply chains (see Figure 1). Therefore, the adherence of rules and guidelines in regard to VSM is required to ensure a common and standardized method for the collection, evaluation and continuous improvement of value streams within cross-enterprise value networks.

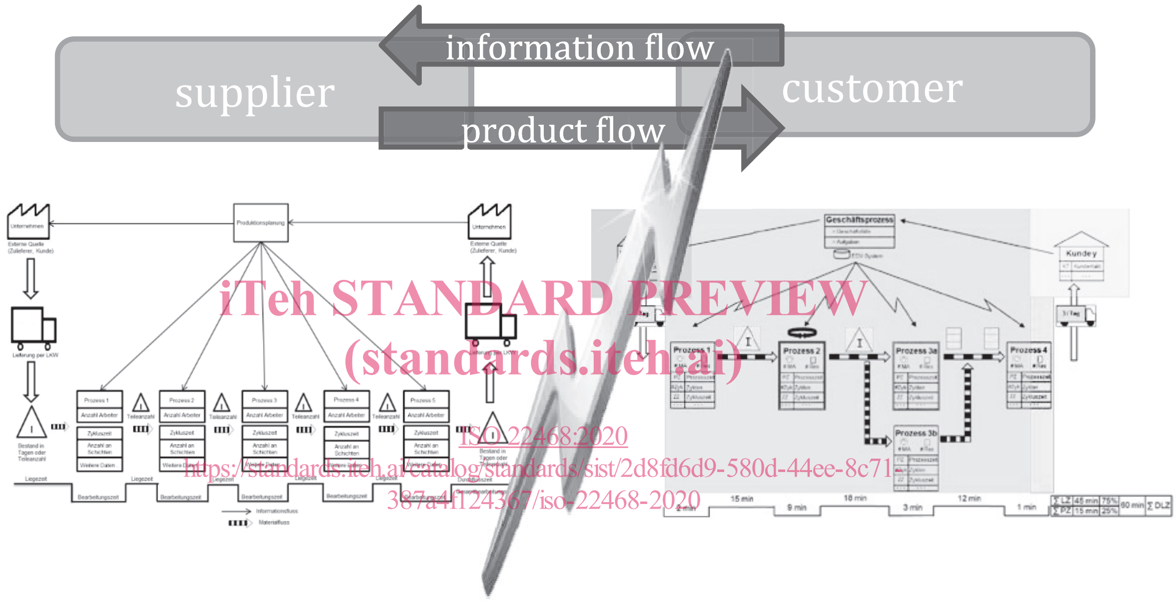


Figure 1 — Communication issues at supply chain interface

This common and goal-oriented application of VSM leads to a reduction or elimination of waste, e.g. unnecessary discussions or the multiple and thus redundant preparation of value stream data targeted to each contact person or auditor are omitted.

With the help of a defined procedure in terms of a unique VSM method, value streams of different sectors and process types are holistically improved. In addition, consistent product and information flows based on a unified VSM method enable a coordinated process planning (see Figure 2).

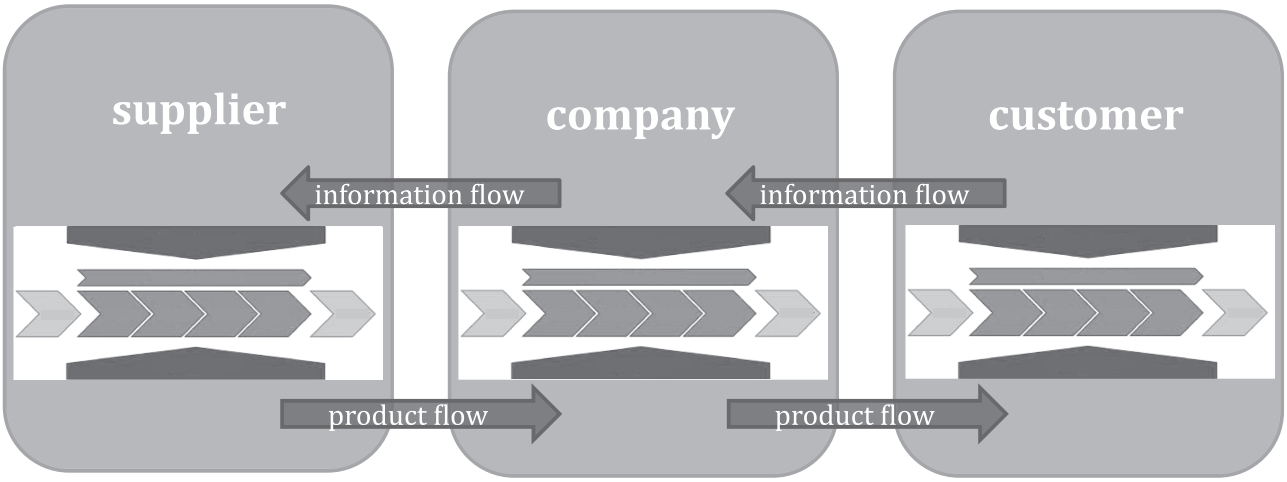


Figure 2 — Integrated supply chain

A common understanding of value streams enables organizations to streamline their internal and external processes. In this regard, the standardized VSM method ensures a unified collection, visualization and calculation of value streams, first within companies or corporations and consequentially along supply chains.

All information or requirements within this document can be transferred to any process type. Figure 3 shows a suitable scheme for the structuring of different process types[2].

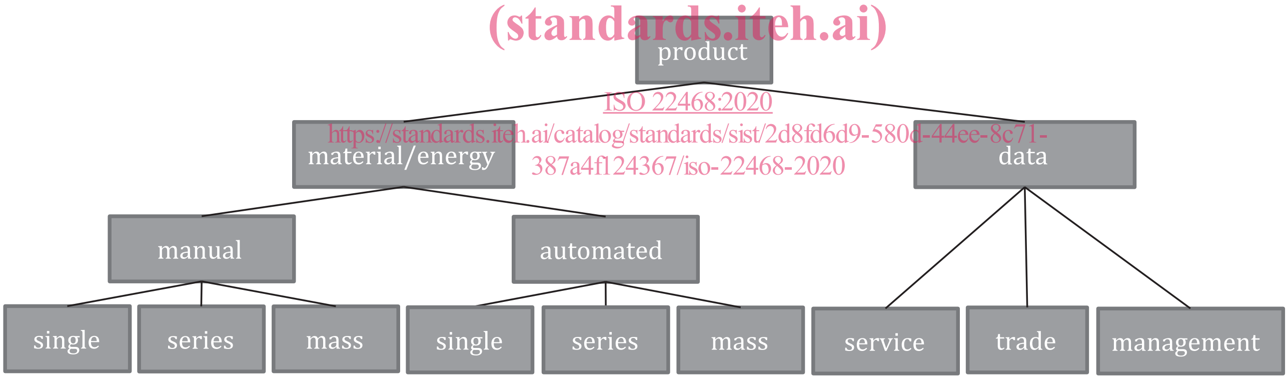


Figure 3 — Main process types

The downstream-oriented product flow in Figure 2 can be generated by material-, energy- or data-related processes. The material- or energy-related processes can be further separated in manual or automated processes of either single, series or mass production. The data-related processes comprise service, trade or management processes.

Value stream management (VSM)

1 Scope

This document provides guidelines for the application of VSM with regard to the collection, evaluation and continuous improvement of value stream relevant data. In addition, it describes the assessment of value streams based on defined key performance indicators.

The VSM method described in this document is generally applicable to material-, energy- or data-related process types. In practice, there are often hybrid forms of these main process types.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
batch size
number of jointly processed (semi-finished) products

3.2
bottleneck
most heavily loaded process (step) in terms of capacity, which is dynamically changing

3.3
continuous improvement
identification of improvement potentials in the sense of a continuous improvement process (CIP) in small steps

3.4
control-ticket
internal purchase requisition, which is used for product flow control (e.g. card, box or electronic)

3.5
customer takt
time interval, which corresponds to the operating time in relation to the (expected) customer demand per period under review

Note 1 to entry: Customer takt is expressed in time unit per piece.

3.6
lead time
time period from the date of order receipt to the transfer of the product to the end customer

3.7
pacemaker process
process step, which sets the pace for the overall process flow

3.8
product family
group of product variants, which require identical or similar process steps

Note 1 to entry: Within this document the term "product" can be understood as material-, energy- or data-related.

3.9
push system
control of product flow based on upstream processes

3.10
pull system
control of product flow based on downstream processes

3.11
range of inventory
time period, which corresponds to the current inventory levels in stock and warehouse

3.12
relative value stream performance indicator
comparative key performance indicator for the assessment of the future state in consideration of the current state of the *value stream* (3.14), in contrast to absolute value stream performance indicators

3.13
supermarket
central instrument with regard to *pull systems* (3.10), which enables a demand-oriented withdrawal

3.14
value stream
all processes oriented at customer demand, that is in particular product and information flows

3.15
value stream mapping
method to develop the current state map of product and information flows within organizations

Note 1 to entry: Value stream mapping is one step of the overall procedure VSM.

3.16
work in process
WIP
total stock level or total range of released starting products and (semi-finished) products within considered *value stream* (3.14), which are either in process or waiting for further processing

4 Value stream management

4.1 Basic VSM procedure

Figure 4 shows the basic procedure of VSM.

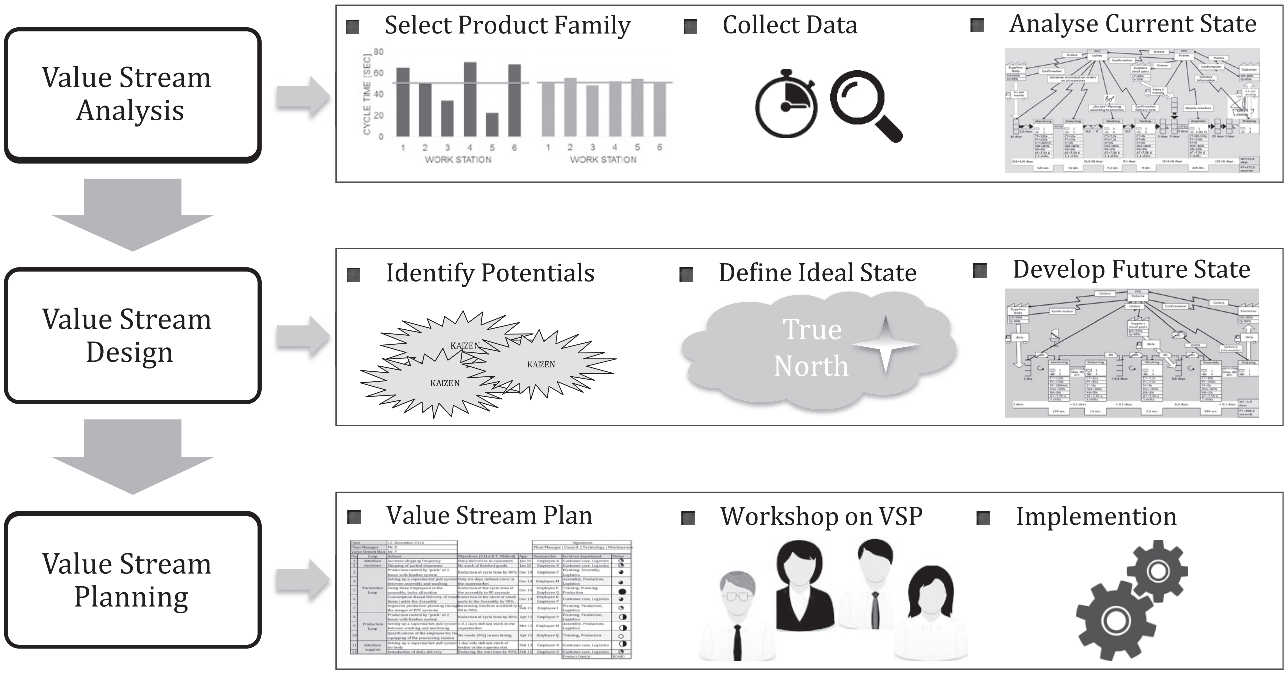


Figure 4 — Basic VSM procedure

The basic VSM procedure can be divided into three main phases: value stream analysis, value stream design and value stream planning. After the selection of a representative product family, relevant data is collected in regard to the current state of the value stream. Based on this current state, concepts for the identification of improvement potentials such as continuous improvement are applied, which lead under consideration of an ideal state as guidance to the desired future state. The individual suggestions for improvement are documented in a catalogue of measures for improvement. Subsequently, this value stream plan is discussed with the responsible employees and implemented within the organization.

These three phases are part of the PDCA (plan-do-check-act) cycle, as they cover “plan” and “do”. Referring to ISO 9001, the first eight steps cover “plan” and the last step, the implementation itself covers “do”. The two missing phases, “check” and “act” are only possible at a later time, since they require a monitoring and an adjustment of the implemented changes. Therefore, they are not included within the basic VSM procedure, but carried out later. In order to conclude the PDCA cycle, an assessment of the value stream is carried out (check), which compares the previous with the target state. The last part covers individual adjustments (act) of the operating value stream to guarantee a stable proceeding. Following this procedure, continuous improvement is ensured by using the PDCA cycle as a frame of reference.

In 4.2 to 4.4, the different phases will be elaborated in detail.

4.2 Value stream analysis

4.2.1 General

The value stream analysis phase is divided into three fundamental steps, which are specified in 4.2.2 to 4.2.4.

4.2.2 Selection of a product family

First, a product family needs to be selected to reduce the complexity of the subsequent steps to collect data as well as to analyze the current state. This product family shall have the following characteristics:

— identical or similar process steps and associated product variants;

— representative product of the organization, with strategic or economic importance;

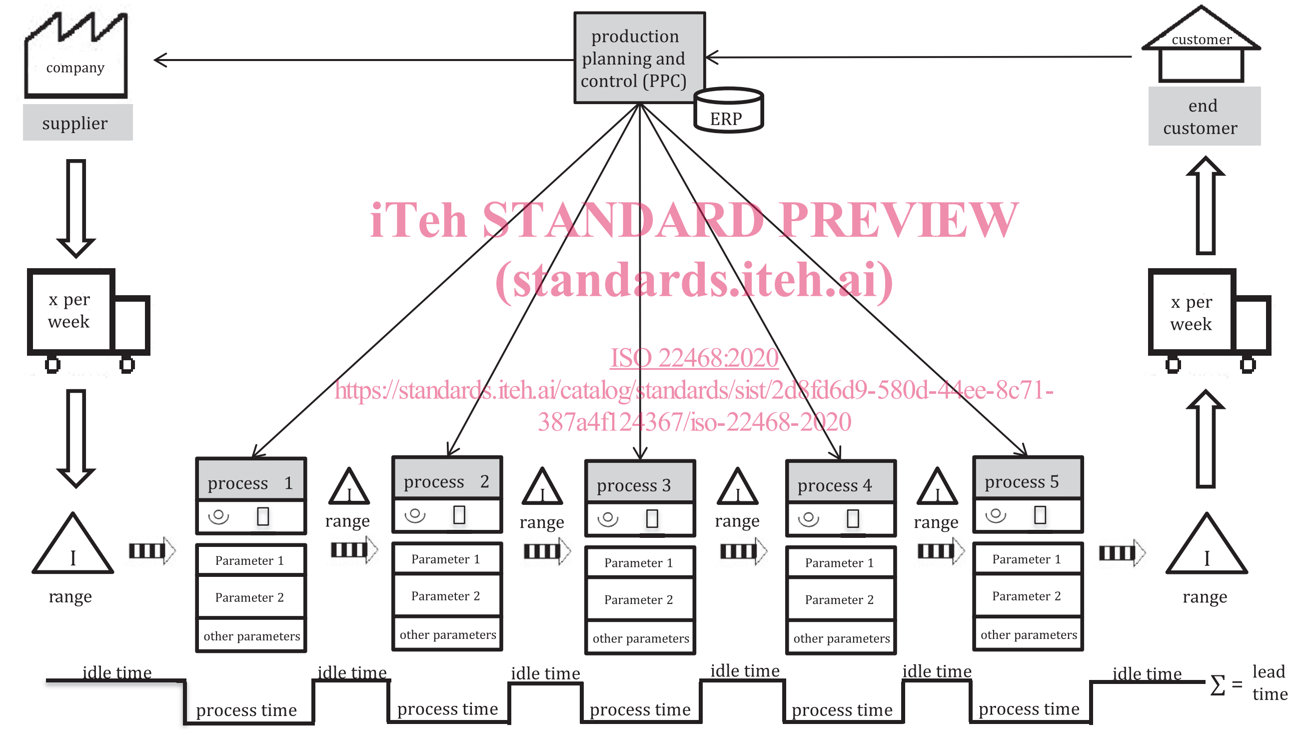
— preferably balanced sales, order or processing volume, no or small takt time variations.

4.2.3 Data collection

For the selected product family, a subsequent collection of value stream relevant data is performed as a second step of the value stream analysis phase (see A.3 for parameters and calculation procedures). For this, i.a. data originating from interviews with process participants, measured or estimated values as well as system data needs to be captured and processed for the later analysis of the current state. A selection of relevant parameters for particular process types is listed in Annex A and Annex B.

4.2.4 Analysis of the current state

Based on the selected product family, the current state of the value stream is analyzed. For this purpose, the captured parameters are mapped comprehensively in form of a value stream map, which shall be in accordance with Annex A. Figure 5 shows the typical setup of a value stream map.



Key

⟶ information flow

material flow

Figure 5 — Typical setup of a value stream map, current state

Since the VSM method is oriented to the needs of the end customer, the symbol for the end customer (A.2) is placed first in the right upper part of the value stream map and associated parameters (A.3) are gathered. Then, the external product flow to the end customer is depicted. Subsequently, the actual process flow with associated data boxes (B.1) and the external process flow from the suppliers, which are illustrated with a supplier symbol in the left upper part of the value stream map, are captured. Furthermore, the information flow among customers, suppliers and processes as well as the process planning and control is visualized. Finally, a value stream assessment based on criteria like lead time (bottom line in Figure 5), costs or resource consumption is performed.

A combination of the typical value stream map (Figure 5) with flowchart elements or swim lane diagrams can be advantageous for example in case of data-related process types to illustrate the detailed process sequence or to clarify responsibilities (see an application example in B.4).

4.3 Value stream design

4.3.1 General

The value stream design phase can be divided into three steps: the identification of improvement potentials, the definition of an ideal state as guidance as well as the design of a future state.

4.3.2 Improvement potentials

In consideration of the 7 types of waste[3], the goal of value stream design is to reduce or eliminate deficits with regard to the product and information flow, which have been identified during the value stream analysis phase. Based on the gathered value stream data of the current state, suggestions for a subsequent implementation of improvements in terms of a CIP are collected and documented, e.g. these suggestions for improvement are displayed as continuous improvement flashes in the value stream map, which shall be in accordance with Annex A.

4.3.3 Orientation towards an ideal state

As a second step of the value stream design phase, an envisaged but practically not achievable ideal state is defined as guidance. This ideal state represents a perfect, waste-free process flow, which can be carried out in minimal lead time.

4.3.4 Design of a future state

By means of the ideal value stream and under consideration of the following guidelines[4], an improved future state as compared to the current state is developed. The value stream map of the future state shall be in accordance with Annex A.

— takt time at the pacemaker process;

— supermarket or direct shipping;

— continuous product flow;

— supermarket pull systems;

— definition of pacemaker process;

— levelling of product mix at the pacemaker process;

— release of products at the pacemaker process;

— further process improvements in terms of a CIP.

During the design of a future state also the collected potentials or developed suggestions need to be considered for the continuous improvement of the value stream. This future state is to be pursued subsequently.

4.4 Value stream planning

4.4.1 General

The value stream planning phase comprises a collection of improvement suggestions in form of a catalogue of measures to achieve the envisaged future state, a cross-departmental workshop with the responsible employees as well as the implementation of the previously discussed measures.

4.4.2 Catalogue of measures for improvement

For the documentation of improvement suggestions, a catalogue of improvement measures for defining, limiting and linking the actions to responsibilities is suitable. With regard to the detailed definition of individual measures, the so-called SMART method shall be applied, so that individual goals are "specific, measurable, accepted, realistic, and time-related[5]". In addition, the status of implementation of the different measures or actions shall be noted.

4.4.3 Workshop on value stream plan

Subsequently, the compiled catalogue of measures shall be communicated to the responsible employees within the organization and, if required, internally discussed. This allows identifying and addressing risks of the suggested changes and accordingly concludes “plan”.

4.4.4 Implementation

Based on the agreement, the determined measures are implemented within the organization in the context of a CIP. This step deals with the realization of what was planned and complies with “do”.

4.5 Assessment of value streams

4.5.1 General

For the assessment of value streams, the following key performance indicators and assessment concepts are suitable (see A.3 for parameters, calculation procedures and example). In addition, a later monitoring of the changed value stream is required. Thus, this function corresponds to “check”.

4.5.2 Value stream performance indicators and assessment concepts

Relative value stream performance indicators provide an analysis with regard to the performance of the future or target state in comparison with the current or actual state of the value stream (indices ACT and TAR). Thus, to assess value-adding and non-value-adding value stream shares, the following KPIs for a relative assessment of (non-) value adding shares (VAS and NVAS) from a customer perspective shall be determined.

TOTAL lead time: $$t_{LT} = \sum t_{PT} + \sum t_{IT}$$

ACTUAL value adding share: $$S_{VA\ ACT} = \frac{t_{PT\ ACT}}{t_{LT\ ACT}}$$

ACTUAL non-value adding share: $$S_{NVA\ ACT} = \frac{t_{IT\ ACT}}{t_{LT\ ACT}}$$

TARGET value adding share: $$S_{VA\ TAR} = \frac{t_{PT\ TAR}}{t_{LT\ TAR}}$$

TARGET non-value adding share: $$S_{NVA\ TAR} = \frac{t_{IT\ TAR}}{t_{LT\ TAR}}$$

Based on the determined value stream performance indicators, relative comparison indicators (ω_{PT}, ω_{IT}, ω_{LT}) shall be conducted to assess the benefit of the future state in contrast to the current state.

Key comparison figure process time:

$$\omega_{PT} = \frac{t_{PT\ TAR}}{t_{PT\ ACT}}$$

Key comparison figure idle time:

$$\omega_{IT} = \frac{t_{IT\ TAR}}{t_{IT\ ACT}}$$

Key comparison figure lead time:

$$\omega_{LT} = \frac{t_{PT\ TAR} + t_{IT\ TAR}}{t_{PT\ ACT} + t_{IT\ ACT}} = S_{VA\ ACT} \times \omega_{PT} + S_{NVA\ ACT} \times \omega_{IT}$$

Also an analysis with regard to multiple assessment criteria, beyond the pure consideration of lead time, is useful in some applications of VSM. In this context, a value stream assessment based on criteria like space requirements, resource consumption or costs can be performed (see Reference [6] p. 156 ff.).

Furthermore, a cost-benefit analysis for the assessment of costs and benefits of suggestions for improvement provides a means to get a quantitative analysis with regard to the advantageousness of individual improvement measures. The improvement measures shall be prioritized according to the result of the cost-benefit analysis and subsequently considered and implemented within the process.

In addition to the assessment of the value stream, it is important to monitor the modified value stream over time to detect weaknesses. This helps to determine if all the planned activities are working as expected and to see if any of them has negative impacts on any other areas.

4.6 Adjustment of value streams

4.6.1 General

After a successful assessment and monitoring of the modified value stream, it is important to take actions to further improve the performance and adjust detected inconveniences. Doing so, “act” of the PDCA cycle is as well covered.

4.6.2 Actions for continuous improvement

Based on the previous assessment and monitoring of the modified value stream, it is now possible to adjust detected weaknesses of the operating processes. It is a repetition of the described VSM procedure in context of continuous improvement.