THE COMPLETE BUSINESS PROCESS HANDBOOK

LEADING PRACTICES OF THE OUTPERFORMERS VOLUME 3

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GLOBAL UNIVERSITY ALLIANCE

LEADING PRACTICE

Value Modeling and BPM: From conceptual models to physical execution

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Introduction

Value Modeling is one of the most common dilemmas and challenges confronting companies today, regardless of factors such as size, revenue, industry, region or business model[1]. There is a need to manage decisions to make large-scale investments in business and IT-enabled capabilities as well as to ensure that these complex investments are effectively and efficiently transformed into the different competencies to realize concrete business value[2]. In far too many cases, this business value simply is not realized[3]. Just consider the many different cases and evidence in the research space today. In recent years, survey after survey has revealed that from 30 to 70 percent of large-scale investments in, for example IT-enabled change, is wasted, challenged or fails to bring a return to the company. In fact, one survey from the Butler Group[4] on measuring costs and value found that, in many enterprises, less than 8 percent of the IT budget is actually spent on initiatives that bring value for the company. Another survey from Deloitte about 'Driving Enterprise Value[5] of 124 financial executives revealed that almost 80 percent of IT projects did not actively encourage value creation and thereby realization in their enterprise. In a yearly (from 2009-2014) accruing CEO study, IBM survey of Fortune 1000 CxO found that, on average, CIOs believe that 40 percent of all IT spending brought no return to their organizations[6]. A 2007 study[7] conducted by The Standish Group found that only 35 percent of all IT projects succeeded while the remainder (65 percent) were either challenged or failed.

The issues of creating performance and real value, for most companies are not new; they have been accentuated by stiffer cost competition, commoditization of products and slower growth in traditional markets. The current economic and business environment makes addressing these issues increasingly urgent. Agile companies, however, will persevere and – in the end – use this economic cycle to their advantage[8]. The need is vital to model "Value" and have a language that provides a standardized set of Value Meta Objects, Value Driven modelling capabilities to model business design as well as a set of shape types that can be used in the various Modelling Notations. Standard organizations such as OMG and LEADing Practice as well as Research organizations like the Global University Alliance have dedicated immense amount of time and resources to

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[1] Value Model Reference Content (LEAD-ES20007BCPG)

[2] Applying Real-World BPM in an SAP Environment, Ann Rosenberg, Mark von Rosing, Greg Chase, Rukhshaan Omar, and James Taylor, SAP Press, 2011, ISBN: 978-1-59229-343-8

[3] Brandenburger, A. M. and H. Stuart. 1996. "Value-based business strategy." Journal of Economics & Management

[4] Butler Group, 'Measuring IT Costs and Value', East Yorkshire, England, Butler Group Press, September 2005

[5] Deloitte, 'Driving Enterprise Value,' Deloite Press, New York, October 2004

[6] IBM Global CEO study, 2009, 2010, 2011, 2012, 2013 and 2014, IBM Value Institute Press, New York

[7] Cook, R.; 'How to Spot a Failing IT Project', CIO Magazine, 17 July 2007

[8] Defining the Business Architecture Profession, Hendrickx, H.H.M., Daley, S.K., Mahakena, M. ; von Rosing, M. Published by: IEEE Commerce and Enterprise Computing, No. of Pages:325-332, Issue Date: 2011-09

analyse, research and develop the subject. This chapter will elaborate on some of the findings, concepts and joint work between the liaison partners OMG[9], LEADing Practice[10] and the Global University Alliance[11].

The chapter focuses on the Value Delivery Modeling Language (VDML) and the use for business design modeling. It supports business analysis, design, and transformation with a focus on optimization of both customer value and business operations from an enterprise perspective. Modeling of the creation and exchange of value is a distinguishing feature of VDML. VDML provides an abstract representation of the design of the enterprise that is meaningful to top executives, business managers, team leaders as well as subject matter experts working with value aspects e.g. value eXperts, value engineers, change managers or value architects. It provides a basis to capture the various forces influencing the organization, the relevant views, the internal and external drivers e.g. value driver or performance drivers, the organizational directions in terms of strategic business objectives, critical success factors and or performance indicators, and how they shape the enterprise focus. In Figure 1 is an example of how multiple value aspects are interlinked. From the various forces influencing the organization, the relevant stakeholder views, the value driver interrelating with the strategic business objects (SBOs) and critical success factors (CSFs) and the performance drivers interrelating with the CSFs and Performance Indicators. Furthermore how the organizational directions in terms of strategic business objectives, critical success factors and or performance indicators are on different enterprise tiers e.g. strategic, tactical and operational, and how this all is a part of shaping the enterprise focus.

[9] VDML (Value Delivery Modeling Language) is a OMG (Object Management Group) Software Standard for modeling business design.

[10] VCR-Value Reference Content is a LEADing Practice Enterprise Standard for value identification, planning, creation, realization and governance (Value Model Reference Content LEAD-ES20007BCPG)

[11] With over 400 universities, lecturer and researchers, the Global University Alliance represents the ww largest vendor neutral University Alliance (www.globaluniversityalliance.net)

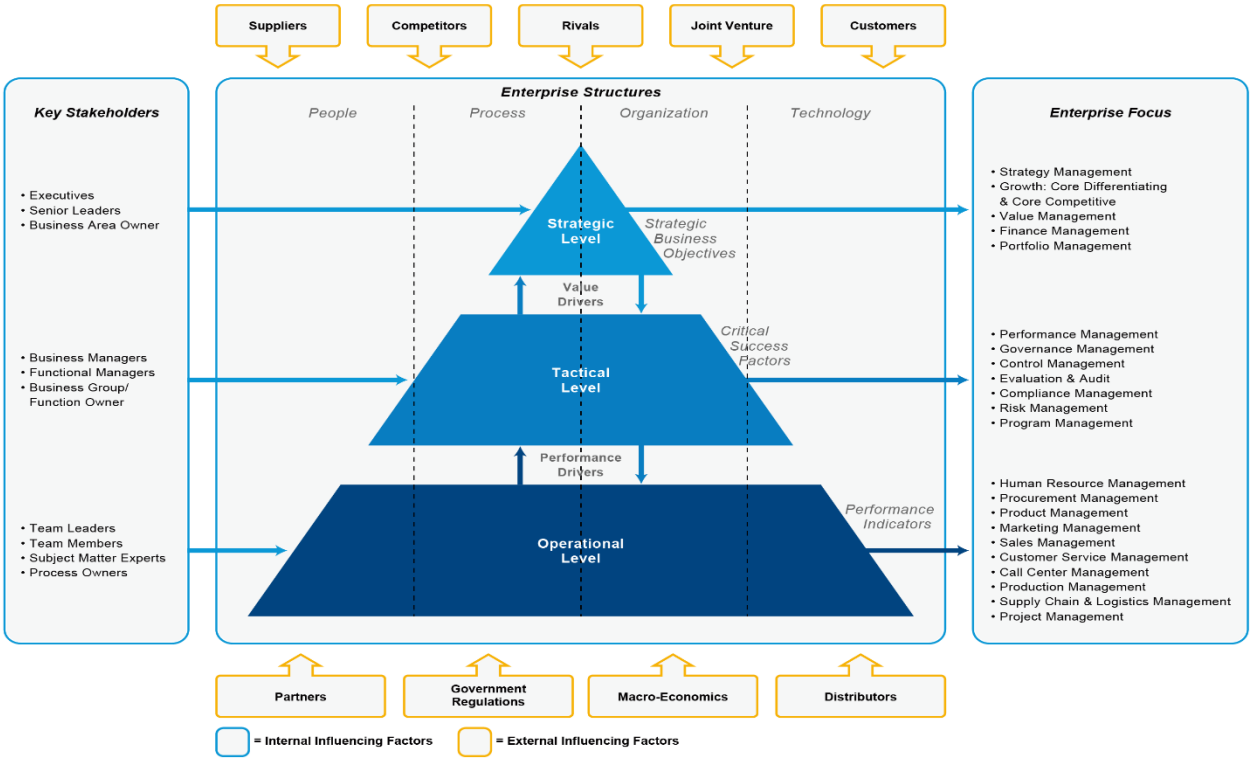

Figure 1, example of Key Stakeholders views and the relations to value topics[12]

The complexity of value modelling is partly captured in Figure 1, from which it is also evident that any value model needs to include measurements at all levels and tiers, operating variables, structures and value contributions. Such measurements must be the basis for assessing the effectiveness of the business operation. Changes to the design or measurements are propagated to changes in the measurements that describe overall performance and thereby value output e.g. customer satisfaction.

VDML modeling is important to BPM practitioners as it provides a process abstraction for management understanding, analysis, coordination, and priority-setting without distraction by the process-control perspective and technical exception handling that is typical for BPMN[13] models. This is relevant for defining both process requirements as well as for providing a management view of how the business actually works. In addition, VDML provides the broader context involving organizations, capabilities, customer value and the impact of shared services.

In this following, we will present an example use case for VDML followed by an overview of VDML concepts and an outline of potential business applications.

[12] LEADing Practice Enterprise Management views (LEAD-ES10)

[13] BPMN, *Business Process Model and Notation*, version 2.0, Object Management Group, June 2010, http://www.omg.org/spec/BPMN/2.0 .

Practical example/Use Case: Healthcare-High-Risk Pregnancy

To illustrate some of the basic VDML concepts, the different modelling techniques, the views and the semantic relationships we have chosen to illustrate an example within the Healthcare industry. The scope of the use case is focused around the aspects needed for analysis of a particular business problem. Such a full analysis would involves multiple views and varying levels of detail, but only key views are presented here to provide a brief illustration of the approach.

The reason we chose an example in the healthcare sector is that even though in nearly all countries and societies, large resources are spent on health care, the service quality is still unsatisfactory in large parts of the health care sector. One reason for this state of affairs is the complexity of health care organisations and practices, which make them difficult to model, engineer, architect and govern. Furthermore, due to the high degree of specialisation, health care organisations often need to collaborate across resources, capabilities, multiple flows and interactions etc., which only adds to the complexity. Therefore due to the healthcare sector's complexity and challenge to model it, we want to demonstrate the modelling, engineering and architecture capabilities of VDML.

The scope of the use case is as mentioned focused on the analysis of a particular business problem. A more complete overview of VDML concepts is outlined in the second section of this chapter. This use case is an analysis of the impact of providing electronic monitoring of high-risk pregnancies. An expectant mother is typically examined by her obstetrician early in her pregnancy and at regular intervals during gestation until time for delivery. For high-risk pregnancies, it may be appropriate for examinations to be more frequent, but, at the same time, patients are advised to minimize their activities, which conflicts with the need for frequent visits to the doctor's office. The use of electronic monitoring is expected to both improve outcomes and reduce the cost of maternity healthcare.

In order to understand the consequences of monitoring high-risk pregnancies, analysis must consider the effects from the initial examination through hospital discharge following delivery. We have made the following assumptions regarding this course of care:

- Doctor's businesses are independent business entities, and the doctors have "privileges" to treat patients in the hospital under contractual arrangements with the hospital.
- Responsibility for hospital healthcare procedures is associated with a clinical oversight organization unit.
- A hospital organization unit is responsible for the remote monitoring service.
- While electronic healthcare records may improve quality of healthcare, the differential effects of monitoring high-risk pregnancies will not be affected by the availability of electronic healthcare records.
- Co-occurring conditions or complications (that may occur with pregnancies) will require additional treatment regimen, but they need not be modeled in detail if the associated measurements are independent of the use of remote monitoring. More or less frequent occurrence of these conditions can be reflected in the summary value contribution measurements of high-level activities for treatment for those conditions.
- The solution will involve minimal changes to established practices and business relationships, so there will be little change to the treatment of normal pregnancies.
- Maternity care can be treated in a manner similar to a line of business (LOB) in other industries.

The healthcare details of this use case may be somewhat over-simplified, but they, nevertheless, serve to present a diversity of modelling requirements that illustrate the use of VDML. In any case, an analyst must make judgments regarding level of detail needed to expose relevant aspects and address business needs.

Business network value exchange

A business network represents the interactions between independent business entities. A high-level perspective is provided by a *value proposition exchange* diagram depicted in Figure 2, below. A VDML value proposition represents the aggregation of values delivered for a product or service. The value proposition exchange is a view of a business network collaboration. The ovals represent business party roles and the squares represent value propositions.

Patient represents the role of a typical individual from a community of patients. Doctor's Office represents the role of a hypothetical organization (organization unit) of affiliated doctors. Each patient from the patient community will be treated by one or more doctors from an affiliated doctors organization. If there are significant differences among groups of patients, then different patient communities (equivalent to market segments) could be defined. Similarly, if necessary to the analysis, the affiliated doctors organizations could be segmented into medical specialties or other sub-sets. Particularly for patient communities, differences between these can be addressed by defining different scenarios, discussed later. Hospital represents the role of the hospital organization that will provide maternity care, including remote monitoring of high-risk pregnancies.

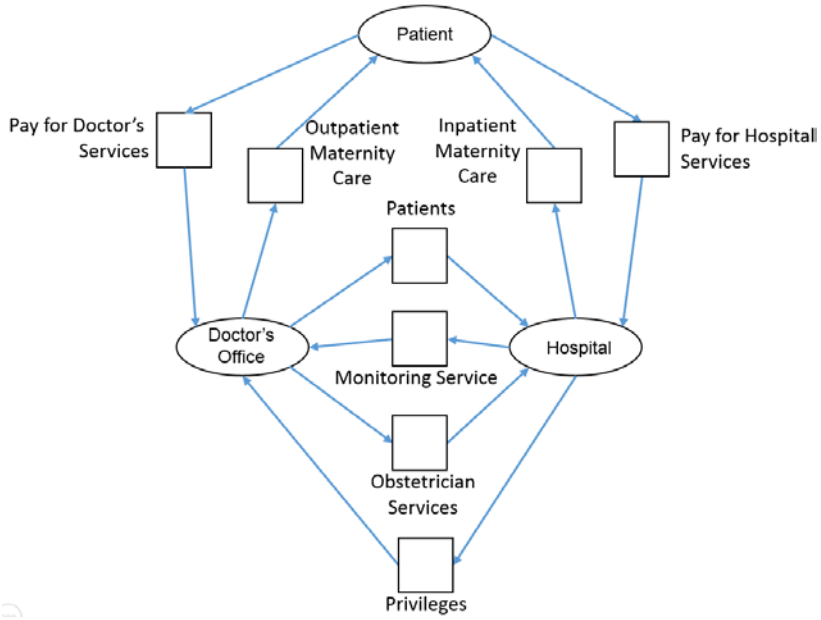

Figure 2, Value Proposition Exchange

For a business to be viable, each of the participants must experience a net positive value from providing and receiving value depicted by the value propositions.

A value proposition typically identifies one or more deliverables and expresses multiple, associated values and their combined effect. The doctor provides outpatient maternity care services to the patient and the patient pays for the services. The doctor also provides services in the context of hospital, inpatient services. The hospital receives patients by referral from doctors. The hospital provides inpatient maternity care for the patient and the patient pays for those services. The doctor and the hospital have a contractual arrangement under which the hospital provides "privileges" (authorization for the doctor to serve patients in the hospital). The doctor refers patients to the hospital and then participates in collaborative medical services to those patients in the hospital. "Monitoring" is the proposed service provided by the hospital. This service may be limited to high-risk pregnancies.

For purposes of this analysis, there is no need to define all values of interest to a recipient of services, but rather the analysis will focus on those values that will be affected by the use of remote monitoring for high-risk pregnancies. We have identified the following values:

- Cost of care
- Duration of hospitalization
- Risk of death of mother
- Risk of loss of child

There may be other values that would be of interest, such as patient comfort or time waiting for service, but the above values are sufficient to illustrate the application of VDML to this use case.

Measurements in a VDML model are not data for individual patients, but are statistical figures representing typical maternity patients in this healthcare system. We describe the basis for measurements as the "unit of production." The unit of production in this case is the course of treatment of a single pregnancy. Thus the measurements are statistical values on a per-patient basis.

Note that the death of a mother or child is, of course, a very negative value. However, we are not evaluating the satisfaction of an individual patient, so the level of satisfaction should not be based on a death per se, but rather on the level of risk expected from care by this healthcare system. A deeper analysis might consider these risks based on different patient "market segments." These would be considered in different scenarios. Scenarios are discussed later.

The industry average for a value measurement may be a reasonable baseline for customer satisfaction. A computation for the level of satisfaction for a particular value could then be based on the degree of variance from the industry average. The overall level of patient satisfaction expressed by the value proposition is computed from a weighted average of these satisfaction measurements where the weights reflect the relative importance of the values to the recipient.

In the VDML model, for the product or service delivered, the relevant value measurements of the doctor's value propositions (Obstetrician Services and Patients) must be included as value contributions to the hospital value proposition (Inpatient Maternity Care). Thus, in the use case, the four values of interest include the effect of the doctor's care.

The exchange of deliverables (with associated values), underlying the value proposition exchanges in Figure 2, as far as they are in scope for further analysis, is being depicted in the *role collaboration diagram* in Figure 3, which provides a more detailed view on the same business network. Ovals represent roles and connectors represent deliverable flows. Table 1 explains how both diagrams reconcile. Value Propositions that represent Patient's payments and Privileges to the Doctor's Office are left out of scope for further analysis.

Value Proposition	Deliverable Flow
Outpatient Maternity Care	Status & Instructions
Inpatient Maternity Care	Monitoring Alert Discharge
Patients	Emergency Admission Hospital Admission Request
Monitoring Service	Monitoring Report
Obstetrician Services	Emergency Admission Hospital Admission Request Monitoring Initiation

Table 1, Reconciliation of Value Propositions and Deliverable Flows

To build the detail of the role collaboration network, we can use a technique similar to project planning where we work backward from the end result. We start with the role that delivers the end result and identify the deliverable(s) needed as input to that role and then identify the roles that provide those deliverables, and so on. The concepts and notation that VDML uses to define role collaboration originate from Value Network Analysis[14].

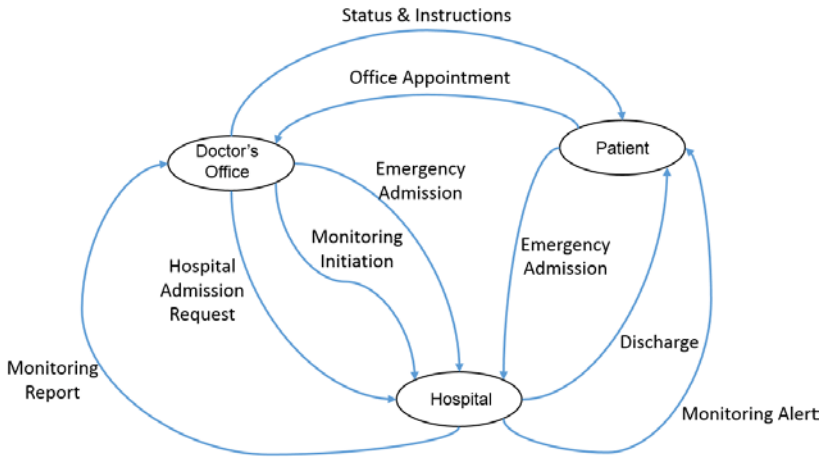

Figure 3, Role Collaboration Diagram

Analysis so-far focused on identification of parties (roles) and exchanges of value and deliverables between parties in the business network. More detailed analysis is concerned with what parties do by themselves, in order to produce and consume the value and deliverables that are exchanged. This involves analysis of activities and their value contributions to value propositions, as well as the capabilities that are required in order to perform the activities, or in other words: analysis of value streams, which is addressed in the next section.

[14] Allee, V., *Value Network Analysis and Value Conversion of Tangible and Intangible Assets*, Journal of Intellectual Capital, Volume 9, issue 1, pp 5-24, January 2008, http://www.vernaallee.com/images/VAA-VNAandValueConversionJIT.pdf .

Activity networks

Activity network analysis is concerned with:

- activities performed by the roles
- additional deliverables that are not exchanged between roles, but that serve role-internal purpose
- coordination between activity networks (as well as value streams) via decoupling points (stores)
- capabilities required to perform the activities
- value contributions of the activities (note that in VDML a value stream is not just about a network of activities, but in particular how these activities contribute value to the value proposition).

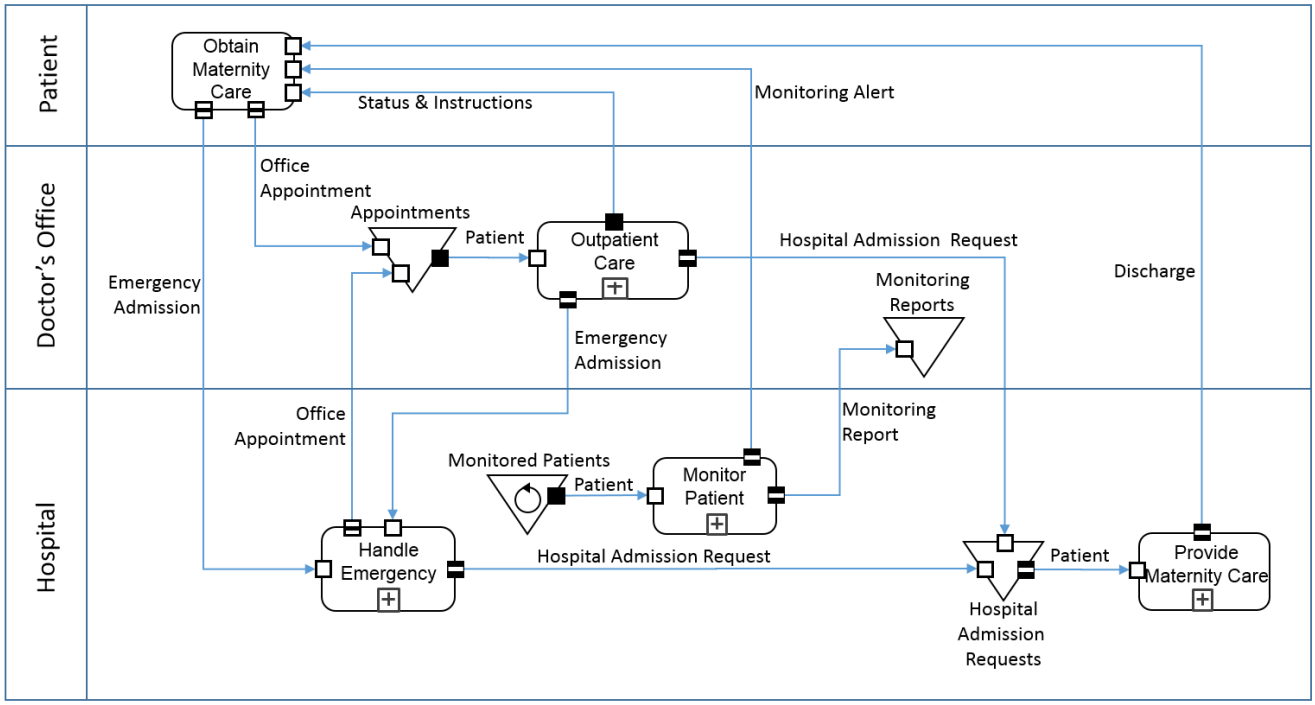

Figure 4, Business Network Activity Network Diagram

Figure 4 is an example of an activity network for the business network exchanges of Figure 2. "Swim lanes" represent roles. They represent the same roles as in Figure 2 and Figure 3. Boxes with rounded corners represent activities. Inverted pyramids represent stores. Connectors represent deliverable flows. The names that are shown on the deliverable flows are the names of the business items, which are the resources that are used or consumed by activities or held in stores, or the deliverables produced by activities. A re-use symbol (circular arrow) as marker on a store shape indicates that the store is a pool of reusable resources. Note that deliverable flows that cross swim-lane (role) boundaries are deliverable flows that appear in Figure 3. The diagrams in Figure 2, Figure 3 and Figure 4 are views on the same collaboration (here the business network). An activity network includes all of the contributing activities for each role, not just the activities that produce the deliverables of the role collaboration diagram (those that cross role boundaries).

The small squares on boundaries of activities and stores represent ports, which denote inputs and outputs. These carry essential information, such as:

- Value contribution (value add). Output ports with value adds show as filled.
- Output condition, indicating whether the connected deliverable flow only occurs under certain circumstances. The port might also define a planning percentage, to determine the allocation of a certain value measurement

to the corresponding deliverable flow (e.g., a cost split). Ports (inputs or outputs) with condition and/or planning percentage show with a horizontal splitter inside the port square.

Activities that have an expand button (+) delegate to other collaborations (usually capability methods) as services.

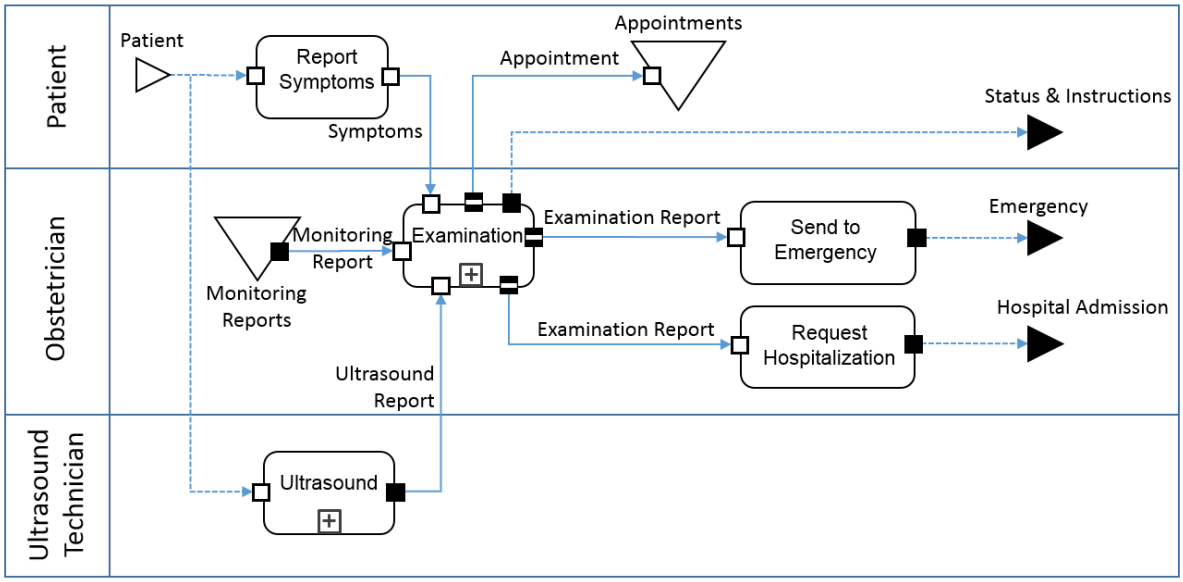

Figure 5, Outpatient Maternity Care Capability Method

The Outpatient Care activity delegates to the Outpatient Maternity Care method, the activity network diagram of which is represented in Figure 5. This is a capability method of the affiliated doctors organization in the Doctor's Office role in the business network. It is engaged from the business network activity based on patients in the Appointments store. The patient input to the Outpatient Care activity in Figure 4 (its corresponding input port) maps to the Patient input port of the Outpatient Maternity Care method in Figure 5. This input port is represented via the small bottom-left pyramid that has Patient as caption. Output ports are handled in a similar way, and are represented by the filled bottom-left pyramids on the right side of the diagram in Figure 5. Also here the notation with filled port shapes denote that the collaboration (capability method) has output deliverables, with value adds associated. Hence the corresponding output ports of the Outpatient Care activity in Figure 4 show as filled.

The doctor's examination obtains monitoring reports from the store and may do an ultrasound to observe the fetal status. The result of the visit may be to schedule the next visit (feeding the same store as is also used in Figure 4), request hospitalization or send the patient to the emergency room. Status information and instructions are provided to the patient.

VDML provides further refined means to control the level of operational detail that is exposed in role collaboration diagrams. For example, the Office Appointment deliverable flow from Hospital to Doctor's Office in the activity network diagram in Figure 4 is not exposed in the role collaboration diagram in Figure 3. A good reason for this could be that this deliverable does not explicitly add value as part of the Outpatient Maternity Care value proposition in Figure 2. On the other hand Figure 3 shows Monitoring Initiation as deliverable flow from Doctor's Office to Hospital, which is not visible in either of the activity network diagrams in Figure 4 and Figure 5. The reason is that this is a deliverable flow that occurs at lower level of delegation. It could show up in an activity network diagram of the capability method to which the Examination activity in Figure 5 delegates, which diagram is not included in the description of this use case.

Activity networks are not concerned with the flow of control for execution of activities as in a BPMN process model, but rather with the flow of deliverables and the statistical value contribution measurements on a per patient basis. Note that the capability method of Figure 5 represents multiple doctor visits for a single patient. Although each activity may be performed many times for a single pregnancy, activity measurements will represent the cumulative effect of repetitions of that activity per patient. For example, Examination will have a cost that is the sum of the costs for each occurrence for one patient.

The same capability may be engaged in different contexts. Suppose that the Ultrasound activity in Figure 5 delegates to an Imaging method (not further analyzed in this chapter), and that also other activities, possibly in other collaborations (capability methods or business networks), delegate to it. Each of these activities would then engage the Imaging method in its own delegation context. The capability method is the same but the circumstances are different, so value measurements may be different. VDML supports a different set of measurements per each such delegation context, which delegation contexts maybe be part of the same scenario (discussed later).

Organization responsibilities

A capability for Emergency handling can be offered as a service by one or more organization units that own resources (people, equipment, materials, etc.) to deliver the capability. The organization unit uses a capability method to define how the resources are applied to provide the capability. In addition, the provider of a capability (e.g., Emergency Handling) may delegate to other capability methods provided by the same or other organization units to do some of the work to deliver its capability. The capability method specification may be owned by the same organization unit that provides the capability, or it may be owned by another organization unit that is responsible for defining and maintaining the method specification. This allows different organization units (for example in different countries) to provide the same capability with the same capability method but different resources. When analysing a value stream and considering improvements, it is important to understand the organizations responsible for the capabilities.

Figure 6, below, depicts an example *capability management* diagram for some of the capabilities of the high-risk pregnancy use case. It shows some of the hospital organization units responsible for certain capability offers, apply their capabilities by performing capability methods and managing resources. A large box represents an organization unit, named in the small box at the top of the larger box. The stretched hexagons on the left side of the organization unit boxes represent capability offers of the associated organization unit. The rectangles connected to the capability offers with bold, dashed lines are the capability methods used to provide the capability. A capability method may be shown in a different organization unit indicating that it is performed by one unit and specified by a different unit (not shown in Figure 6). The fine, dotted lines visualize how one capability (method) depends on other capabilities (capability offers).

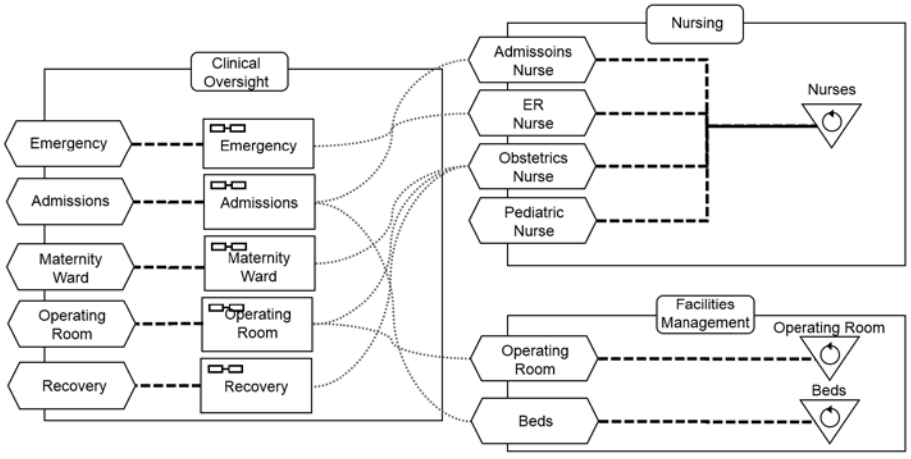

Figure 6, Clinical Capability Management Diagram

Some capabilities, like Emergency in Figure 6, are "composite", being supported by capability methods, through which they depend on other capabilities. Other capabilities, like ER Nurse (ER stands for "Emergency Room"), are "atomic", which are not supported by capability methods but directly by resources, represented as stores or pools (inverted pyramids in Figure 6).

The Emergency capability offer in Figure 6 is applied via the Handle Emergency activity in Figure 4, which activity therefore delegates to the Emergency method, which is the capability method that supports the Emergency capability.

The capability management diagram could be expanded by showing also how hospital capabilities depend on capabilities of the affiliated doctors organization, but that is, for simplicity reasons, omitted in Figure 6.

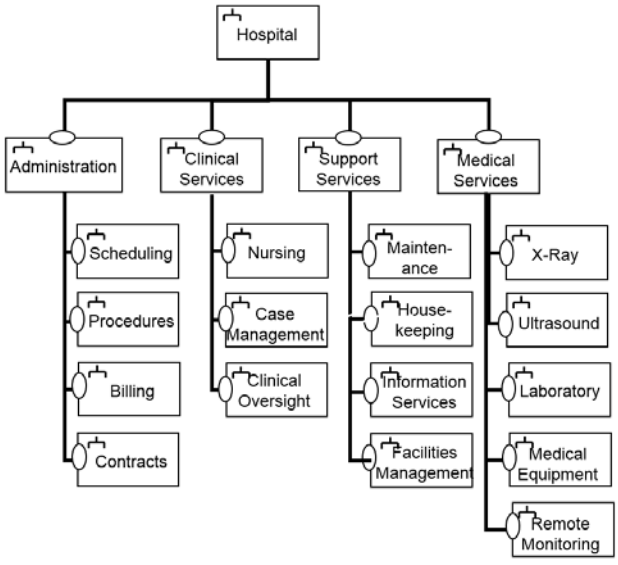

Figure 7, Organization Structure in a Collaboration Structure Diagram

The analyst can navigate to an organization structure diagram like that in Figure 7, to locate the organization units of the capability management diagram and their management chains. Figure 7 uses a *collaboration structure* diagram to represent an organization structure. In VDML, both capability methods and organization units are collaborations, which are shown as rectangles in capability management diagrams and collaboration structure diagrams. Their shapes are distinguished by a marker: collaborations (rectangles) in Figure 6 are

capability methods, suggested by an “activity sequence” marker, and collaborations in Figure 7 are organization units, suggested by an “hierarchy” marker. Hierarchy in the organization structure in Figure 7 is based on the assignment of positions (roles) of a parent organization unit (collaboration) to sub-organization units. Similar hierarchy can be represented for other types of collaborations, such as business networks, or it could show how communities are part of organizations. A collaboration structure diagram for the business network in this use case (see Figure 2) would show hierarchy based on assignment of the Hospital role to the Hospital organization unit, the Doctor’s Office role to the affiliated doctors organization, and the Patient role to a risk pregnancy patient community. Hence a structure diagram in VDML is specified as a collaboration structure diagram, of which the representation of an organization structure is just a common application.

Value contributions

The activity network defines a structure for identification of sources of value contributions. As has been demonstrated based on the activity network diagrams in Figure 4 and Figure 5, sources of value can be highlighted based on filled output port shapes, which represent deliverable outputs that have associated value adds. VDML supports value add aggregation, typically as follows:

- Value adds from stores (resources) that feed activities are aggregated into activity value adds
- Value adds from activities are aggregated into value adds from the collaborations (typically capability methods) that contain the activities
- Value adds from sub-collaborations are aggregated into parent activity value adds (value adds from activities that delegate to these collaborations)
- In top-level collaborations, typically business networks, activity value adds are aggregated into values of value propositions.

Aggregation of values (and their value measurements) from value sources to value proposition, is not visualized in activity network diagrams themselves, but can be expressed via *measurement dependency* diagrams. Implementers of VDML modelling tools can provide additional tabular displays for further detail. A *measurement dependency* diagram like that in Figure 8 can be generated from the activity networks and related activity value contributions.

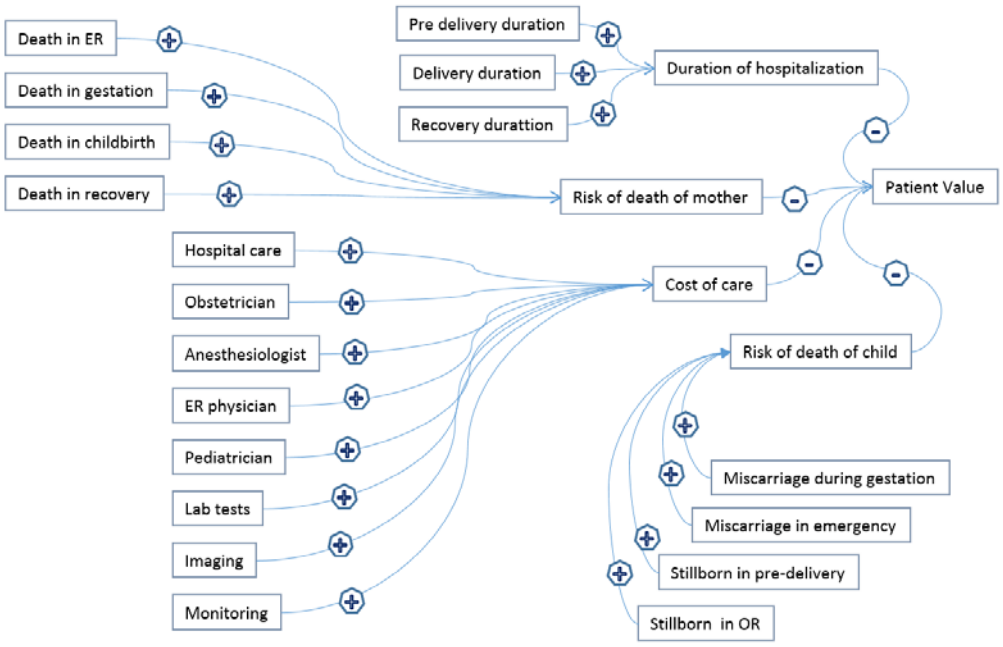

Figure 8, Measurement Dependency Graph

The plus (+) and minus (-) decorators on the connectors indicate if the source measurement increases or decreases its target measurement. The graph depicts value aggregation for the Inpatient Maternity Care value proposition in Figure 2. The top level node represents the overall patient satisfaction of the value proposition. Its first level child nodes represent values of that value proposition, which represent the same four value components as have been discussed earlier. Lower level nodes represent value adds from activities, whereby it is possible that the same value proposition value component is affected by value adds from multiple activities. Note that the activity diagrams in Figure 4 and Figure 5 only represent a small subset of activities in the complete use case.

Computation for aggregation of these values, based on so-called measures, depends upon the nature of the measurement. For example, durations and costs may be added (assuming the durations are sequential), while risks must be aggregated as probabilities. Costs may be adjusted for flow percentages or for activities performed multiple times.

Note that tracing back of values of a value proposition is not a necessity, but is applied where useful and meaningful. A value proposition might also contain values for which tracing back to value sources might impose modelling burden and is less meaningful to do. Values that represent brand recognition, for instance, might be included, e.g., for purpose of establishing relative priority of values from a customer perspective, but might not be traced back to value sources explicitly. It is up to the ambition of an analyst to decide how far to go.

Relevant scenarios

VDML provides the ability to capture sets of measurements that represent different circumstances. A set of measurements for elements of a VDML model for a certain circumstance is called a scenario. The same model may be used to represent different scenarios. So a scenario for the course of care for a typical pregnancy could be represented by one scenario with associated measurements, and a scenario for the course of care for high-risk pregnancies could be represented by a different scenario. This allows the analyst to compare the performance variables and satisfaction levels achieved for each of the scenarios, and then examine the sources of differences

between the scenarios by tracing back to the value contributions of activities. A VDML tool implementation may provide tabular displays or reports to support such comparisons.

The following are different scenarios that may be of interest for assessing and understanding the implications of remote monitoring of high-risk pregnancies.

- All maternity patients
- Normal risk patients
- High-risk patients without monitoring
- High-risk, monitored patients
- High-risk patients that opt-out of monitoring
- Alternative high-risk selection criteria scenarios (i.e., what is “high-risk”?)
- Alternative high-risk alert scenarios (i.e., when does monitoring result in action?)
- Normal risk ER admissions
- High-risk ER admissions

Value propositions for each scenario provide an overall perspective on the difference between the scenarios. However, this is not the whole story. Using the measurement dependencies, the analyst can identify the activities that have a significant impact on overall satisfaction. The activities depend upon capabilities that may help or hurt the specific value measurements. This will highlight capabilities that can be improved in order to have a positive impact on value propositions.

Capabilities

Capability represent the "ability to act"[15].[16] Organizational capability represents the ability of the organization to act.

Capability definitions are captured in a VDML *capability library*. Capability libraries might be developed for an enterprise, or for an industry. VDML also supports for-enterprise customization of, e.g., industry-based capability libraries. A library defines a capability taxonomy so that more general capabilities can be defined as including more specific capabilities. The consistent definition of capabilities helps specifying the capabilities that are needed by activities, it identifies the capabilities that are available and the organizations that offer them, and it helps identifying capabilities offered by multiple different organizations that might be considered for consolidation.

[15] Applying Real-World BPM in an SAP Environment, Ann Rosenberg, Mark von Rosing, Greg Chase, Rukhshaan Omar, and James Taylor, SAP Press, 2011, ISBN: 978-1-59229-343-8

[16] Defining the Business Architecture Profession, Hendrickx, H.H.M., Daley, S.K., Mahakena, M. ; von Rosing, M. Published by: IEEE Commerce and Enterprise Computing, No. of Pages:325-332, Issue Date: 2011-09

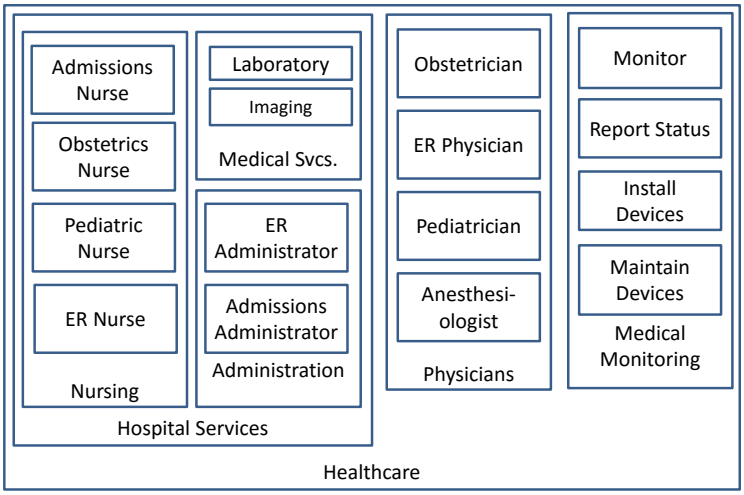

Figure 9, Capability Map

Figure 9 shows a capability library diagram (or capability map) for a fragment of the capability library for the use case. This diagram may be used to visualize the capability library, as well as to maintain it. A variation of it, called *capability heat map*, might be used by the analyst, e.g., for management presentation purpose, to highlight certain capabilities in the capability map that should be targeted for improvement. The analyst can then navigate from the capabilities on the heat map to the capability management diagrams and associated organization units.

The mapping of capabilities to organizations, as identified in the capability management diagram, see Figure 6, enables an organization to model, engineer and architect an organization structure to more effectively align the organization structure with the enterprise capabilities. For example, multiple organizations may have the same or similar capabilities that could be consolidated in a single organization as a shared service. In addition, capabilities that require some of the same resources might be consolidated in a single organization in order to balance workloads and realize economies of scale. The VDML capability taxonomy therefore enables analysis of related capabilities, independent of existing relationships to the organizational structure.

Overview of VDML

This section provides an overview of VDML concepts in order to provide a more general understanding of VDML and potential applications. The following paragraphs describe

- Collaborations and roles
- Activity networks
- Capabilities
- Values and value propositions
- Value stream
- Measurements and scenarios

For additional detail, see the VDML specification available from OMG.

Collaborations and roles

The fundamental, structural concept of a VDML model is collaboration. A collaboration is defined as a group of participants, working together for a shared purpose. An enterprise involves many, networked collaborations

including collaborations with customers and suppliers. Roles within a collaboration define how each of the participants contribute to the collaboration. A participant can be an actor (person or automaton), a supporting collaboration or another role. For example, a manager (role) of an organization (collaboration) can be assigned as a member (role) of a task force (collaboration).

There are four specialized types of collaboration in VDML: an organization unit, a business network, a community and a capability method. These are described in the following paragraphs.

An *organization unit*, such as a department, a team, a division or a corporation, is a collaboration that is relatively stable with associated resources including people, facilities and intellectual capital. The roles in an organization unit may be filled by people and/or other organization units thus representing an organization hierarchy (see Figure 7 above for an example). There are typically organizational relationships in an enterprise that do not fit the conventional organization hierarchy pattern such as project teams, interest groups and committees. VDML provides for the representation of all organizational relationships.

An organization unit typically has defined capabilities (as represented in a capability management diagram such as in Figure 6, above) based on its purpose, resources, facilities and intellectual capital. The activities required for an organization unit to apply a specific capability can be modelled with a capability method, discussed below.

A *business network* is a collaboration among economically independent business entities. This may represent customer relationships and relationships with suppliers or other business partners. Business networks focus on the exchange of products, services, money and related values such as product quality and availability of field support. Figure 2 and Figure 3 above represent such exchanges at different levels of abstraction. In a viable business network, participants exchange values such that each participant receives values that, in its context, has greater economic value than the values it provides.

A *community* is a loose association of members such as a professional association, an industry standards group, a market segment or employees with a common interest who share ideas. In a business network, a typical customer may be represented as a member of a market segment community.

A *business capability* is the ability to perform a certain kind of work. A *capability method* is a collaboration with defined roles and activities for applying a business capability to deliver a particular result. An organization unit may have a general capability, but it typically delivers more specific capabilities using its resources, facilities and intellectual capital in particular ways. Its capability methods define patterns of activities and resources required to apply the more specific capabilities. Capability methods will often define shared services.

Activity networks

Within any collaboration, activities can define what the participants do in their roles. Activities receive business items and add value to change or produce business items as deliverables. Stores represent inventories of business items pending consumption by activities or pending delivery to another recipient. Business items can include resources, intermediate products, sales orders, money, specifications, intellectual property or anything that is an input or deliverable of an activity that is relevant to the value contribution. Most deliverables are received by activities or stores in the same collaboration, but some are outputs to other collaborations, including external business entities.

The dependencies based on deliverable flows between activities and stores form an activity network within a collaboration (see Figure 4 and Figure 5 above for examples of activity networks). An activity network can represent any form of repetitious, organized behavior including adaptive processes that perform some activities only part of the time.

VDML does not represent process flow-control loops or decision branches, but focuses on the statistical performance of activities and stores, and deliverable flows between them. Measurements of values (for example, cost and duration) associated with activities and stores each represent an average per unit of production, so the measurements for an activity may reflect that it is engaged only once for some units of production, and multiple times for other units of production.

Capabilities

VDML includes a capability taxonomy that may be represented as a capability map, like the one that is represented in Figure 9. Each capability identifies the organization units that can provide that capability.

Each activity requires a capability and identifies the role of a participant that has or supports the capability to perform the activity. The activity defines how that capability contributes to the particular collaboration. The role of a participant may be associated with multiple activities in the collaboration. The participant must meet the capability requirements of each of the activities associated with that role.

A role may be filled by an actor, or, where the work of the activity requires multiple participants, it may be filled by an organization unit that provides a team (participants in roles of a collaboration) with the required capability. The organization unit may identify a capability method that defines the roles of participants and how the capability is applied. The capability method is engaged as a service by the activity through delegation. Delegation is the mechanism by which a capability method can be shared as with shared services. Delegation also defines how inputs of the parent activity are handled by the capability method and how outputs of the capability method become deliverables of the parent activity.

The capability taxonomy and its links to organizations and activities provides the basis for consideration of consolidation of similar operations into shared services. The delegation linkages that engage shared services support analysis of the impact of changes or disruptions to shared services as well as their impact on the customer values of the lines of business served.

Values and value propositions

Activities add value to produce deliverables. Values may be positive or negative. Values of interest typically include per-unit cost, duration and defects, but other product-specific values may also be captured. Each value contribution (value add) is expressed with a measurement. From contributing activities, value adds of each type are aggregated in a value proposition that represents the delivered values of the product or service (see Figure 8 above for an example of value aggregation).

A value proposition is a package of values and deliverable(s) that are offered to a recipient, typically a customer, but a value proposition can also be offered to other stakeholders such as business owners or internal "customers." The value proposition incorporates those values that are of interest to the recipient. The value proposition also expresses its values from the recipient's perspective. For each type of value, the aggregated measure is transformed to a level of satisfaction based on a formula for the particular type of recipient. Different customers or market segments may be interested in different values with different priorities, so separate value propositions can represent the levels of satisfaction for these different recipients.

Value stream

The activities, deliverables, capabilities and values that contribute to a value proposition are characterized as the value stream for that value proposition. Value contributions and deliverable flows that feed the value

proposition can be traced back to the activities involved and the capabilities they use to contribute to the value proposition.

When a value proposition indicates a poor level of satisfaction of a value, the value stream can be examined to identify the activities and thus the capabilities that contribute to that value and the analyst will look for potential improvements that could raise the satisfaction level. Conversely, if a capability is disrupted, an analyst can determine all value streams, and thus the products and services, that will be affected.

Measurements and scenarios

VDML provides the ability to represent the same business model under different circumstances. The structure may be the same, but the measurements are different. We describe these different circumstances as scenarios. So the measurements of different product mixes might be represented with different scenarios. In addition, a capability method might be engaged more than once within a value stream or by multiple value streams. Measurements of the capability method are specific to each context. VDML manages the measurements separately for each occurrence.

Applications of VDML

The following paragraphs briefly describe a number of applications of VDML modelling .

Strategic planning

A result of strategic planning is to define changes to the business in general terms and define objectives to be achieved. However, these are generally abstract. The requirements for transformation are often interpreted in different ways as implementation is pursued in different organizations, thus involving considerable collaboration and rework, if not failure of the initiative. A VDML model of the proposed business design provides, not only an assessment of the value impact (comparison of as-is to to-be scenarios), but it also provides operational detail for a shared understanding of requirements, support for detailed planning of implementation and a basis for monitoring the realization of objectives.

Shared services

VDML promotes the use of shared services through identification of redundant capabilities and the representation of delegation to a shared service in multiple delegation contexts and different users. In addition, management of an enterprise with shared services becomes more complex because changes to a shared service may affect multiple LOBs. A VDML model provides accountability of shared service organizations and clarity of the impact of changes to shared services.

Business Process Management

VDML provides an abstraction of business processes that is more suitable for definition of requirements and communication with business leaders. VDML can be used to define the intent of a business process

transformation that is then developed in detail using BPMN[17] and/or CMMN[18]. The linkage of capability methods to organizations clearly defines responsibility for changes or development of specific business processes. Managers and executives can refer to a VDML model when problem-solving, determining accountability and considering business changes.

New business planning

The business design for a new business can be configured including existing capabilities and identifying capability gaps. Value contributions of existing and expected capabilities can be used to assess viability of the new business plan, including competitive position and to set objectives for proposed capabilities. It may also identify the need to share or enhance existing capabilities.

Mergers/acquisitions

In general, the expectation of a merger or acquisition is that each participant brings unique capabilities that can then be leveraged by the other or shared capabilities can realize economies of scale. Typically, there is an expectation that capabilities possessed by both participants will be consolidated. In many cases these expectations are not met because capabilities are not as sharable as expected, and the existing LOBs must adapt to the use of shared capabilities. VDML models of the potential merger participants can clarify the consistency of requirements with the capabilities to be shared. A VDML model of the intended, new enterprise can more clearly define the desired end state and associated responsibilities for the transformation.

Innovation

Innovation is not just about great ideas from top management. Instead great ideas from people throughout the enterprise should be recognized and pursued. Often people at the operating level see an opportunity but do not have an understanding of how that innovation will affect other parts of the enterprise. A VDML model of the enterprise can provide a basis for understanding the implications of an innovation and refining the approach to be more viable. In some cases, the innovator can then collaborate with affected parties to develop refinements and gain acceptance. In other cases, innovators can be empowered because it becomes clear that the innovation can be pursued within the innovator's own organization.

Investment priorities

Improvements in capabilities and methods often require investment. Decisions regarding which improvements should be funded are often political (less than objective). A VDML model can provide impact assessments for proposed improvements both in terms of more detailed requirements and in terms of impact on the customer and other aspects of the business.

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[17] Cummins, Fred A., and De Man, H., *Analysis of the Relationships between VDML and BPMN*, Object Management Group, November 2013, OMG document number bmi/2013-11-01, http://www.omg.org/cgi-bin/doc?bmi/2013-11-01 .

[18] CMMN, *Case Management Model and Notation*, version 1.0, Object Management Group, May 2014, http://www.omg.org/spec/CMMN/ .

Link business model to business operations

Multiple writers[19] have defined high-level business model frameworks for consideration of proposed businesses. These frameworks provide a level of abstraction appropriate for consideration by innovators, investors and planners, but they typically do not have the operational detail needed to validate a proposal. VDML can provide the supporting business design to validate and implement the business model.

Context for dashboard

Executive dashboards provide visibility of key performance indicators (KPI). However, these KPIs are not useful if the executive does not fully understand the operation of the business. Furthermore, with a full understanding of the design of the business, the executive might select other KPIs or change KPIs as circumstances change. A VDML model of the business can provide this deeper understanding and can provide the context for defining and understanding appropriate KPIs.

Operational risk analysis

A VDML model defines dependencies between activities as well as the impact of activities on customer value. This provides the basis for understanding the impact of potential disruptions and possible measures for risk mitigation.

Informal roles and relationships

The formal roles of members of an enterprise are defined by the organization chart—the management chains of command. However, in a modern enterprise, other collaborations are often at least as important as the management hierarchy. VDML captures these relationships for a more comprehensive understanding of roles, relationships and responsibilities.

Conclusion

As illustrated in this chapter, one can unlock new possibilities in modelling value aspects and components. We have demonstrated that by applying value concepts to one's organization an organization can get in-depth information about the resources, collaboration potential, capabilities, processes, value drivers, performance aspects, measures etc. With such modelling capabilities, VDML is both ideal for business analysts, business architects, value engineers, value architects, transformation experts as well as business managers. It can also be used by process experts, process architects and process owners, who want to move beyond business process

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[19] Afuah, A, Business Models: A Strategic Management, McGraw-Hill/Irwin

Johnson, M. W., C. M. Christensen, and H. Kagermann. "Reinventing your business model." Harvard Business Review December, 2008

Osterwalder, A. and Pigneur, Y., *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*, John Wiley & Sons, 2010.

Newth, F., Business Models and Strategic Management: A New Integration, 2012

Masterson, A., Business Model Generation: The Blueprints Every Entrepreneur in Every Industry Needs Today to Achieve Maximum, 2014

modelling to incorporate modelling of value creation and exchange, capabilities and capability sharing, organizational relationships and performance measurements as well as relationships with business partners and customers. Business processes are an aspect of VDML models but are represented in a way that is relevant to the business, focusing on capabilities applied, deliverables used and produced, and value created. By applying value modelling techniques an organization can simplify their way of working and create the needed value output defined by the Strategic Business Objectives (SBOs), the critical success factors and even the performance indicators. It can be used as a bottom up or a top down approach:

1. **Bottom up approach**, which could incorporate:

- Analyze inefficient resource collaboration (huge cost potential).
- Analyze the external and internal value flow e.g. value proposition (huge service potential).
- Analyze ineffective capabilities (transformation potential).
- Identify duplication of resources, capabilities, measurements etc. (Transformation and huge cost potential).
- Prioritize process improvement, applying the changes ether for the entire organization (big bang) or by either process by process or project by project.

2. **Top down approach** which could include:

- Link to strategy and the critical success factors of the organization (innovation potential).
- Tie resources, capability and value flow to business model (innovation & transformation potential)
- Identify executive value drivers (proactive change and requirement fulfillment)
- Specify executive performance drivers (enable performance management)
- Clarify accountability for performance problems (expedite corrective action).
- Analyze effects of consolidations, mergers and acquisitions (improved economies of scale)

Depending on the stakeholder and the specific needs, both focus areas, have their benefits and modelling advantages. Both however will ensure to improve the accountability for creating and delivering customer value. VDML models are sustainable to apply to new circumstances and evolving business design, so the design of the enterprise can continue to be represented by a valid, shared model. A VDML model will continue to provide insights to business leaders as well as information needed by first-line managers to improve their operations with an understanding of their impact on the rest of the business and the related organizations with whom they must collaborate and coordinate. In general, it will provide a shared understanding at all levels so that people throughout the organization can work together, more effectively and objectively, for the benefit of the enterprise.

We are not saying that modelling value is easy; however, we are clearly stating that modelling value aspects is finally possible. We believe that VDML is a significant step forward and hope that the examples and explanations shown have given some inspiration in the right direction.

About the authors

Fred A. Cummins

Fred A. Cummins is an independent consultant doing business as Agile Enterprise Design, LLC. He is a former HP and EDS Fellow. He has developed solutions or functioned as an analysis and design consultant across multiple industries including manufacturing and distribution, financial services, transportation, insurance, health care, and government.

Fred has been cochair of the Business Modeling and Integration (BMI) task force at OMG (Object Management Group) for 14 years. He has been an active participant in the development of a number of OMG specifications, and most recently was a leader in the development of the Case Management Model and Notation (CMMN) specification and the Value Delivery Modeling Language (VDML) specification. CMMN supports the design of event-driven, adaptive processes to improve planning, coordination, and collaboration of knowledge workers. VDML provides a business design abstraction appropriate for business leaders that brings together multiple dimensions of business design including organization, capabilities, processes, resources, performance measurements and the creation and delivery of customer value.

The BMI task force is also responsible for a number of other business-focused specifications including BPMN (Business Process Model and Notation), BMM (Business Motivation Model), SBVR (Semantics of Business Vocabulary and Rules), and DMN (Decision Model and Notation).

Fred has presented at conferences, authored numerous papers, and published three books, most recently Building the Agile Enterprise with SOA, BPM, and MBM (Elsevier, 2009).

Henk de Man

Henk de Man is architect with over 20 years of experience in IT and Business concepts. He has a successful track record of commercializing research insights to launch world-class Enterprise Application Software products, in the areas of ERP, Lean Enterprise, and BPM, that today serve a global customer base to integrate and smoothly run their business operations while serving as platforms for business transformation.

In his current position as cofounder of VDMbee, he focuses on supporting business managers, analysts, and architects with Business Model Innovation, Transformation and Management technology on mobile platforms.

Over the years, Henk served as active developer and implementer of OMG specifications in related areas, in particular Value Delivery Modeling Language (VDML), Structured Metrics Metamodel (SMM), and Case Management Model and Notation (CMMN).

Henk also participated in European Research and authored and coauthored various articles and papers in these areas.

Mark von Rosing

Prof. Mark von Rosing is in every way an innovator impacting developments, standards, frameworks, methods, and approaches around the world. He founded in 2004, the Global University Alliance (GUA), the largest nonvendor academic platform for academic collaboration. As a part of the GUA work he has been involved of developing 96 Enterprise Standards and 51 Industry Standards. He is a leader in the industry in developing standards. He has not only founded the largest Enterprise Standard community "LEADing Practice" used by practitioners and organizations around the world, but also has a main role in developing standards in the following standard bodies:

- World Wide Web Consortium (W3C): Prof. Mark von Rosing is leading development member of the World Wide Web Consortium (W3C). The W3C purpose is to lead the World Wide Web to its full potential by developing protocols and guidelines that ensure the long-term growth of the Web/Internet. Prof. Mark von Rosing is thereby part of developing the internet principles and standards; that will help radically improve the way people around the world develop new technologies and innovate for humanity. See the link under LEADing Practice that is a strategic liaison partner of W3C www.w3.org/2001/11/StdLiaison#L.
- ISO: As a leader and development member of "The International Organization for Standardization (French: Organisation internationale de standardization)"; known as ISO, Prof. Mark von Rosing coordinates the development of international standards among various national standards organizations. Prof. von Rosing is thereby a leading mind in promoting worldwide proprietary, industrial, and commercial standards. The standards focused on at the moment are ISO 42010, the Systems and software engineering Architecture description, as well as ISO 279 the Innovation standard.
- Energetics: As a core development of the energy standard body Energetics, does Prof. Mark von Rosing, develop the energy standards used by countries and companies around the world. This also includes the standards used by the upstream oil and gas organizations around the world, improving their business model, performance concepts, process models, and data models.
- Object Management Group (OMG): Prof. Mark von Rosing is cochair and leading development member of the software standards in OMG. This development includes:
    - Value Delivery Modeling Language (VDML)
    - Business Planning and Motivation Modeling (BMM)
    - Business Process Modeling Notations (BPMN)
    - Semantics of Business Vocabulary and Rules (SBVR)
    - Decision Model and Notation (DMN)
    - Risk and Threat Modeling.
- The Information Security Forum (ISF): Prof. Mark von Rosing is a core team development member of the Information Security Forum. Investigating, clarifying and resolving key issues in information security, and developing best practice methodologies, processes, and solutions that meet the business and IT needs around security.

  Additional standard development that are worthwhile mentioning:
    - Research collaboration and developer with IEEE standards.
    - Codeveloper of the Global TOGAF Business Architecture Methods & Certification Development Group.

- Development member of the NATO standards, including EA, BPM, Capabilities and joint mission execution.
- Built the BPM and EA curriculum for the SAP University Alliance (+900 universities).
- SAP AG Method developer e.g., ASAP, SAP Agile, BPM, Enterprise Architecture (EAF). Author of multiple publications among them the last 3 years:
- SAP Press bestseller: “Applying real-world BPM in an SAP environment”
- IEEE publication “defining the profession of the Business Architect” as well as the publication “How to integrate Enterprise Architecture and BPM,”
- Springer: Conceptual Structures in LEADing and Best Enterprise Practices as well as The Impact of Culture Differences on Cloud Computing Adoption.
- Future Strategies Inc. and the Workflow Management Coalition (WfmC) “Passports to Success in BPM.”