Chapter 8
itsVALUE: Modelling and Analysing Value Streams for IT Services

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Abstract In 2020, the new ITIL 4 standard was introduced. ITIL standardisation had and still has a big influence on how IT Service Management is seen and performed in practice. Thus, the new standard is expected to have a high impact as well. A key element of ITIL 4 is the strong focus on Stakeholder Value in the analysis of IT Services. Yet apart from ITIL, stakeholder orientation is a current trend in business analysis. *its*VALUE method and Modeller provide means to model and analyse value delivery in IT Services and thus can be used in Service Design. It combines "traditional" approaches to value stream analysis and service modelling and ads concepts and functionalities that meet the requirements of IT Service Management and ITIL 4. The resulting approach is unique in its combination of modelling and analysis capabilities and helps implement the advantages of value orientation in IT Service Management.

Keywords ITIL · Service modelling · Service value · Value stream modelling · Stakeholder value · Service blueprinting · IT Service Management

8.1 Introduction

A new era in the field of IT has begun, as services are the biggest and most dynamic market component of both industrial and developing countries [3]. Moreover, services are the most important goods for generating organisational value for both the company itself and its customers. Further, almost any current service is supported by IT components, and IT is developing as fast as never before in human history. Thus, companies can take advantage of enhancing their understanding and

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D. Karagiannis et al. (eds.), *Domain-Specific Conceptual Modeling*,
https://doi.org/10.1007/978-3-030-93547-4_8

performance for IT Service Management. New techniques (e.g. cloud computing, machine learning, blockchain, etc.) enabled new opportunities for the value chains and value creation of companies. Thus, IT (especially IT Service Management) is one of the most important business drivers that companies should carefully consider nowadays to achieve competitive advantage. ITIL v3 is a well-known reference for best practices in IT Service Management. It describes processes, roles, and KPIs. Current trends like increasing market dynamics, the advent of agile software development, and the integration of products and services made a revision necessary. In 2020, ITIL 4 was released. It primarily focuses on enabling responding to new stakeholder demand quickly and simply. According to [3], a company's purpose is to create value for its stakeholders. Everything a company does must serve (directly or implicitly) creating value for its stakeholders. ITIL has a strong industrial background, and it is likely that many companies will adopt the new version in order to improve their IT Service Management capabilities. While ITIL 4 generally describes these capabilities and their integration, a concrete method or toolset for the integration of stakeholder value in service design is not provided. Even if an enterprise does not intend to implement ITIL 4, considering Stakeholder Value in IT Service Management can improve demand orientation.

A literature analysis [9] showed that there are approaches like IT Self-Service Blueprint[15] or VSD 4.0 [6, 7] that support modelling and analysis of IT Service delivery from a value and stakeholder-oriented perspective. However, these are either specialised on a certain use case (e.g. IT S-SB) or just miss some aspects and requirements of value delivery modelling that are important to ITIL v4. Furthermore, there are notations like Value Delivery Modelling Language[1] (VDML) and the Archimate Motivation Extension[2] that provide the necessary modelling concepts. Yet, there is no method support in terms of procedures and guidelines for the creation and usage of models. Usage of these notations for value-oriented IT Service Management would also imply a further operationalisation since they remain on a high abstraction level. "It's a Value Added Language You Employ" (*its*VALUE) has been developed to provide a method and a tool (the *its*VALUE Modeller) for modelling and analysing IT Service value delivery that can be generally applied to IT Services and that is built on proven concepts of Service-, Value, and Enterprise Modelling (references can be found in the sections discussing the method). Thus, it fills a gap in terms of missing tool, method, and notation support, for value-oriented design and analysis of IT Services.

The description of *its*VALUE in this chapter follows roughly the method framework suggested by Goldkuhl et al. [5]. According to them, a method consists of method components that can be arranged and combined based on the application context of the method. The framework defines the dependencies and conditions of component usage, and each component defines procedures, concepts, and a notation. Following this view on a method, the *its*VALUE framework and components and

[1] https://www.omg.org/spec/VDML/.

[2] https://pubs.opengroup.org/architecture/archimate3-doc/.

thus the process of *its*VALUE application are described in Sect. 8.2. The meta-model describing the complete notation and forming a base for the *its*VALUE Modeller implementation is presented in Sect. 8.3. An exemplary view and more detailed knowledge on modelling and analysing value delivery using the *its*VALUE Modeller can be obtained in Sect. 8.4. The last Sect. 8.5 describes the current state of the development and provides an outlook to next steps to foster *its*VALUE application.

8.2 The *its*VALUE Method

As mentioned in the introduction, *its*VALUE brings together and amends proven concepts of Service-, Value, and Enterprise Modelling in order to support Value Stream analysis for IT Services, especially with a focus on ITIL v4 [3] because of its practical relevance. According to the ITIL 4 documentation [1, 3], *value* is a set of a perceived usefulness, importance, and benefits of something. This goes beyond "traditional" value stream analysis and value modelling, where the focus lies on value stream optimisation in terms of processing times and modelling the exchange of economic value. Furthermore, ITIL 4 recommends Service Blueprinting to model and understand the customer journey. The key features of Service Blueprints are customer actions and the physical evidence seen by the customer during the various stages of the service delivery. Service Blueprinting has some tradition as a modelling approach in Service Science (see, e.g. [4]). Service Blueprints allows everyone in the organisation to visualise an entire service process and its underlying business processes. It makes all points of customer contact and physical evidence explicit. This helps analyse the stakeholder perspective in a service setting. Yet, the "traditional" Service Blueprinting approach does not consider the complexity of IT Services. We developed *its*VALUE to provide a sound combination of new ideas and requirements for value-oriented IT Service Management based on ITIL 4 and the named "traditional" approaches. Thus, key elements of *its*VALUE are taken from VSA 4.0/VSM 4.0/VSD 4.0 [6, 7, 10, 11] and VSMN [8] as extensions of "traditional"value stream modelling that considers information processing and stakeholder perspectives, IT Self-Service Blueprint[15] as an approach that adds information technology to "traditional" Service Blueprints, and 4EM [14] as a participatory Enterprise Modelling method that supports the integration of stakeholders and provides concepts that allow to model context influence on value delivery.

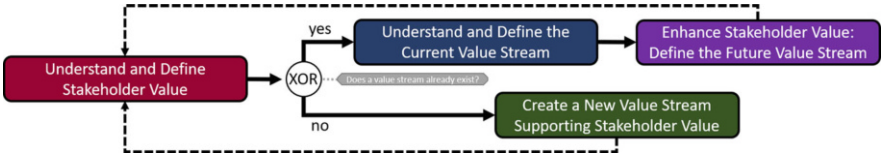


Fig. 8.1 *its*VALUE framework

The *its*VALUE method consists of four components that describe the steps to model, analyse, and (re-)design value streams of IT Services. Figure 8.1 shows the method framework, aligning the components in a process. Two alternatives are distinguished depending on whether there is already an existing value stream or not. As shown in the figure, we understand that the method has to follow an iterative approach in order to develop the required insight into the analysed value stream. We recommend also performing approximately four iterations of *its*VALUE, especially for an entirely new service.

*its*VALUE defines three model types that are used to collect and represent the resulting artefacts of the method components. Table 8.1 provides a brief overview. The generation of these models is described in the respective method components. Sections 8.2.1, 8.2.2, 8.2.3, and 8.2.4 introduce each component of *its*VALUE in detail.

Table 8.1 *its*VALUE model types

	Value Perception Model (VPM)	Stakeholder Value Map (SVM)	Value Stream Blueprint (VSB)
Purpose	Identify relevant stakeholders, their values, and value delivery perceptions of the value stream components (affecting objects)	Understand and define the relations between different Stakeholder values	Define and analyse AS-IS and TO-BE value streams. Identification of involved activities/processes, resources, and their relations. Mapping between value stream components (affecting objects) and Stakeholder values
Main concepts	Stakeholder, value, affecting objects (process, IT system, . . .), values/affects relations	Value, problem, opportunity, cause, supports/hinders/contradicts relations	Activity/process, information flow, affecting objects (process, IT system, . . .), interface, waste, requires/generates/affects relations
Method components	Understand and define Stakeholder value	Understand and define Stakeholder value	Understanding/defining/creating/improving value streams

8.2.1 *Understand Stakeholder Value (SV)*

The first phase of our major *its*VALUE approach model focuses on understanding and explicitly defining what each relevant stakeholder affected by a service actually values (see Fig. 8.2). Besides the customers, [2] lists employees, managers, suppliers, partners, the media, public, and much more as important stakeholders a company should also consider. It is recommended to explore and understand the needs of each relevant stakeholder to define what they value. Different approaches for assessing this information seem reasonable, depending on the relationship to a stakeholder. For instance, close customers or employees can be directly interviewed, whereas the public or media should be investigated by continuous monitoring of the own image. AXELOS [2] underlines that the closer the collaboration with a stakeholder is, the more affected they are. Thus, they should receive more attention in tracking their value perceptions.

The results of these investigations are modelled in the Value Perception Model. An example can be found in Sect. 8.4.1, Fig. 8.12. A Value Perception Model is is created for each relevant stakeholder. In these models, the stakeholder's value assumptions are placed around the stakeholder. Each modelled Stakeholder Value should be classified regarding its Relevance Factor (RF) and Current Performance Level (CPL):

- **Relevance Factor:** For the RF, we defined four rating values: *Mandatory*, *Moderate*, *High*, and *Outstanding*. Here, we adopted the idea of distinguishing between hygiene and success factors from [13]. A stakeholder value is considered as a hygiene factor if it causes dissatisfaction when missing while not providing much potential to increase satisfaction when delivered. Oppositely, we understand *Moderate*, *High*, and *Outstanding* Stakeholder Values as different levels of relevance for success factors: If success factors are provided, they increase satisfaction (depending on relevance) while causing not much dissatisfaction when missing.
- **Current Performance Level:** Current Performance Levels reflect the perceived performance of value delivery. If new value streams or value stream components like Processes, IT-Systems, or interfaces are designed, Current Performance Levels cannot be assessed. However, our method requires a CPL for each Stakeholder Value to perform a value stream analysis as later presented in Sect. 8.2.2.2. Thus, a default CPL should be defined for new Value Streams and new Value Stream components. For the CPL, we define the following rating values: *Poor*, *Moderate*, *High*, and *Outstanding*. We recommend to use *Moderate*

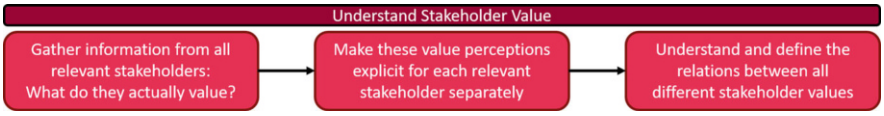


Fig. 8.2 *its*VALUE component: understand Stakeholder value

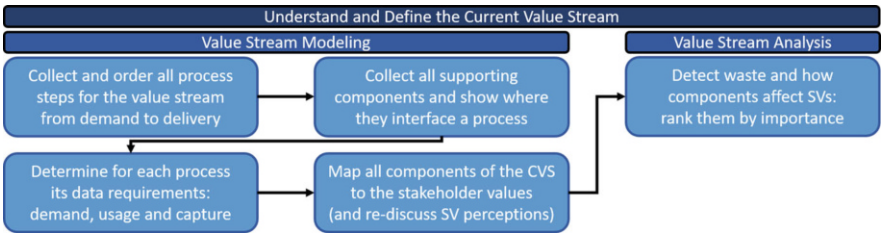


Fig. 8.3 *its*VALUE Approach model: define the current value stream

as the default value for the CPL, as this setting does not influence value stream analysis outcomes (cf. Sect. 8.2.2.2).

Once each relevant stakeholder's value perception is explicitly defined, the dependencies and relations among all Stakeholder Values should be investigated. We understand Stakeholder Value as a specialisation of business goals in the sense of [14]. Thus, delivering different values may cause mutual support, obstruction, or even contradiction. For example, an extra validation activity may reduce the risk within a Value Stream and thus provide value but also negatively influence value delivery in terms of short processing times. The results are reflected in the Stakeholder Value Map. Understanding how different Stakeholder Values affect each other can assist companies in detecting which Stakeholder Value are beneficial or problematical to other Stakeholder Values. Combined with the RF and CPL of a value, such an understanding can be useful for deciding which Stakeholder Values is more important than another when defining development actions (Fig. 8.3).

8.2.2 Understand and Model the Current Value Stream (CVS)

A Value Stream is a series of steps carried out by a company to create and deliver products or services to their consumers [1, 3]. When structuring a company's activities as Value Streams, a clear overview is created, showing what the company actually delivers. Services can be analysed for elements hindering the workflow and activities not adding any value. Such activities are commonly referred to as *"waste"* and should be eliminated. According to [1, 3], Value Streams focus on the end-to-end flow of activity from demand to value. Value Streams are not processes, but they can reference them. The processes are units of work (at different granularities or contexts). Value Streams use the information provided by stakeholders as inputs or other Value Streams and use resources of service providers and service consumers to generate outputs required to create outcomes demanded by the stakeholders. Key objectives are maximising value generation and minimising waste.

If a Value Stream already exists, it must be modelled, understood, and analysed before it can be improved. The second component of our *its*VALUE method deals

with these issues. It is divided into two sub-components: first, the value stream modelling which is described in Sect. 8.2.2.1 and, second, the analysis described in Sect. 8.2.2.2. Though dividing both components, both are able to provide new insights into value stream performance.

8.2.2.1 Modelling and Connecting the CVS with the SVs

In the first step, any process or activity that is part of the Current Value Stream should be collected and ordered from the initial demand to the final delivery (cf. [6, 7]). We developed the Value Stream Blueprint for the visual representation of the value stream. It is described more precisely in Sect. 8.4.3. Basically, it is a combination of IT Self-Service Blueprint and Value Stream Model and Notation that can be used to model Value Streams.

After processes and activities have been collected, all additional components (e.g. storage media, IT systems, physical evidence, information, waiting times, etc.) should be collected and connected to the processes and activities they are used or required at. This step can also be carried out by using a Value Stream Blueprint. It combines steps 2 and 3 known from Value Stream Analysis 4.0 [6, 7].

Afterwards, required data for each process or activity should be defined (step 4 of Value Stream Analysis 4.0). Therefore, the following information of each desired or captured data should be defined: *desired (yes/no)*, *captured (yes/no)*, *used (yes/no)*, and *acquisition (automatically/manually)*. Collecting these information for each data of each process or action allows calculating Key Performance Indicators for value stream analysis (cf. Sect. 8.2.2.2).

Next, we advise mapping all components of the Current Value Stream to the Value Perception Models created earlier. The Value Perception Models describe Stakeholder Values belonging to their stakeholder. To map these Value Perception Models with all components that are part of the Current Value Stream, each component should be analysed with regard to its actual effects on any Stakeholder Value. This identification provides awareness and understanding of the Current Value Stream and Stakeholder Values. It is possible to detect hidden, indirect effects of components in the value stream on the value perceptions as well as new value perceptions. While new value perceptions should be added to the respective Value Perception Model, an indirect effect will be further investigated in the analysis step.

8.2.2.2 Analysing the CVS: Detection of Waste and Ranking

In this step, waste inside the Current Value Stream and potential improvement spots are detected (steps 5 and 6 from Value Stream Analysis 4.0 [6, 7]). Besides cycle time analysis from "traditional" value stream analysis, we distinguish between the analysis of data processing and the analysis of stakeholder perspectives. Generally, the analysis concentrates on value stream components that cause poor performance in value delivery (e.g. long idle times, increased effort, or general obstacles) and

are thus considered wasteful or as producing "waste". *its*VALUE provides different mechanisms of waste detection. With regard to data processing, VSB allows identifying missed digitisation potentials and mismatches between information demand and provision. Furthermore, waste can be detected and analysed based on the mapping to Stakeholder Value Maps. Both analysis mechanisms are explained in the following. A third implemented mechanism for waste detection uses timing information to identify, for example, idle times. For reasons of brevity, it is not further described.

- **Data processing:** According to Meudt et al. [10, 11], data can generate waste regarding its usage, acquisition, processing, and storage. They originally derived the Digitisation Rate, Data Availability, and Data Usage Key Performance Indicators. These are calculated as described in Fig. 8.4. The required information for calculation is part of the Current Value Stream model (cf. Sect. 8.2.2.1). If the Digitisation Rate is lower than 1, the process has the potential to become more automatised and thus more efficient. If the Data Availability is not equal to 1, the process receives either not enough required or too much unnecessary data. If the Data Usage is lower than 1, the process captures unnecessary data. To conclude, with every Key Performance Indicator close or even equal to 1, a process produces very low or even no waste ([7, 11]).
- **Stakeholder perspectives:** ITIL 4 demands that each activity of a Value Stream should generate more value than it consumes. This originates from an economic perspective of value. Here, consumed value means costs that can be calculated for value delivery activities. Waste would be negative revenue from an activity. Especially in the service domain, there are also intangible, non-economic values like fun or simplicity delivered. Consequently, these values are generally not quantifiable in terms of costs and revenues. The VPMs mostly describe this "unquantifiable" type of value. Thus, *its*VALUE does not focus on the detection of negative revenues. Instead, we concentrate on the identification of the analysis and detection of waste based on RF, CPL, and dependencies in the Value Perception Models. We developed an algorithm detecting for each component of a Value Stream how it supports and hinders Stakeholder Values. With the Supporting Score and Hindering Score of such a component, we defined two new Key Performance Indicators addressing this issue: the Supporting Score (SS) and Hindering Score (HS) of a component. Not considering economic values, we are not dealing with a metric scale. A direct calculation of created value against the detected waste of negative influences on the delivery of certain Stakeholder Values is problematic. Therefore, interpretation of both is left to human analysis.

$$DR = \frac{\sum automatically\ acquired\ (and\ digitally\ captured)\ data}{\sum captured\ data}$$

$$DA = \frac{\sum captured\ data}{\sum desired\ data} \qquad DU = \frac{\sum used\ data}{\sum captured\ data}$$

Fig. 8.4 Calculating the DR, DA, and DU, according to [7, 11]

$$RF: \begin{cases} 3 & \textbf{if} \quad \text{"Mandatory"} \\ 1 & \textbf{if} \quad \text{"Moderate"} \\ 2 & \textbf{if} \quad \text{"High"} \\ 3 & \textbf{if} \quad \text{"Outstanding"} \end{cases} \quad CPL: \begin{cases} -3 & \textbf{if} \quad \text{"Poor"} \\ 1 & \textbf{if} \quad \text{"Moderate"} \\ 2 & \textbf{if} \quad \text{"High"} \\ 3 & \textbf{if} \quad \text{"Outstanding"} \end{cases} \quad IF: \begin{cases} \frac{1}{2} & \textbf{if} \quad \text{"Low"} \\ 1 & \textbf{if} \quad \text{"Moderate"} \\ \frac{3}{2} & \textbf{if} \quad \text{"High"} \end{cases}$$

$$VW = RF \times CPL$$

Fig. 8.5 Variable assignments and calculating the Value Weight of a Stakeholder Value

The SS provides the created Stakeholder Value attributed to a Value Stream component, while the Hindering Score provides the waste attributed to that component. Thus, it is possible to identify components creating much value as well as components creating no value at all and also components that create waste by non-performance or hindering the creation of value. The calculation is based on the Value Weight (VW) as shown in Fig. 8.5. In addition to the ratings of the Value Perception Model, an influence factor (IF) of a component affecting service delivery can be specified for fine-tuning. Based on the VW, the SS (sum of positive Value Weights) and HS (sum of negative Value Weights) are calculated considering direct and indirect supports and hinder relations in the model. The weights assigned to the ratings "Mandatory", "Moderate", etc. are a first suggestion and need to be evaluated in the future.

- **Ranking of potential improvement spots:** The Key Performance Indicators previously described are used to identify potential improvement spots. Further, key Stakeholder Value can be identified as well, showing which Stakeholder Value or key components require enhancements the most. Those Stakeholder Values having a low CPL and high RF also embody a high potential for improvement. Therefore, the Supporting Score and Hindering Score of all affecting components can be considered as well. If they do not support those Stakeholder Values or even hinder them, they embody a high potential of improvement. This could reveal which specific development actions are required to directly enhance any Stakeholder Value. Moreover, we also recommend to consider the Stakeholder Value Map earlier created as well (see Sects. 8.2.1 and 8.4.2), as it might assist not missing out any problematically dependencies or relations between several Stakeholder Values. Understanding those relations might assist in identifying the best development actions to enhance as much Stakeholder Values as best as possible. Furthermore, the data processing Key Performance Indicators can be used to identify media breaches and other problems in the data supply.

8.2.3 Enhance Stakeholder Value: Define the Future Value Stream (FVS)

Once the Current Value Stream is understood and explicitly defined, one or multiple potential Future Value Streams can be developed. For this purpose, we derived our approach model (see Fig. 8.6) in reference to [10, 11, 14]. The Stakeholder

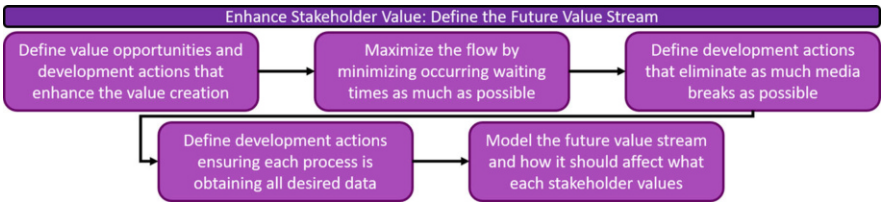


Fig. 8.6 *its*VALUE approach model: define the Future Value Stream

Value Map can be used to define further information like opportunities, problems, constraints, or causes to sharpen the general scope of improvement to be planned. Thus, opportunities regarding bad performing Stakeholder Values should be defined in the Stakeholder Value Map. Development actions explicitly affecting components that affect Stakeholder Value could be defined in the Value Perception Models.

Additionally, Value Stream Design 4.0 [10, 11] recommends maximising the flow of the Value Stream, especially by avoiding as much waiting times as possible. For information flows, avoiding media breaches seems to be the most important task. As media breaches require a manual processing of the information from one media to another, they immediately prevent a continuous and uninterrupted flow of information. The general solution to avoid media breaches is the development of machine-to-machine interfaces. The re-design of complex processes in the Value Stream should be done in a bottom-up approach. This ensures that combinations of sub-processes contain optimised components only. *Decomposition* of processes is possible in "It's a Value Added Language You Employ" to support this approach. For each process, development actions should be defined to satisfy each process needs regarding Digitisation Rate, Data Availability, and Data Usage. This also includes a thorough analysis of information demands and determining how required data and information are stored and accessed.

Lastly, the Future Value Stream is modelled. For *its*VALUE, this implies not just modelling the Value Stream Blueprint but also future versions of all Value Perception Models and the Stakeholder Value Map. After modelling the Future Value Stream, a new iteration of the *its*VALUE method is recommended to find unwanted side effects and iteratively refine them. However, we advise revising each service modelled with *its*VALUE on a regular basis, as [3] underlines the importance of achieving high business flexibility to be able to adapt to rapidly changing demands and requirements and to satisfy all stakeholder's needs and desires sustainably.

8.2.4 *Create an Initial Value Stream Supporting Stakeholder Value*

In Service Design, it might be possible that a new service has to be developed. This includes modelling a Future Value Stream and connected Value Perception Models and Stakeholder Value Maps. The first step of this method component is a combination of the first steps of the components "Understand Stakeholder Value" and "Enhance Stakeholder Value"—the definition of value opportunities and the collection of all processes required for the Value Stream. Each potential process of the new Value Stream should be immediately evaluated regarding its effects on the defined Stakeholder Values and its data processing Key Performance Indicators. If a process is considered as not beneficial to any Stakeholder Value or as hindering the continuous flow of the Value Stream, a company may drop that process or activity directly. This analysis is performed in the next steps.

The second step of this method component focuses on a similar domain like the second step of the "Enhance Stakeholder Value" component. Potential waiting time should be eliminated or at least minimised, as they embody waste by decreasing the efficiency and even potentially effectiveness of a Value Stream in the sense of [10]. The leaner and smarter a Value Stream is, the more efficient it performs (Fig. 8.7).

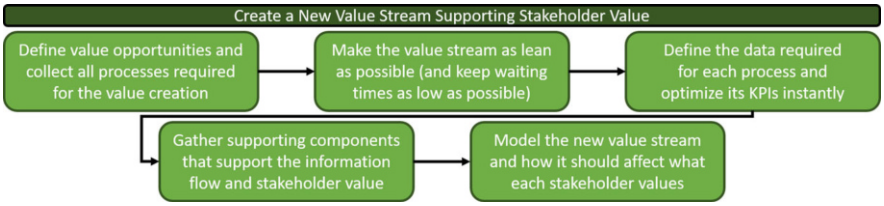


Fig. 8.7 *its*VALUE approach model: define a new value stream

The third step of this method component is a combination of the third step of "Understand Stakeholder Value" (define data requirements) and the fourth step of "Enhance Stakeholder Value" (development actions for data requirements). Once each required process or activity has been identified, the data and information requirements for each one of them should be defined to immediately achieve good Key Performance Indicator values (see Sect. 8.2.2.2).

For further refinement, the fourth step of this method component is a combination of the second step of "Understand Stakeholder Value" (identifying supporting components) and the third step of "Enhance Stakeholder Value" (development actions to avoid media breaches). Reasonable and effective (i.e. providing a supportive influence on Stakeholder Values) supporting components should be identified and connected to all processes or activities requiring or dealing with data.

Lastly, a combination of the fifth steps of "Understand Stakeholder Value" (mapping of the Value Stream components and Stakeholder Values) and "Enhance

Stakeholder Value" (modelling the future state) should be performed to explicitly define how each Stakeholder Value should perform and be affected with this new Value Stream. Like already argued at the end of Sect. 8.2.3, this should be checked by entering and performing a new iteration of *its*VALUE. Especially, a reconsideration of what highly relevant stakeholder values should be performed to ensure not missing out any forgotten or even new value perceptions that are important for the service and its value creation (like already argued at the end of Sect. 8.2.2).

8.3 Conceptualising *its*VALUE

This section presents the *its*VALUE meta-model. The purpose of this section is to expose the meta-model and in order to facilitate adoption and use of the method. The meta-models are represented using the UML standard and can be seen as conceptual meta-models of the modelling language of *its*VALUE. As described, the method adopts well-known and established concepts of existing approaches like 4EM and VSD 4.0 to assure understandability and to reduce learning effort. Thus, not all concepts will be described in detail. While Sect. 8.3.1 describes the abstract notation of our method based on the meta-model, Sect. 8.3.2 shows the visual notation of the meta-model's concepts.

8.3.1 The itsVALUE Meta-model

Figure 8.8 provides an overview of all *its*VALUE concepts. The most general is the abstract class *itsVALUE Object* providing each concept with a name. Besides the decomposition concepts, every concept carries a Description attribute. *Decomposition Objects* provide special semantics for decompositions within a visual model. *Decomposable Objects* can be decomposed in linked sub-models. These sub-models would then implement *Decomposition Objects* among other concepts to specify the decomposition. Concepts inheriting from *Linked Object* can be linked to identical instances in different models. Moreover, *Affecting Objects* (Value Stream Components) can influence Stakeholder Values and receive a Supporting Score and Hindering Score. Further, *Affecting Objects* can be related to other *Affecting Objects*. For instance, this provides the possibility to connect processes with supporting components of a Value Stream. *Activity/Processes* objects can be assigned to multiple Data Information objects providing all required data to calculate the Digitisation Rate, Data Availability, and Data Usage for a Process. Moreover, Processes and Events are *Time-Storing Objects* to explicitly track the time consumption of a Value Stream in the sense of [8]. In addition, *Typable Objects* can be further specified: Processes (not specified, information related, or material

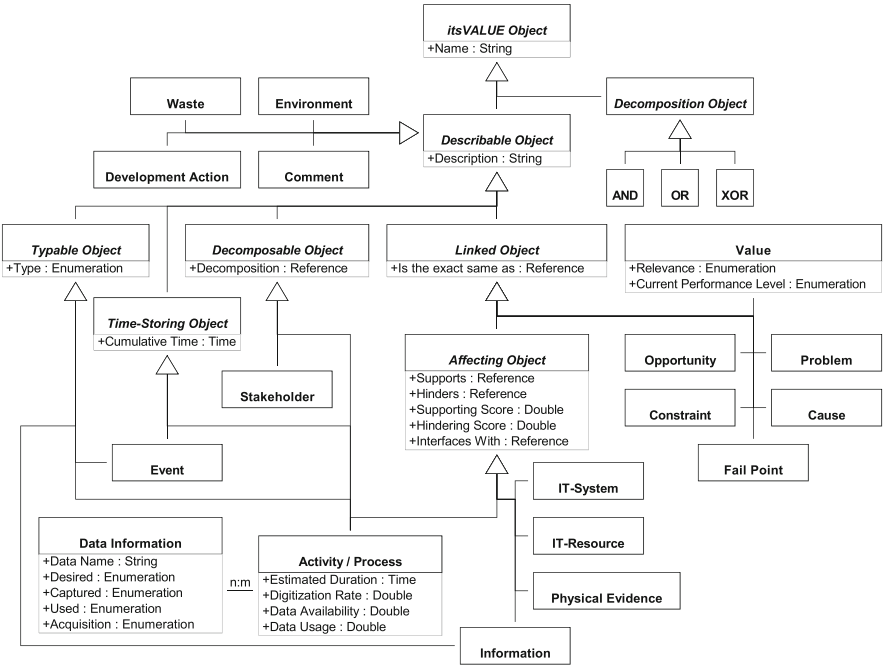


Fig. 8.8 *its*VALUE meta-model: concepts

related), Information (analog, digital input, or digital output), and Events (start, common, or end). Instances of the Value concept receive a RF and CPL.

Figure 8.9 shows the *its*VALUE relation concepts. The most general relation concept is the abstract *itsVALUE Relation* providing each relation with a name and description attribute. *Time-Containing Relations* provide explicit tracking of

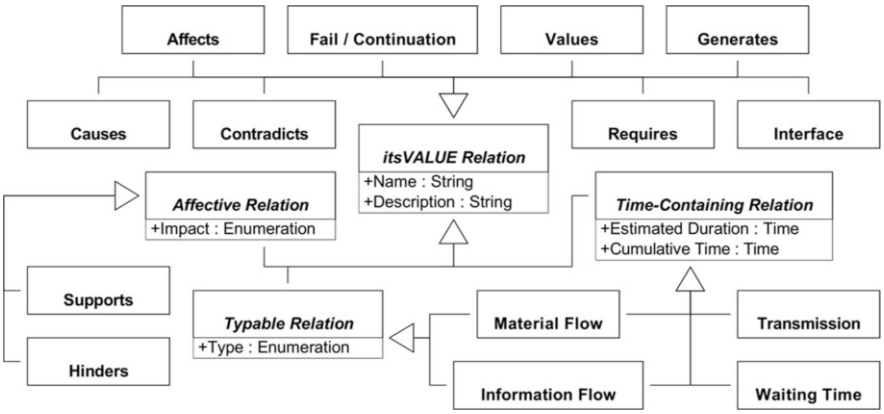


Fig. 8.9 *its*VALUE meta-model: relations

the time consumption of a Value Stream. Oppositely to the *Time-Storing Objects*, we intend to understand the Estimated Duration of a relation as a time buffer in the sense of [8]. By applying this property to relations, we do not have to introduce a separate buffer concept increasing the understandability and decreasing the complexity of "It's a Value Added Language You Employ". Some relation concepts inherit from *Typable Relation* providing them with a more precise specification: Material Flow (Push or Pull) and Information Flow (Product Information Flow or Process Information Flow). Those relation concepts inheriting from *Affective Relation* receive an Impact Factor. However, the relation concept *Affects* is not an *Affective Relation*. It just indicates that there is an influence that is not further specified but may be important for analysis.

Figure 8.10 shows the constraints for relation usage by specifying domains and ranges. For instance, any *itsVALUEObject* can be connected with any other *itsVALUEobject* with a relation of the class Affects. Oppositely, only *Activity/Processes* objects can require a specific Information.

Figure 8.11 presents an overview of *its*VALUE model types showing the concepts and relations that are provided by them. Many concepts and relations appear in multiple model types (e.g. Value is part of the Stakeholder Value Map and Value Perception Model). This underlines the importance of intermodel relations, especially for identical instances of the same object in multiple models. The concepts of *Development Action, Comment, AND, OR, XOR, and Affects-relation* are part of any model type of "It's a Value Added Language You Employ". We derived the Comment and Development Action from For Enterprise Modelling. According to [14], it is reasonable to provide users with the possibility to easily add further information they want to visualise in any model. The *Affects* relation is used for connecting *Development Actions or Comments* with any other object type.

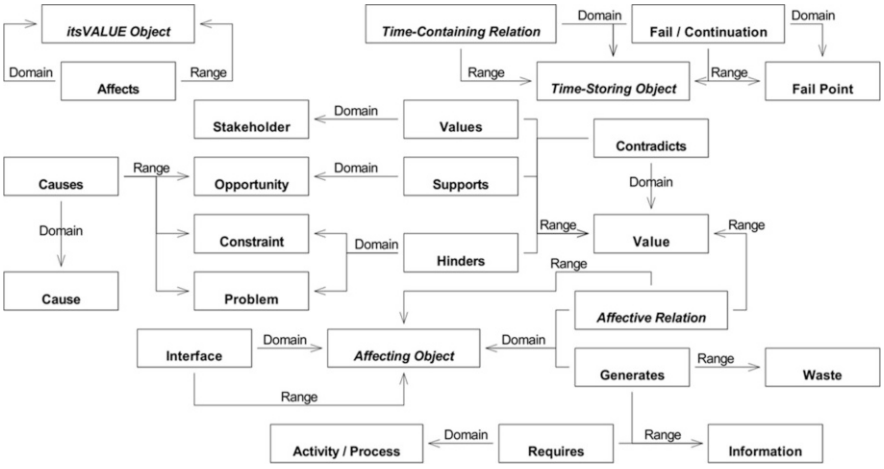


Fig. 8.10 *its*VALUE meta-model: relation domains and ranges

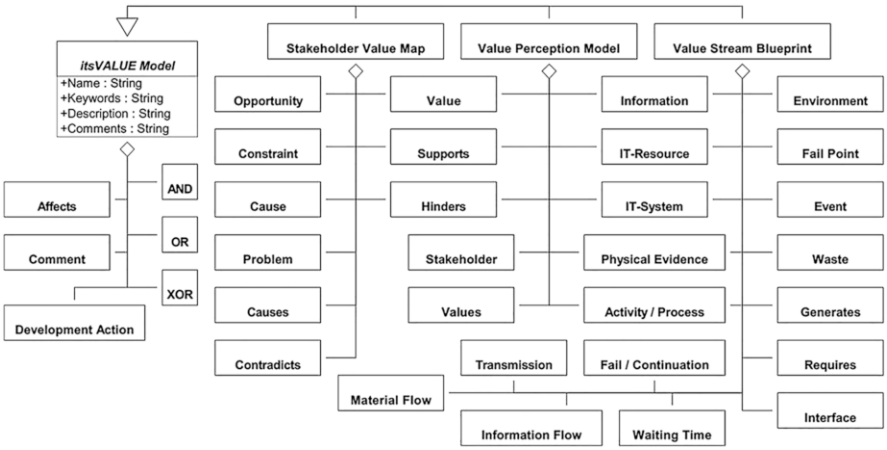


Fig. 8.11 *its*VALUE meta-model: model types

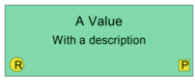
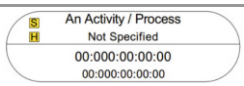
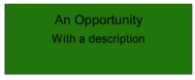
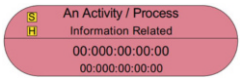
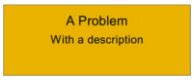
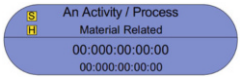
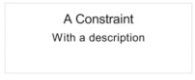
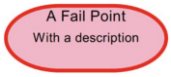
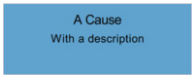
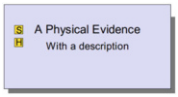
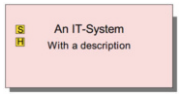
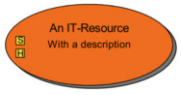
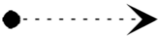
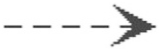
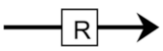
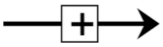
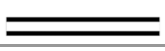
8.3.2 The itsVALUE Visual Notation

For drafting the visual representations of *its*VALUE notation elements, we stick very close to the visual representations of 4EM, BPMN, IT S-SB, and VSD 4.0, as we wanted to comply with the principles for cognitively effective visual notations by Moody [12]. These notations are familiar at least in parts to enterprise modelling experts. Thus, we support, e.g. the principle of *Cognitive Fit* of the visualisations. Table 8.2 provides an overview of the symbols used in *its*VALUE.

*its*VALUE complies with the *principle of semiotic clarity* [12], as we assigned each semantic construct an individual graphical representation. Further, we comply with the *principle of perceptual discriminability*, as every visual representation from Table 8.2 is clearly distinguishable from each other by providing a wide variety of colours and shapes. We aimed for this wide range of visual variables also to serve the *principle of visual expressiveness*. To follow the *principle of dual coding*, almost every concept contains visual text. Moreover, we added letters to small icons adding information to some instances. For Stakeholder Values, the circle in the lower left corner containing also an "R" indicates its RF and the square in the lower right containing a "P" for "Performance" its CPL by a specific colour (red, *Mandatory* or *Poor*; yellow, *Moderate*; green, *High*; blue, *Outstanding*). For *Affecting Objects*, a square containing a "S" indicates its Supporting Score by colour (Supporting Score $= 0$, yellow; Supporting Score > 0, green). Oppositely, a square containing a "H" indicates its Hindering Score by colour (Hindering Score < 0, red; Hindering Score $= 0$, yellow).

Further, *its*VALUE complies with the *principle of semantic transparency*, as the visual appearances suggest their meaning. For instance, stakeholders are represented by a group of three persons, information by letters, and relations like Supports with symbols indicating their influence ("+" indicating a positive influence). Elements

Table 8.2 Visual representations of the object and relation concept classes

Concept	Visualisation	Concept	Visualisation
Information		Stakeholder	
Environment		Value	
Activity/process		Opportunity	
(Information related)		Problem	
(Material related)		Constraint	
Fail point		Cause	
Physical evidence		IT-system	
Waste		IT-resource	
Event (start/usual/end)		AND/OR/XOR	
Development action		Comment	
Fail/continuation		Affects	
Transmission		Generates	
Interface		Requires	
Material flow (push)		Supports	
Material flow (pull)		Hinders	
(Product) information flow		Contradicts	
(Process) information flow		Causes	
Waiting time		Values	

inside the Value Stream Blueprint can be nested in order to express a relation (not explicitly part of the meta-model).

The *principle of cognitive integration* is supported by providing the possibility to explicitly define intermodel relations by linking objects across several models. For instance, this enables tracking whether an *Affecting Object* supports or hinders a Stakeholder Value. To address the *principle of complexity management*, we provide decomposition mechanisms for stakeholders and processes. However, such a mechanism is not applicable to the Stakeholder Value Map. We consider a decomposition of Stakeholder Values as not beneficial to effectively decrease a Stakeholder Value Map's complexity, as every single stakeholder may already have multiple Stakeholder Values that must be considered.

8.4 Modelling and Analysing with the *its*VALUE Modeller

This Section provides an insight into modelling and analysis of IT Service Value Streams using the *its*VALUE Modeller. First, the *its*VALUE sub-models are described together with exemplary models, and last, we provide an overview of the implemented analysis functionalities.

8.4.1 The Value Perception Model (VPM)

Value Perception Models provide stakeholder-centric views where each stakeholder has its own Value Perception Model. Figures 8.12, 8.13, and 8.14 provide exemplary Value Perception Models of the same fictional example. As Fig. 8.11 previously showed at the end of Sect. 8.3.1, a Value Perception Model consists of the following concepts and relations: Stakeholder, Value, *Affecting Objects* (Physical Evidence, IT-System, IT-Resource, Information, and Activity/Process), *Decomposition Objects* (AND, OR, and XOR), Development Action, Comment, Values, *Affective Relation* (Supports and Hinders), and Affects.

The core of every Value Perception Model is its stakeholder connected to all of its Stakeholder Values with the Values relation. Value Stream Components can be related to Stakeholder Values as *Affecting Objects* by using a Supports, Hinders, or general Affects relation. Furthermore, *Affecting Objects* can influence other *Affecting Objects* and thus implicitly via transitivity Stakeholder Values as well. Based on these relations, a stakeholder-specific Supporting Score (SS) and Hindering Score (HS) can be visualised for each *Affecting Object* showing how it influences those Stakeholder Values for that specific stakeholder. For this purpose, their Impact Factor as well as the Value Weight and CPL of the Stakeholder Values can be defined. For instance, in Fig. 8.14, the process "Orders Material" supports the Stakeholder Value "Receive Orders" belonging to a supplier. As this Stakeholder Value is mandatory to the supplier and performing well, the SS of the process

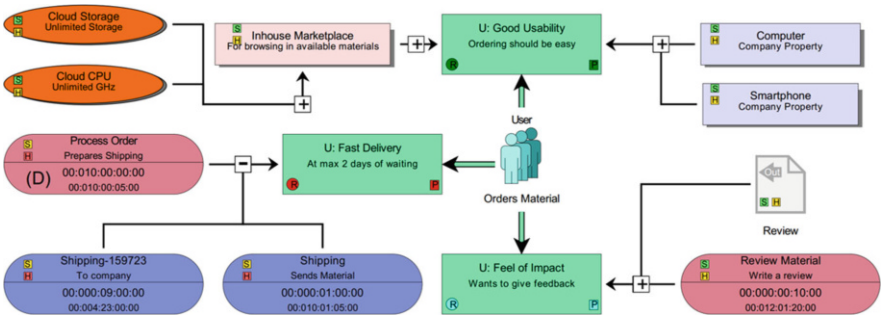


Fig. 8.12 Exemplary VPM of a user

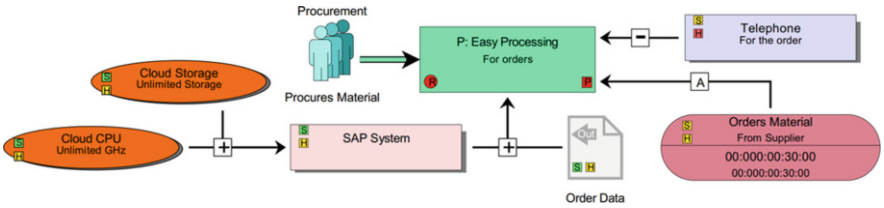


Fig. 8.13 Exemplary VPM of a procurement employee

Fig. 8.14 Exemplary VPM of a supplier

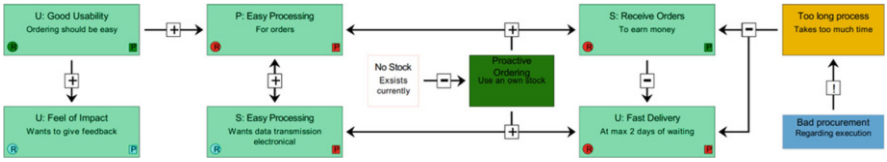


Fig. 8.15 Exemplary SVM for Figs. 8.12, 8.13, and 8.14

"Orders Material" is positive. Oppositely, the HS of the Physical Environment "Telephone" is negative. The Development Action, Comment, and *Decomposition Objects* are not part of the examples from Figs. 8.12, 8.13, and 8.14. To get an idea of their universal application in *its*VALUE, please consider the Value Stream Blueprint of Fig. 8.16 in Sect. 8.4.3.

8.4.2 The Stakeholder Value Map (SVM)

Figure 8.15 provides an exemplary Stakeholder Value Map containing all different Stakeholder Values of Figs. 8.12, 8.13, and 8.14. Thus, it continues the completely fictional example from Sect. 8.4.1. As Fig. 8.11 previously showed at the end of Sect. 8.3.1, a Stakeholder Value Map consists of the following object and relation concept classes: Value, Opportunity, Problem, Constraint, Cause, *Decomposition Objects* (AND, OR, and XOR), Development Action, Comment, *Affective Relation* (Supports and Hinders), Contradicts, Causes, and Affects.

The purpose of a Stakeholder Value Map is to explicitly define the dependencies between the several different value perceptions of all stakeholders involved. Furthermore, context information about influences on value delivery can be modelled using Opportunities, Problems, Constraints, and Causes. These concepts are adopted from the Goals Model of 4EM (cf. [14]). An Opportunity always supports Stakeholder Values, whereas Problems and Constraints always hinder Stakeholder Value. A Cause always causes something, and only Stakeholder Values can be Contradictory to each other. If a Stakeholder Value Map becomes too complex, it can be split up into several parts. For each part, specific clusters of Stakeholder Values can be focused independently from other clusters.

8.4.3 The Value Stream Blueprint (VSB)

Figure 8.16 provides an exemplary VSB continuing the example from Sects. 8.4.1 and 8.4.2. Additionally, Fig. 8.17 shows an exemplary decomposition or sub VSB of the process "Process Order" from the main VSB of Fig. 8.16 (visually indicated by a "(D)" inside the process.). As Fig. 8.11 previously showed at the end of Sect. 8.3.1, a VSB consists of the following concepts and relations: Environment, *Affecting Objects* (Physical Evidence, IT-System, IT-Resource, Information, and Activity/Process), Fail Point, Event, Waste, *Decomposition Objects* (AND, OR, and XOR), Development Action, Comment, *Time-Containing Relation* (Transmission, Waiting Time, Material Flow, and Information Flow), Fail/Continuation, Interface, Requires, Generates, and Affects.

In contrast to the fixed layers of a "traditional" Service Blueprint, a VSB contains several horizontal lanes of Environments. This provides high flexibility in modelling, as the lanes can be chosen freely. Further, flows can easily switch between those environments (in contrast to other approaches like VSMN). Although environments can be defined freely, we recommend keeping at least the general order of a "traditional" Service Blueprint. The higher the environment is positioned in the model, the more visible it is to the customer or user.

To design the flow within the Value Stream, we adopted and amended the concepts of VSD 4.0. *Time-Containing Relations* carry a buffer as "estimated duration" and cumulative time that have passed in the Value Stream so far. Processes

provide this timing information visually as well. Events just store them. Generally, a VSB always starts with a “Start” Event and ends with an “End” Event. Events always have to be linked to a Transmission indicating either the start, end, or switch of flow types inside a Value Stream. “Common” Events indicate such a switch from a material flow to an information flow or reverse. An Information Flow can be either a “Product” or “Process” Information Flow and a Material Flow either of the type “Push” or “Pull”.

Furthermore, *Affecting Objects* can be linked by an Interface relation, indicating that one component uses the other. For a process, this shows which components are used by that particular process. For supporting components, this shows in what Processes they are actually used. For Information Flows, an Interface relation can

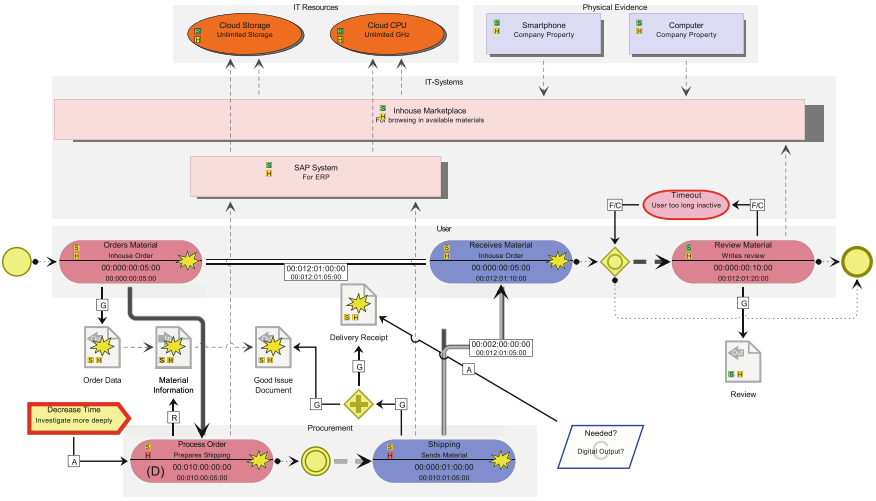


Fig. 8.16 Exemplary VSB for Figs. 8.12, 8.13, 8.14, and 8.15

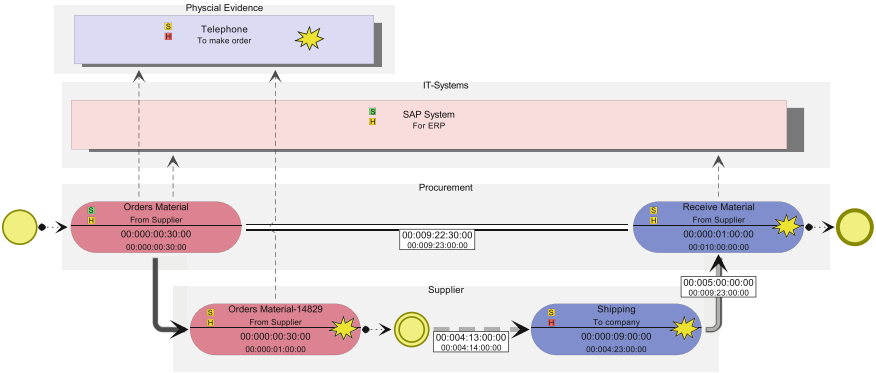


Fig. 8.17 Exemplary sub VSB for a process of Fig. 8.16

indicate whether there is a media breach by specifying the media types of outputs and inputs. Generally, waste can be assigned using the Generates relation applicable to any *Affecting Object*.

Process data requirements can be specified in the notebook of the process. This allows the calculation of data processing KPIs. Moreover, a Value Stream of an IT Service should consider Fail Points as suggested in the IT S-SB method. Usually, they are either connected to Processes, *Decomposition Objects*, or Events by the Fail/Continuation relation. Waiting Times can be specified for environments performing multiple Processes. These times indicate how long it takes to be able to continue the flow. As in the other sub-models, Development Actions or Comments can be defined and connected to any other component by the Affects relation. For complexity management, Processes can be decomposed in a sub VSB (like Fig. 8.17 does for Fig. 8.16).

8.4.4 VSB Analysis Functionality

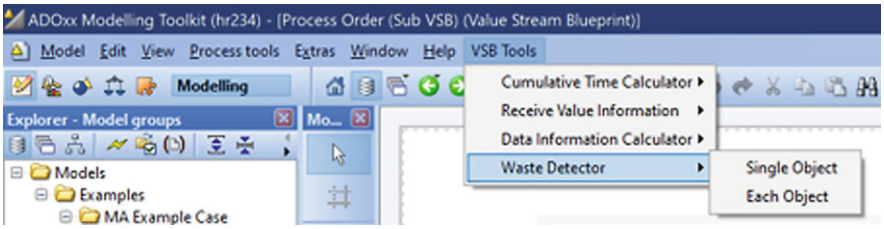


Fig. 8.18 Callable procedures in the upper menu bar

VSB analysis functionalities can be triggered manually through the upper menu bar of the *its*VALUE Modeller (cf. Fig. 8.18). All of them can be applied to either an object, a group of selected objects, or the entire model:

1. The "Cumulative Time Calculator" calculates and stores the cumulative time for *Time-Storing Objects* in a VSB. For Waiting Times, it further calculates its estimated duration. Waiting Times are generally considered as waste.
2. The "Receive Value Information" detects and stores all direct and implicit affections a component has to a Stakeholder Value. Moreover, it calculates and stores both the Supporting Score and Hindering Score of *Affecting Objects*. Therefore, these components are considered for any Value Perception Model they are part of. All Stakeholder Values that are supported or hindered are listed with references inside each *Affecting Object*. This allows to cumulate positive (Supporting Score) and negative (Hindering Score) value perceptions for Value Stream component.

3. The "Data Information Calculator" calculates and stores the Digitisation Rate, Data Availability, and Data Usage Key Performance Indicator for each Activity/Process.
4. The "Waste Detector" detects and places visual Waste indicators for each object of a VSB. It can detect "bad" KPIs indicating further potential for the improvement of data processing or value creation and media breaches in information Flows. Digitisation Rate, Data Availability, and Data Usage not equal to 1, Supporting Score equal to 0, and Hindering Score less than 0 are considered as "bad" KPIs.

Based on the analysis results, potential improvement spots can be identified in the Value Stream. The *its*VALUE Modeller allows further investigation of these spots with regard to the type of waste and possible side effects of changes. If, for example, a Value Stream component is subject to change, the mapping to the Stakeholder Value Maps identifies all involved stakeholders and their perceptions of the component. Positive and negative perceptions can be negotiated between stakeholders.

8.5 Conclusion and Outlook

*its*VALUE in combination with the Modeller supports comprehensive modelling and analysis of IT Service-related Value Streams. Based on its consideration of ITIL 4 concepts, it has the potential to support practitioners in adopting that standard. A first case study on a hardware purchasing service for the evaluation of *its*VALUE showed a great relevance of models and analysis results for Service Design according to the involved stakeholders (Service Users, Service Managers, Service Staff). Furthermore, a majority of case study participants showed interest in the future use of *its*VALUE method and Modeller. The feedback of this case study and future evaluations will help better adjust and refine the approach for practitioners. Having the Modeller freely available at OMiLAB assures access for and involvement of potential users. An important next step will be the development of a method guideline that fits the needs of practitioners. Furthermore, complexity handling needs to be evaluated in a more complex scenario compared to the first case study.

Tool Download https://www.omilab.org/itsvalue

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