# Managerial Technology Evaluation

## Selection of organizational design visual methodologies

Daniele Gianni

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DANIELE GIANNI

# MANAGERIAL TECHNOLOGY EVALUATION

## SELECTION OF ORGANIZATIONAL DESIGN VISUAL METHODOLOGIES

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# CONTENTS

*To Rossana and to Olesya*

# ABOUT THE AUTHOR

Daniele Gianni is a business educated versatile computer engineer who works at the intersection of IT and management. Currently, Gianni works as business systems analyst for an EU authority. Previously, Gianni held consulting positions at the European Commission Directorate of General Informatics (DIGIT) (Luxembourg) and the European Organization for the Distribution of the Meteorological Data (EUMETSAT) (Germany). Before these consulting positions, Gianni worked in research, gaining visiting and postdoctoral experiences in prestigious institutions, such as European Space Agency, University of Oxford, Imperial College, Georgia Institute of Technology, and the Auckland Bioengineering Institute. Gianni has published over 20 research papers, in journals and conference proceedings, and co-edited a book in the CRC Engineering Management series on Modeling & Simulation-based Systems Engineering.

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# ACKNOWLEDGMENTS

This book is based on my thesis for the Master of Business Administration that I have received from the Frankfurt School of Finance and Management, Germany. Studying new subjects and researching a new topic are rare privileges that perhaps can be best appreciated with some experience on our shoulders and with some grey hairs grown on our heads. Experience and grey hair may theoretically call for less guidance in the studies, but certainly cannot compensate for the many constraints that indirectly they bring. Thinking that one alone could cope with all these constraints, it would partially depreciate the value of this experience and would likely reduce the graying of the hairs only to a purely biological process. My first thoughts are for my parents, Giorgio and Rossana, and to Prof. Giuseppe Iazeolla, whose examples and teachings have provided me with the fundamental means to get to the starting line of these studies. For the time during the studies, I certainly owe a debt of gratitude to my ex-managers, Dr. Peter Albert, for the flexibility granted, and to Dr. Lorenzo Sarlo, for encouraging me in this dual commitment and for sharing pills of his wisdom. A sincere note of gratitude is also for my thesis advisers, Prof. Dr. Andreas Tolk, for being a dedicated and a very understanding advisor as well as an appreciated supporter in several previous occasions, and to Prof. Dr. Nils Stieglitz, for welcoming the challenge of accepting this less traditional topic as well as for offering his time availability for a few discussions.

Last, but not least, my thoughts are also for Olesya, for her encouragement during these studies.

# 1 INTRODUCTION

Visual representations are known to facilitate human communications and decisions making as these representations tend to be processed more easily by the human brain, with respect to other representations, such as the textual ones [1]. Recent research has further remarked the usefulness of visual representations of the organization's governance and of the organizational architecture to clarify the current status, to display the possible options for re-organization, and to qualitatively evaluate these options down to their implementation [2]. Moreover, opinions were raised on the importance of organizational architecting capability for CEOs [3], letting us further speculate on the importance of visualizing any information element – here on organizational concept – needed in an organizational (re-)design. Visual methodologies – i.e. design methodologies based on visual representations – are available in a large variety. As a consequence, when a manager is tasked to do a technology selection for a visual methodology for organizational design, the manager faces the question "which is the most suitable visual methodology for the expected organizational design activities and for the overall organizational context?". Although this question can only be answered in specific organizational context as the design activities and the context are central to determine the suitability of any methodology, the question raises the general problem of supporting a manager in the managerial evaluation of a technology selection for visual methodology to support organizational design.

The book aims to define a solution for the above problem of supporting a manager in the evaluation of a technology selection, with the introduction of a meta-process – a process to develop processes [4] – that can guide the manager in answering the above question of identifying the most suitable visual methodology. In several disciplines, visual methodologies aim to enhance the communication of statistical insights with the most suitable form of graphical display of quantitative data [5]. However, the book specifically focuses on engineering disciplines, in which visual methodologies have a different scope that inherently originated by a series of interleaved historical and technological developments.

Concerning the historical developments, in engineering disciplines, visual methodologies have been used to represent systems, processes, and transformations in the design of new systems or in the maintenance of existing ones. In these disciplines, the definition and adoption have been objectives of decades of studies since the beginning of the IT era. As an indirect result, a pre-IT visual methodology was defined by partially independent sub-parts: 1) one or more visual modeling languages – which provide the visual symbols and may be structured within a visual modeling framework; 2) one or more modeling methods – which define how to use the visual modeling language; optionally 3) one or more model development methods – which define how to create visual models – i.e. models created with a visual language – for a design activity; and optionally 4) one or more design methods – which guide the design activities with the visual language and the development method. However, in the engineering community, some ambiguities arise as – occasionally – a name is used interchangeably to indicate the visual modeling language, the visual modeling framework, the modeling method, and the whole visual methodology. These ambiguities are not necessarily raised by the misinterpretations of the terms visual language, method, and methodology. The ambiguities also origin by tacit knowledge, by the definition of modeling methods coupled to visual languages, and also by the coupling of visual methodologies to the supporting visual language(s). The book presentation is consequently affected by these ambiguities. Nevertheless, an effort has been made to distinguish the respective terms when needed to support the understanding of the book contribution – i.e. the meta-process. However, the meta-process is structurally unaffected by these ambiguities as the meta-process concerns the evaluation of visual methodologies, and transitively of each constituent sub-parts of these methodologies. Nevertheless, some of the meta-process' steps may become irrelevant when restricting the evaluation to only some sub-parts.

Concerning the technological developments, in line with progress in computing capabilities, machine-readable grammars and semantic checks are more and more commonly offered for automatic processing of visual models in software-oriented visual modeling languages (e.g. UML [6], BPMN [7], or ArchiMate [8]). As indirect consequence, additional software-oriented visual methodologies and supporting tools have been developed to enable software code generation, (semi-)automated engineering documentation derivation, models correctness verification, models reuse, or models enactment/execution. Leveraging on these technological advancements, in the computing history of the early 90s, enterprise engineering emerged as new discipline that aims to apply engineering methods to the design of enterprise systems with the implicit goal of achieving similar maturity in the design of organizational systems [9][10][11]. A number of conditions – from the rising of enterprise engineering to the computing pervasiveness within organizations – have inevitably led to a convergence of the pre-IT visual methodologies towards the software-oriented visual methodologies. Initially, the software-oriented visual methodologies were applied only to the representation of the technical aspects of information technology (IT) and information systems (IS) architectures. However, the software-oriented visual methodologies have been subsequently extended to represent the whole enterprise architecture, which covers both technical architectures and the organizational architectures. Concurrently, these visual methodologies became increasingly used beyond the simple representation of organizational structures (also known as organizational chart) for two reasons [12]: 1) enterprise architecture was identified as a key enabler to support the organization strategy [13]; and, 2) the steady digitalization trend has further increased the inter-dependencies between the design of IT-based information systems and the design of the organization [14]. When using the same visual methodology for both the organizational and technical architectures, an organization can gain the potential advantages of resource and knowledge sharing.

However, these apparent advantages may mislead a manager evaluating a visual methodology as they could be dissipated if the evaluation is based only on purely technical considerations. As such, the meta-process can also contributes to reduce the likelihood of dissipation of these potential advantages while ensuring an informed selection of the best suitable visual methodology.

## 1.1 WHY DEFINING A META-PROCESS FOR THE EVALUATION OF VISUAL METHODOLOGIES

Currently, several visual methodologies are available for organizational design. However, evaluating both their suitability and their managerial impact may not be trivial. Managers are not necessarily skilled in applying these methodologies and may underestimate possible risks in this key selection. Moreover, the methodology selection is often only a semi-reversible, yet costly, decision. For example, once model artifacts are developed in a visual methodology, these artifacts may not be ported into a different visual methodology as technological limitations (e.g. data formats, conversion tools) and inherent semantic incompatibilities (e.g. mismatching of concepts and/or relationships) may prevent the reuse of the artifacts. Specifically, in the current engineering panorama, the two predominant methodologies are developed by two independent standardization consortia: the Object Management Group (OMG) [15] and by the Open Group [16]. The OMG's methodology is based on the visual modeling language Unified Modeling Language (UML). Differently, the Open Group's methodology consists of the visual modeling language ArchiMate [8], of an architecture development method, and of the architecture framework named The Open Group Architecture Framework (TOGAF) [17]. TOGAF can be customized and used with visual modeling languages other than ArchiMate. Although some explorative technical initiatives have been undertaken to assess the possibility of a technical integration among diverse methodologies [18][19][20][21], these initiatives may likely not result in a complete integration, particularly for the OMG's and the Open Group's methodologies as conflicting interests seem to undermine this possibility – even in the medium and long terms. On the sociological side, in each community of practice, personal and technical pride can be a considerable obstacle for opening to integration solutions with other methodologies. On the technical and political side, each community has developed into a considerable ecosystem that includes industrial partners with steering power, practitioners benefitting from their recognition/certifications, tool vendors, and overall millions of USD revenue from sponsorships, conferences, training programs, certifications, educational material, and other forms of products and services. Although all the above statements cannot be numerically substantiated for the unavailability of market data, these statements are congruent with recently released white papers on the topic of strategy definition for the protection of the individual ecosystems [22], for example. As a consequence, the problem of selecting a visual methodology is still and will probably remain of interest to current and future managers. Moreover, this problem is further exacerbated by the intrinsic complexity deriving from the interleaved technical, market, and organizational aspects that indirectly affect the selection and use of each visual methodology. Consequently, even before undertaking any trade-off analysis for the methodology selection, a manager faces the challenge of gathering, structuring, and prioritizing the relevant information to evaluate each of the candidate visual methodologies. Finally, a meta-process definition is inherently more valuable than a process that only evaluates pre-identified methodologies in a pre-identified organizational context (e.g. OMG vs Open Group in a large organization in the space industry) as the meta-process can be reused in multiple contexts, and therefore can be of interest to a wider audience.

## 1.2 WHAT THE META-PROCESS CONSISTS OF

The book specifically focuses on the definition of a meta-process that can guide managers to structure relevant information for the evaluation and subsequent selection of a visual methodology for organizational design. However, the meta-process can be adapted to cover other technology selections. The meta-process is developed under the following assumptions: i) the CEO is the sponsor of the visual methodology evaluation; ii) within the organization, the visual methodology is used only as information capability for organizational design – e.g. the organization does not develop tools for the visual methodology; and, ii) the visual methodology is for the entire organization – i.e. not for an individual organizational unit or a project. These assumptions do not structurally affect the meta-process. However, when these assumptions are not satisfied, minor amendments may be required within some of the steps. Figure 1 shows the meta-process definition, which consists of six steps:

1. *Identification of the Visual Methodologies to Evaluate.* This step aims to define the scope of the evaluation with the identification of the methodologies to be evaluated. In the meta-process definition, this step is not detailed as it would require guidelines that are specific to the organizational context. Differently, the meta-process is defined independently from the possible organizational contexts.
2. *Information Requirements Coverage Assessment.* This step aims to assess the methodology with respect to the information requirements (e.g. organizational concepts) that are needed to support the organizational design process. In the book, this step is based on the design process introduced by Burton [23]. However, other design processes can seamlessly replace or complement the Burton's one.

3. *Methodology Relative Positioning.* This step aims to display a relative positioning of the methodologies with respect to general managerial concerns based on the value offered by the methodologies. In particular, this step introduces classification schemas that can graphically highlight the differences among the methodologies under evaluation. The schemas are defined by abstracting the key properties of existing methodologies in common classification patterns and in common managerial concerns.
4. *Organizational Forces Analysis.* This steps aims to analyze the forces that may influence the methodology use and maintenance. The forces are distinguished in competitive and cooperative. The competitive forces are analyzed as they are key to identify the available strategic options. Moreover, Henderson warns about the common pitfall of excluding the market of input from the competitive forces analysis on the organization [24]. Consequently, the book introduces an interlinked two Porter's frameworks that can be used to display the forces within the operation industry and the visual methodology industry as well as the forces across these two industries. The collaborative forces are analyzed with identification of the organizational stakeholders, of their tasks, and of their responsibilities in the use of the visual methodology.
5. *Risk Assessment and Management*. This step aims to evaluate the risks related to the adoption and use of the visual methodology. The assessment is developed in three steps. First, current CEO's major concerns are identified from recent surveys and research – CIO's or other CxOs' concerns can be seamlessly embedded in this step. Second, these concerns are mapped onto the range of features and capabilities offered by the visual methodologies. Third, a root-cause analysis is performed to identify the causes that could hinder the benefit realization in the use of the visual methodology. The risk management further builds on the risk assessment and defines a series of measures that can reduce the risk – risk mitigation actions – and can limit the impact in the case risk occurrence – risk contingency actions.

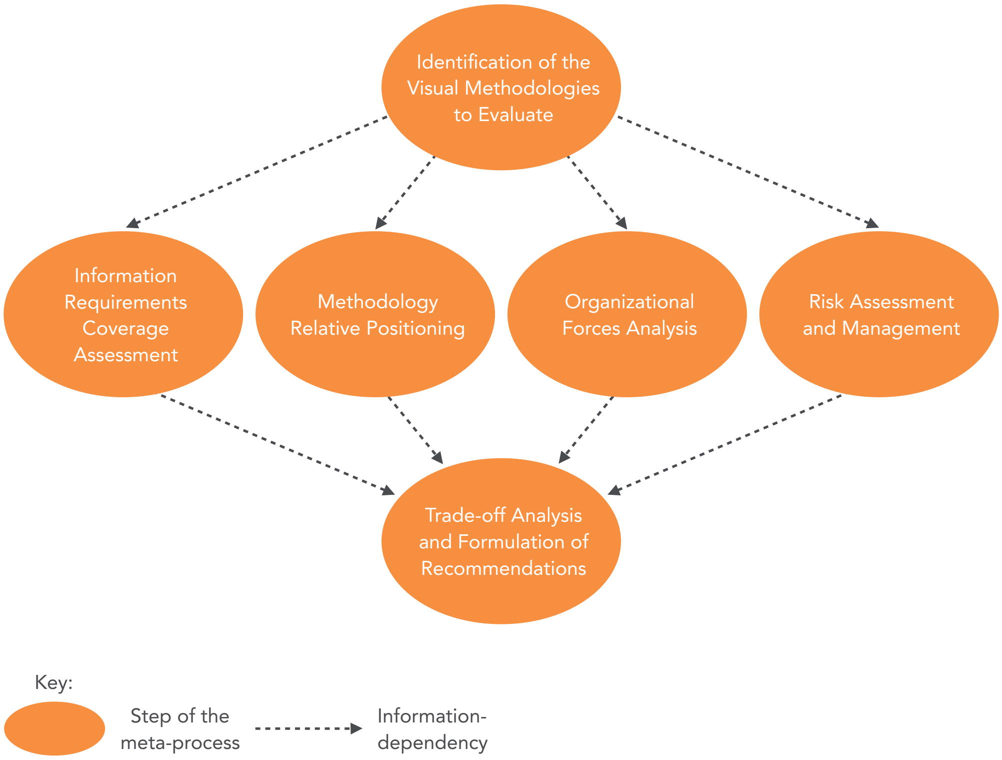



**Figure 1** High-Level Definition of the Meta-Process

6. *Trade-off Analysis and Formulation of Recommendations*. This step aims to assess the alternative methodologies and to reach the final recommendations. However, this step is included mainly for completeness of presentation as it does not prescribe any implementation guideline apart from instructing the manager on the respective purpose of the step. Single or multi-decision criteria methods and formulations of final recommendations are inherently specific to the overall organizational context.

## 1.3 META-PROCESS DEFINITION APPROACH

In this book, the meta-process is developed according to the paradigm of design science [25] [26], which aims to expand the knowledge boundaries with the definition and application of new artifacts. This paradigm was determined to be more suitable than other paradigms (e.g. case study, empirical research) on the topic discussed in this book, for the practical nature of the managerial question and problem. Moreover, the use and support of quantitative empirical methods may be irrelevant or unfeasible for two reasons: i) market data is unavailable; ii) data relevance and data interpretation may depend on the organizational context.

The meta-process has been specifically defined for the technology evaluation of visual methodologies for organizational design. Nevertheless, the meta-process can be taken as guiding example for other managerial evaluation of technology solutions in other topics or domains.

## 1.4 STRUCTURE OF THE BOOK

The book is structured as follows. The chapter "Background" covers i) a brief review of OMG's and the Open Group's methodologies; and, ii) a summary of the Burton's organizational design process. The chapter "A Meta-Process for the Evaluation of Visual Methodologies" describes the detailed definition of the meta-process. This chapter also provides a guiding diagram that graphically traces the key parts of the meta-process definition to the respective sections of this document. The chapter "Example of Meta-Process Application" discusses an example application to a simple organizational context that considers the evaluation of the OMG's and the Open Group's methodologies.

# 2 BACKGROUND

## 2.1 EXISTING VISUAL METHODOLOGIES

In engineering communities, visual methodologies were first mentioned in the 80s [27] [28]. Around the same years, with the economical viability of computing capabilities, visual methodologies started to flourish in almost every engineering community. However, it was only in the 90s, when Dietz [29] proposed the idea of applying engineering methods to enterprise problems, that the engineering visual methodologies began to be specialized for enterprise engineering purposes. Since then, a plethora of visual methodologies has flourished or reused for enterprise engineering activities, among which the enterprise architecting are the most prominent. In [29], Dietz distinguishes enterprise architecting activities related to organizational architecting – as synonymous of organizational design – and to IT architecting. Different authors adopt slightly different terminology conventions, either restricting the enterprise architecting only to the IT system architecting [12] or only to the organizational design [30]. As the Dietz's definition appears to be the most general, this definition has been adopted as reference for the rest of the book. In addition, the book uses "enterprise architecture" – related terms (e.g. enterprise architecture capability, enterprise architect) when referring to existing literature, existing methodologies or existing tools – for example – as these are the terms with which most of the related work and methodologies are known. Differently, for the book contribution, organization design-related terms are preferred as the book mainly focuses on the domain of organizational design within the enterprise engineering discipline.

Currently, many visual methodologies – or sub-parts of them – are available: from visual languages (e.g. BPMN [7], ArchiMate [8], or YAWL [31]) to architecture frameworks (e.g. UPDM [32], TOGAF [17], DoDAF [33], DEMO [34] etc.), and to complete methodologies (e.g. IDEFx [35]). Each visual methodology – or sub-part of it – offers advantages and disadvantages and has its own user and developer communities. As such, each would be a valid candidate for the example application of the meta-process. However, for the sake of conciseness and relevance, the book focus is on the arguably two most popular methodologies – in terms of users and industrial support: the OMG's one – which include UML, BPMN, BMM [36], VDML [37], etc. – and the Open Group's one – which include ArchiMate and TOGAF.

The OMG is a large not-for-profit standardization consortium that has been considerably supported by large academic and industrial members. The consortium initial scope originated in the core IT domain of distributed computing and software modeling standards. Gradually, the consortium spanned several other domains, such as the financial, biomedical, and enterprise engineering, often leveraging on the technological integration of new standards with the already successfully established ones. Concerning the modeling standards, the OMG's central technological modeling framework is heavily based on two core elements: the Meta-Object Facility (MOF) and the Unified Modeling Language (UML). The former provides the primitives for the definition of any visual modeling language. The latter is a "universal" modeling language – and associated methodology – on which most of the recent business modeling specifications (e.g. UPDM, BMM, VDML, etc.) have been defined. The OMG consortium provides also certifications for tools and people. Although no formal analysis has been released, the OMG competitive advantage can be identified in the interlinking of four resources: 1) brand credibility; 2) market advantage (popularity of existing standards) on both the user and the tool supplier sides; 3) integration across a wide portfolio of standards ranging from distributed computing to visual modeling on a diverse set of application domains; 4) well-established and powerful community of practice spanning across many industrial domains.

The Open Group is also a large not-for-profit standardization consortium which is differently focused on achieving business objectives through the definition of IT standards. In contrast to the OMG, the Open Group has a narrower scope with respect to the number and domain of the available standards. More specifically, the Open Group addresses only areas that are strictly related to enterprise engineering (e.g. TOGAF, Enterprise Maturity Model, Service Oriented Architecture, Security) almost regardless of the specific application domain[1]. The Open Group is supported by a large and prestigious community of members of the same caliber of the OMG, though the Open Group ones appear to be more focused on IT and to be of smaller size than the OMG's members. Differently from the OMG, the Open Group is less technologically focused and more methodologically oriented as suggested by their portfolio of standards. Particularly, the Open Group offers standards on the Service Oriented Architecture (SOA) / IT4IT reference architectures[2], SOA governance framework, architecture development methods and framework (TOGAF), visual modeling languages (ArchiMate), etc., besides the technological legacy ones on IT platforms based on operating system UNIX. Central to the Open Group's ecosystem is TOGAF, which integrates with several of the consortium's standards. Similarly to the OMG, the Open Group provides certification programs for tools and people. The use of the standards is free only for non-commercial purposes – their commercial use must be pre-emptively licensed. Although no formal analysis has been released, the Open Group competitive advantage can be identified in one single point: TOGAF. Other aspects also contribute to form the Open Group's advantage, such as the user community, powerful industrial members, related consortium's standard for security, SOA, enterprise modeling, etc. However, these factors add only marginal value to the competitive advantage and should be indeed considered as successful attempt to define an ecosystem around TOGAF. Finally, the Open Group's competitive advantage is inherently vulnerable as it is primarily based only on TOGAF, which does not formally prescribe other standards developed by the Open Group. Example and real-world projects have an integrated TOGAF with non-Open Group visual languages, achieving discrete levels of compliance [38]. Nevertheless, higher compliance levels may be more easily achieved when using the Open Group standards such as ArchiMate or the SOA framework.

## 2.2 BURTON'S ORGANIZATIONAL DESIGN PROCESS

Several processes are available to support the organizational designers in the identification and the selection of the trade-offs that would eventually lead to the overall organizational architecture [30][39][40][41]. Although these processes differ in several ways, they share an overarching abstract structure and decision criteria that can be related to the ones defined by Burton [23], which is taken as reference in this book. The Burton's process consists in seven steps: 1) Getting started, which aims to identify the organizational goals; 2) Assessing the Strategy, which covers both the organizational strategy and the environment in which the organization operates; 3) Analyzing the structure, which regards the current and future organizational configuration; 4) Assessing processes and people, in terms of the task design, employee skills/experiences, and organizational leadership; 5) Analyzing coordination, control, and incentives, which concerns the systems used people in the implementation of the processes; 6) Designing the architecture, which aims to define the to-be organizational architecture; and, 7) Implementing the architecture, which aims to support the phases for the implementation of the to-be architecture. Steps 1 through 5 consist of a set of questions that guide the manager in assessing the context and in determining the suitability of the organizational design alternatives. In addition, each step also provides one or more Cartesian diagrams which can be used to position and display the alignment of the organizational status or alternatives across these steps. For example, step 2 concerns the strategy assessment and is sub-structured in two topics: strategy and environment. Specifically, for the environment topic, Burton's questions aim to assess 1) the degree of complexity of the environment for the unit under analysis; and, 2) the environment unpredictability, quantifying and identifying the environment category (e.g. varied, turbulent, calm, locally stormed). Differently, steps 6 and 7 are only guidelines for the architecture design and implementation, which are related to the cost assessment and alignment with future scenario (step 6) as well as project specification and communication for the implementation (step 7). Besides from the above classification of the solution space, the process also guides the designer in the assessment of the fit/misfit degree of the values across the above design dimensions, with the use of the Cartesian diagrams. For an extensive description of the Burton's process, including also examples, please refer to the Burton's book [23].

# 3 A META-PROCESS FOR THE EVALUATION OF VISUAL METHODOLOGIES

The meta-process guides a manager in the evaluation and selection of a visual methodology for organizational design activities, though it can potentially cover also enterprise engineering activities. Figure 2 shows a comprehensive view of the meta-process definition, which includes: i) the meta-process steps – represented with ovals; ii) the information items – represented with rectangles; and, iii) the information production/consumption relationships – represented with arrows – which indicate if a step takes in input or produces as output the respective item. The figure also indicates where the individual steps and the information items are primarily presented – though the example application (Section 5) inherently discusses also the tailoring of the meta-process definition.

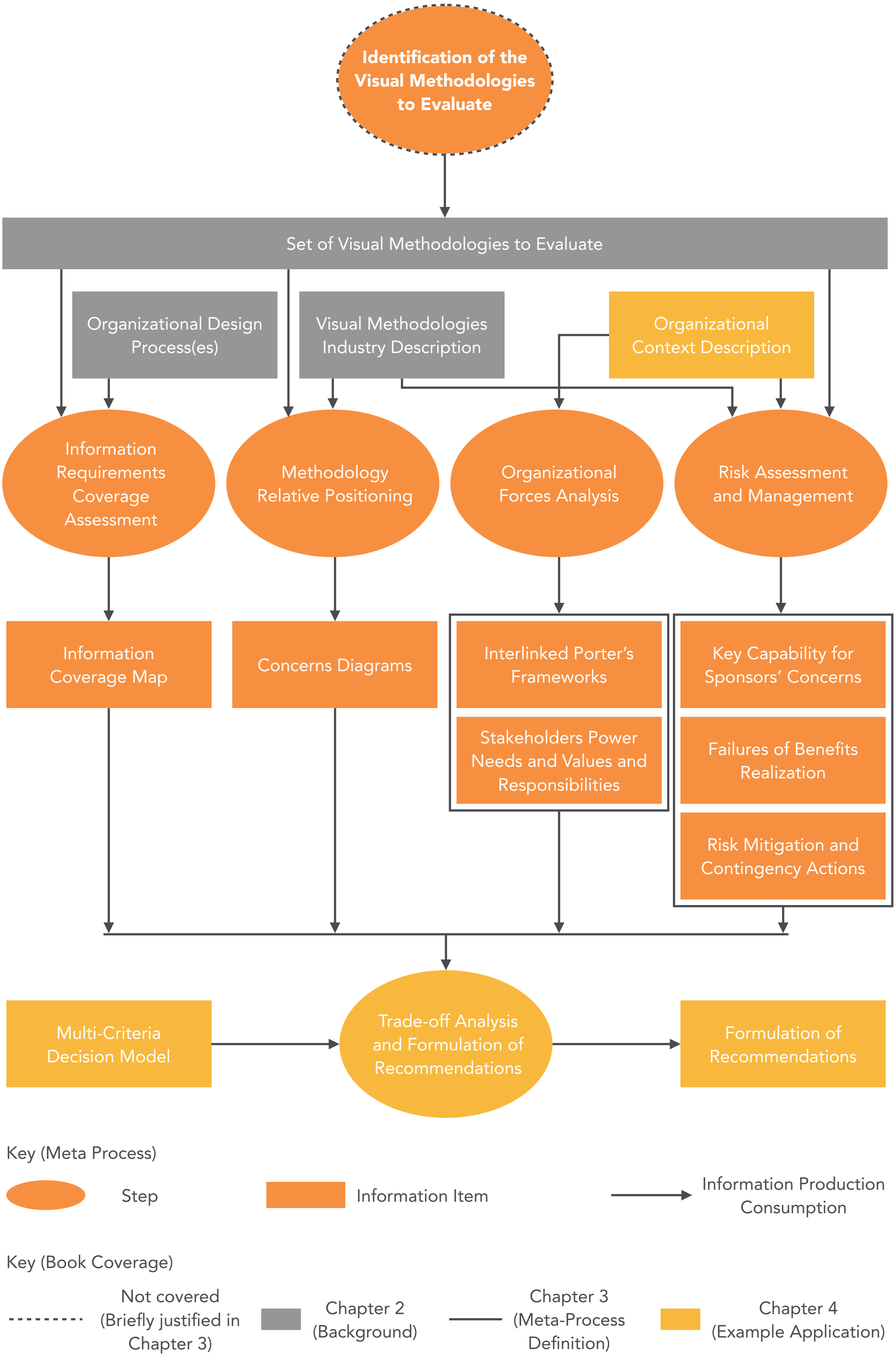



**Figure 2** Detailed Definition of the Meta-Process

## 3.1 STEP 1: IDENTIFICATION OF THE VISUAL METHODOLOGIES TO EVALUATE

This step aims to define the set of visual methodologies that are to be evaluated. As such, this step is included mainly for completeness of presentation as it concerns activities that are highly specific to the organizational context or are commonly addressed by various means of information search.

## 3.2 STEP 2: INFORMATION REQUIREMENTS COVERAGE ASSESSMENT

This step aims to derive an information coverage map that provides a measure of the methodology suitability to represent the organizational elements needed to support the enterprise, or organizational, design process. The step does not prescribe any specific form for the information coverage map – for example, the map could be expressed as a table reporting the level (low, medium, high) for the information coverage in each of the individual steps in an organizational design process. In this book, the Burton's organizational design process is used – other enterprise engineering domains and design processes can be seamlessly assessed and integrated in this step. As example, the Burton's steps are individually analyzed with the objective of identifying the underlying information concepts that must be represented for the manager to be able to answers the Burton's checklists. As such the analysis does not intend to identify how the checklists should be answered, but rather which information concepts can support or facilitate the formulation of the answers for the checklists. The analysis should consider the concepts of[3]: i) entity (E); ii) relationship (among entities) (R); iii) attribute (of an entity) (A); iv) viewpoint (V); v) data input into the visual model (DI); vi) data extraction from the visual model (DE). For example, for step 2, topic environment, the following information requirements are identified:

- (E) Environment, Industry, Market, Organization, Exogenous Variable,
- (R) Variable Affects Environment, Variable Affects Market, Variable Affects Variable, Organization participate in Market, Market is part of Industry
- (A) Variables is Directly Observable, Variable is Controllable, Variable has Positive/ Negative Influence, Organization is Supplier, Organization is Customer, Environment Qualitative description, Variable Predictability

For all the steps, the information requirements can be summarized as follow:

- step 1) requires concepts that purely describe the current status quo of the enterprise;
- steps 2) to 5) require concepts that represent organizational elements ranging from external to internal to the organization, and ranging from high-level organizational unit down to individual employees;
- step 6) introduces the concepts for the quantification of the fit/misfit degree in the Burton's dimension. Step 6 also leverages on almost all the concepts required by the previous steps;
- step 7) requires concepts that mainly regard the domain of project and change management.

## 3.3 STEP 3: METHODOLOGIES RELATIVE POSITIONING

This step aims to provide the means for the graphical positioning of the individual visual methodologies over the range of possible choices available. Central to this step is the definition of a classification schema that can be used to structure the comparison of the existing visual methodologies. The classification analysis consists of: 1) identification of the classification factors – and, recursively, sub-factors – that can be used to distinguish and relatively position the visual methodologies; 2) definition of three managerial value-oriented concerns that allow a summarized and relative graphical positioning of the methodologies.

### 3.3.1 CLASSIFICATION FACTORS

Figure 3 shows the root of the classification schema, which consists of six factors: 1) scope – what the methodology definition includes; 2) use assistance – who/what can support the methodology use; 3) technological support – what/how can the visual model – i.e. artifacts developed with the visual methodology – be exploited; 4) language definition – technical characteristics of the visual language; 5) market coverage – with respect to users and suppliers; and, 6) licensing – the legal conditions required by the methodology. Each of these factors is further decomposed in sub-factors in order to provide more accurate guidelines in what needs to be assessed/measured. However, the definitions below purposely omit to specify how to evaluate the individual factors as these may not be quantifiable with commonly available or easily collectable data in any organizational context. However, most methodology evaluation are often based on a comparative assessment by an individual manager. As such, the most detailed sub-factors need not be formally and absolutely defined in the meta-process, but they need to be consistently identified within the scope of individual applications of the meta-process.

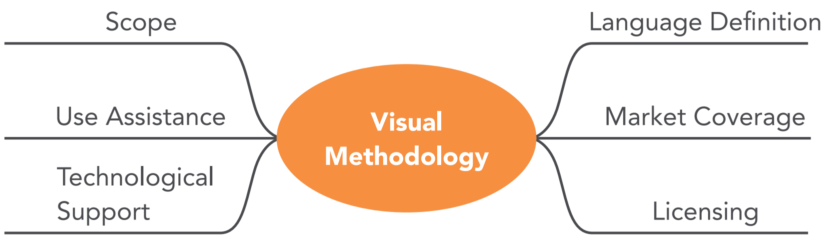



**Figure 3** Root Classification Factors

### 3.3.1.1 Scope

This factor concerns what the underlying methodology specification covers. As shown in Figure 4, the factor consists of three sub-factors: 1) modeling scope; 2) process scope; and 3) technical depth. Modeling scope responds to the question "what can be done?". The answer can be provided in terms of: a) the enterprise domain that the methodology is addressing; b) the extensiveness of the domain concepts covered; and c) the availability of model patterns for representations of common realities in the enterprise engineering. Process scope responds to the question "how can it be done?". The answer can be provided in terms of the three key lifecycle processes for a visual model: a) the governance process (i.e. how to administer the model); b) the modeling process (i.e. how to develop the model); and, c) the design process using the model (e.g. Burton's one for organizational design, etc.). Finally, technical depth responds to the question "how precise can it be done?". The answer can be formulated with respect to: a) the visual syntax – i.e. the graphical symbols and their composition rules; b) language semantics – i.e. the meaning of the individual symbols; and, c) storage format, which specifies the file format for storing the visual model.

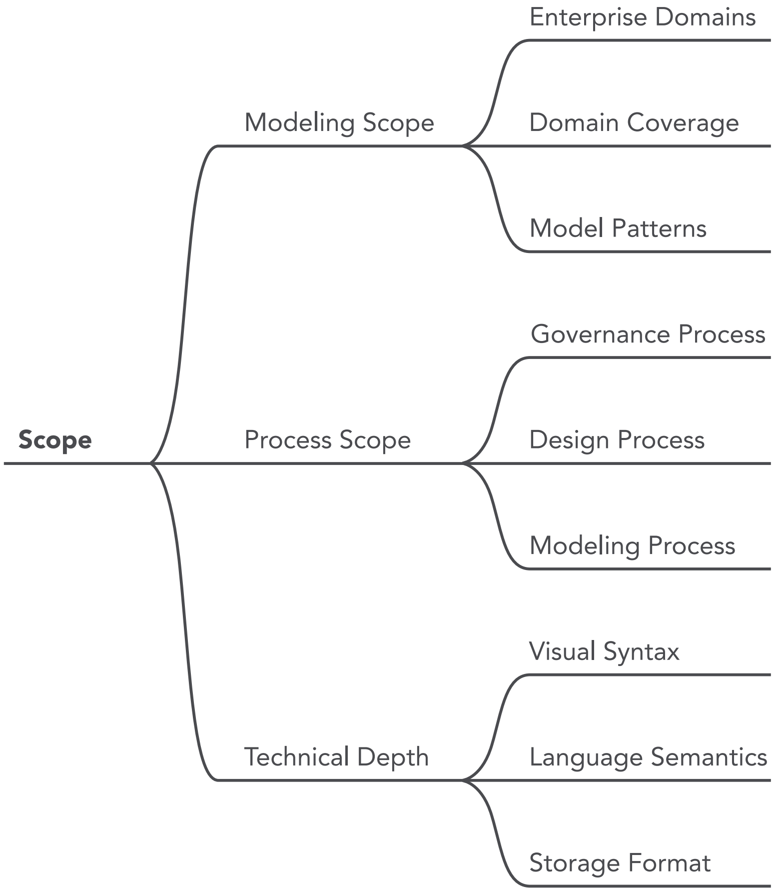



**Figure 4** Decomposition of Scope in Sub-Factors

#### 3.3.1.2 Use Assistance

This factor concerns the assistance that the organizational designers may be able to receive when using the visual methodology. As shown in Figure 5, this factor can be determined by the contribution of five sub-factors: 1) community of practice, which is inherently related to the characteristics of the user, developer, and supplier markets; 2) standard openness, which is the degree of access to the methodology specification so that the using organization can solve its problems in-house; 3) formal training and certification programs, which can offer assurance on training quality and employee skills; 4) documentation and recommended practices, which may directly guide the self-learning of the methodology; 5) model patterns, which can provide applicative examples asides from the documentation.

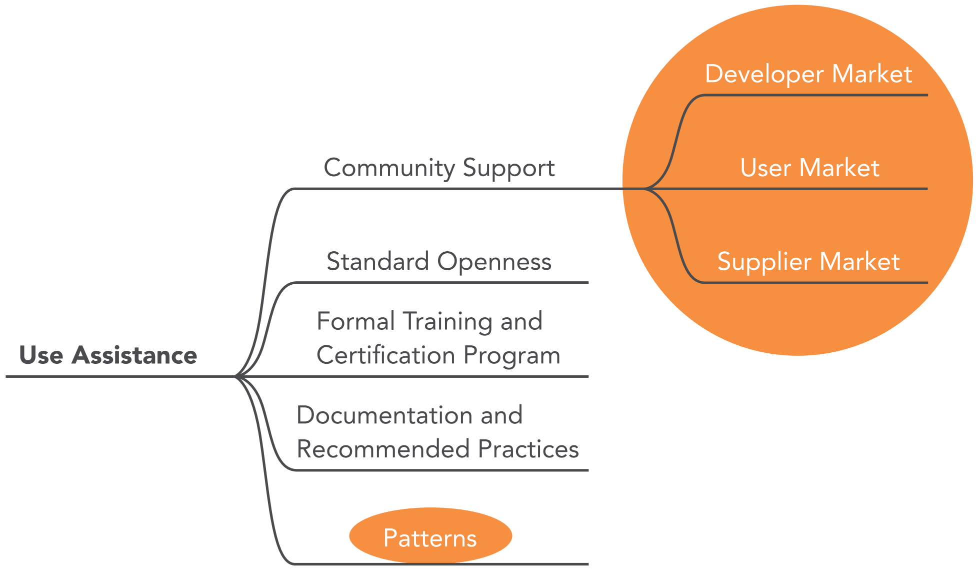
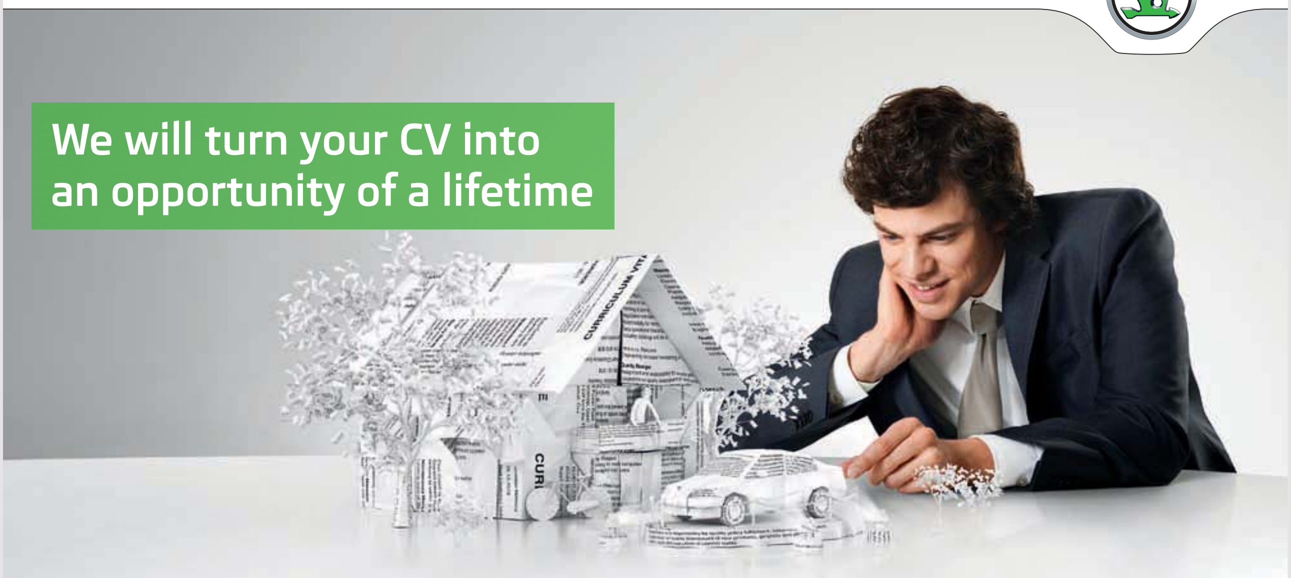



**Figure 5** Decomposition of Use Assistance in Sub-Factors – the White Circle Indicates that The Contained Elements are Shared with Other Factors or Sub-Factors in the Classification Schema

#### 3.3.1.3 Technological Support

This factor concerns the assistance that the organization could receive for creating and exploiting the artifacts developed with the visual methodology. As shown in Figure 6, this factor can be determined by the contribution of the sub-factors: 1) tool capabilities, i.e. what the existing tools – e.g. simulation tools, business reporting tools – are and how they can support the design activities; 2) tool and technology licensing, i.e. the legal restrictions that may constrain the use of the tools and of the technologies underlying the visual methodology; 3) integration with standard technologies, i.e. how conveniently the methodology's underlying technologies can be integrated with other commonly used technologies, such as the web ones; 4) the characteristics of the supplier market, which include both commercial supplier and community-led projects.

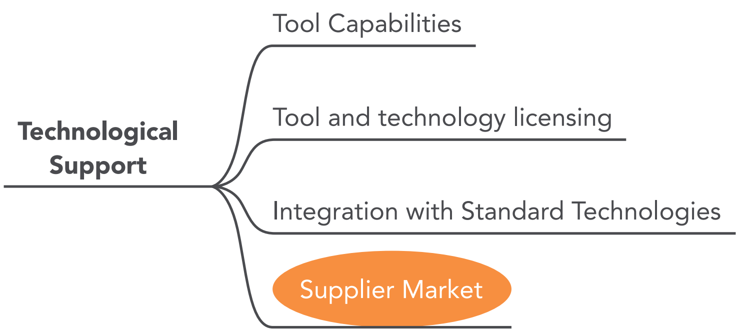



**Figure 6** Decomposition of Technological Support in Sub-Factors – the White Circle Indicates that the Contained Elements are Shared with Other Factors or Sub-Factors in the Classification Schema

#### 3.3.1.4 Language Definition

This factor concerns the intrinsic methodology characteristics that are related to the use of the visual language embedded in the visual methodology. As shown in Figure 7, this factor can be determined by the sub-factors: 1) usability, which quantifies how intuitive is to use the language for the organization users; 2) extensibility, which provides a measure on the degree of possible customization of the language symbols for specific purposes; 3) maturity level, which provides a measure of the stability and validity of the language specification from both technical and business perspectives – with the latter perspective to be formulated in terms of the supplier and user markets; and 4) formality level, which inherently provides a measure of the language ambiguity or risk of model misinterpretation with respect to the visual syntax and semantics.

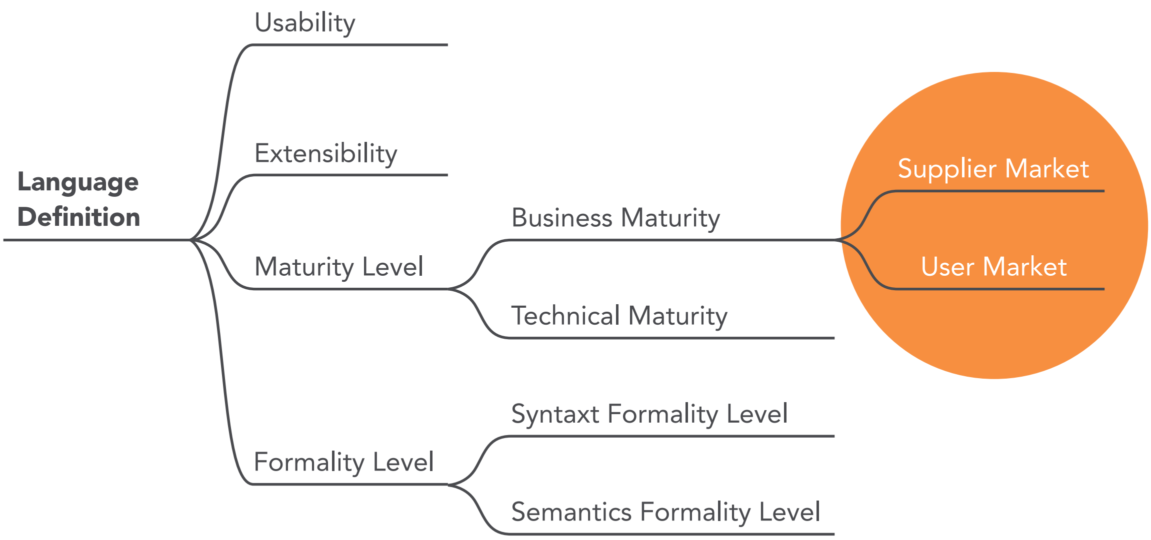



**Figure 7** Decomposition of Language Definition in Sub-Factors – the White Circle Indicates that the Contained Elements are Shared with Other Factors or Sub-Factors in the Classification Schema

### 3.3.1.5 Market Coverage

This factor concerns the characteristics of the markets related to the methodology ecosystem. As shown in Figure 8, this factor is determined by the sub-factors: 1) users market, which identifies the market covered by the community of practice; 2) developers market, which identifies the market of the developers of the methodology; and, 3) suppliers markets, which identified the market of the providers of information or tools for the methodology. These factors are all linked to the grey circle as each can be further described by: a) industry sectors in which the organizations operate; b) characteristics of the organizations; and, c) characteristics of the markets.

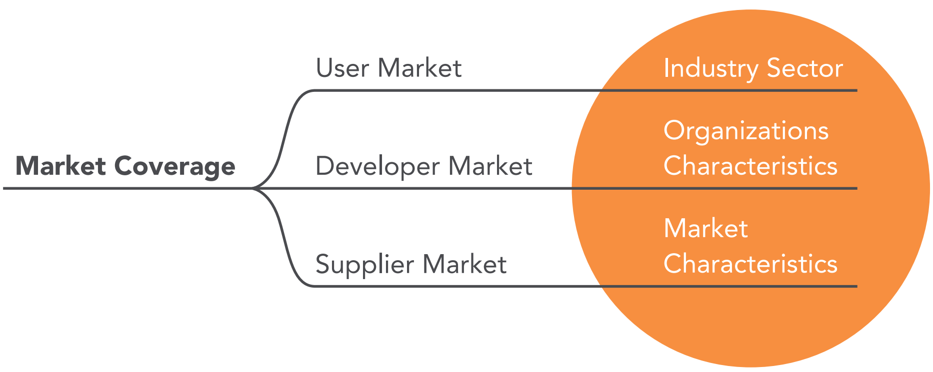



**Figure 8** Decomposition of Market Coverage in Sub-Factors – the Grey Circle Indicates that all its Content is to be Individually Associated to the Factors User Market, Developer Market, and Supplier Market

#### 3.3.1.6 Licensing

This factor concerns the legal aspects that regulate the use of the visual methodology. As legal expertise is needed to develop further this factor, no decomposition is offered at this stage.

All the above factors – including the sub-factors – can provide the means for the punctual positioning of the visual methodologies[4]. However, these factors individually may not effectively provide managerial insights as they can be too detailed and too numerous for a manager to highlight the relative positioning of the methodologies. The relative positioning is critical to 1) help the managers to visualize the key differences with respect to the managerial concerns; and, to 2) identify which of the factors should be further analyzed to accurately differentiate the methodologies. With the objective of providing the manager with a high-level view, the above factors are aggregated into the managerial concerns defined below.

### 3.3.2 MANAGERIAL CONCERNS

Regarding the visual methodologies, the managerial concerns are: value origin; value distribution over lifecycle processes – adoption, use, and maintenance; and, value scope. These concerns can be used to graphically represent the methodologies relative positioning in the diagrams of Figure 9.

The concern "value origin" considers whether the source of an advantage or disadvantage originates from an external aspect of the methodology definition or from an intrinsic aspect of the methodology itself. For this concern, the visual assessment can be plotted on a bi-dimensional diagram with two axes: internal value (derivable from the factors: scope and language definition) and external value (derivable from the factors: use assistance and technological support). Internal value provides a qualitative assessment of the intrinsic advantages that the methodology would bring. External value provides a qualitative assessment of the advantages that the methodology would indirectly bring through factors that are not intrinsic to the methodology definition. Consequently, this managerial concern also characterizes the fitness level of the methodology with the external organizational context.

The concern "value distribution over lifecycle" considers the aspects related to the assessment of the methodology with respect to the phases of the methodology lifecycle in the organization. In particular, three phases are distinguished: adoption – optional for its temporary nature and therefore omitted from the respective diagram in Figure 9; use; and, maintenance. Adoption provides a measure of the easiness in the acquisition and in starting to use the visual methodology. Use provides a measure of suitability of the visual methodology for organization design activities. As such, this concern should be assessed on the factors: modeling scope, design and modeling process, visual syntax, community support, documentation and recommended practices, model patterns, and tool capabilities, usability, maturity level, for example. Maintenance provides a measure of the evolvability of the methodology and of the adaptability with respect to the changing organizational needs. As such, this concern should be assessed on the factors: market coverage, extensibility, integration with standard technologies, and governance process.

The concern "value scope" considers the magnitude and nature of the advantages and disadvantages that could be conveyed by the methodology. In particular, the nature can be intrinsic to the methodology definition – therefore assessed on the factors: scope, standard openness, language definition, and model patterns – or can be related to the methodology's own eco-system – therefore assessed on the factors: community support, formal training and certification programs, documentation and recommended practices, and technological support.

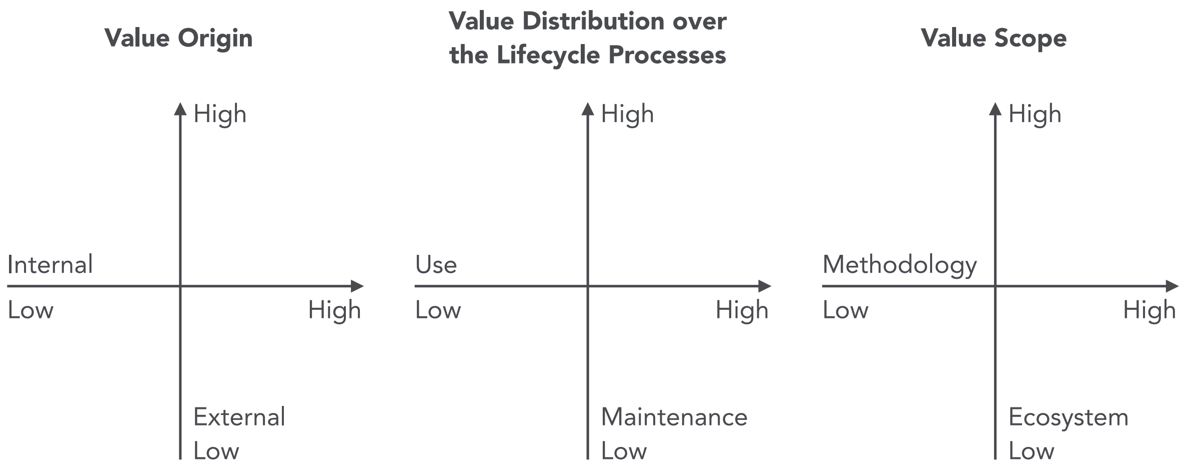



**Figure 9** Concern Diagrams for the Methodologies Relative Positioning

## 3.4 STEP 4: ORGANIZATIONAL FORCES ANALYSIS

This step aims to identify and assess the organizational forces that can influence the selection and use of the visual methodology. These forces can be driven by competition – eroding organizational value – or collaboration – contributing to sustain organizational value. Competitive forces originate from the external environment and are analyzed with the Porter's framework [42]. Differently, collaborative forces originate both from the internal and the external environment. These forces are identified and analyzed through the stakeholders of the visual methodology, including their power/interest and their responsibilities in the use of the methodology. For simplicity, the visual methodology is assumed to be applied within the boundary defined by the organizational perimeter – i.e. between the organization and the external environment. Consequently, minor amendments may be needed to the following analysis if a different boundary is considered (e.g. in the case of selection of visual methodology for a project or for an internal business unit only). Moreover, the analysis does not cover industry-specific aspects as these are to be analyzed for the industry in which the organization – selecting the methodology – is operating.

### 3.4.1 COMPETITIVE FORCES

Figure 10 shows the diagram that interlinks two instances of the Porter's framework to visualize the connection between the organization industry – in which the organization operates – and the visual methodology industry – in which the visual methodologies are offered and developed. This diagram is needed to avoid the pitfall of omitting the market of input from the strategic positioning [24]. Moreover, as these two industries can be interrelated, particularly for the defense and space sectors, it is critical to identify their interconnections to acquire a comprehensive view of the dependencies among the organization and other industry actors. However, the competitive force analysis only covers the visual methodology industry as the meta-process does not concern aspects that are specifically related to the organization operations industry. In the visual methodology industry, the distinction among the roles of supplier, customer, and industry player is fuzzier than in more conventional industries, for two reasons: 1) the non-exclusively competitive nature of the interactions among the industry actors; and, 2) the diverse roles that the industry actors play within the industry – e.g. simultaneously methodology contributor and supplier of tools. In addition, the force analysis adopts the following conventions: 1) the industry rivalry is considered only among the standardization organizations promoting the visual methodologies; 2) the suppliers can provide the IT tools and the intellectual input for the visual methodologies definition; 3) the customers can be actors from several industries, including from the organization operation industry; 4) there are practically no effective substitutes to the visual methodologies; 5) complements include tools and technologies that offer advanced capabilities such as data collection from IT infrastructure or business intelligence – model drawing and reporting are basic capabilities and therefore are incorporated in the industry rivalry. Upon on the above conventions, a synthetic industry analysis is formulated below, for the relevant forces of the Porter's framework.

#### 3.4.1.1 Industry Rivalry

Visual methodologies are available in large variety and are promoted by a similarly large number of standardization organizations – from industrial consortia to military agencies, and to individual academic research groups. However, the predominant visual methodologies can be clustered around two standardization organizations: the OMG and the Open Group.

Concerning the type of the costs (variable vs fixed), these are mainly fixed as the nature of the products (specifications) are in electronic format, which has very low reproduction costs (if any). With respect to the range of products and services, the industry is only centered on the visual methodologies. However, these methodologies are complemented with tools for artifacts development (e.g. model drawing) and exploitation (e.g. reporting, business analytics, etc.), to technologies for software generation (simulation or software derivation from models). Tools may not be directly produced by the players in the visual methodology industry. Finally, concerning the differentiation and strategy, the analysis needs to distinguish large and small players. Large players tend to 1) foster cross-domain standardization with the objective of providing a portfolio of integrated visual methodologies and visual languages that can support diverse functions within the customer organizations; 2) develop relationships with suppliers and leverage their power to further strengthen their customer base; 3) ensure the standard availability through open-source and commercial visual modeling tool; 4) introduce some elements of differentiation with respect to other large players (e.g. process definition to guide the organizational architecting activity, modeling guidelines, best practices, etc.). Small players tend to adopt differentiation strategies mainly based on the characteristics of the language embedded in the visual methodology (one of the above classification factors), offering tools under open source licenses (often the case of an actor competing on other markets, such as the one of resource funding) or commercial licenses (the case of an actor willing to enter the tool industry).

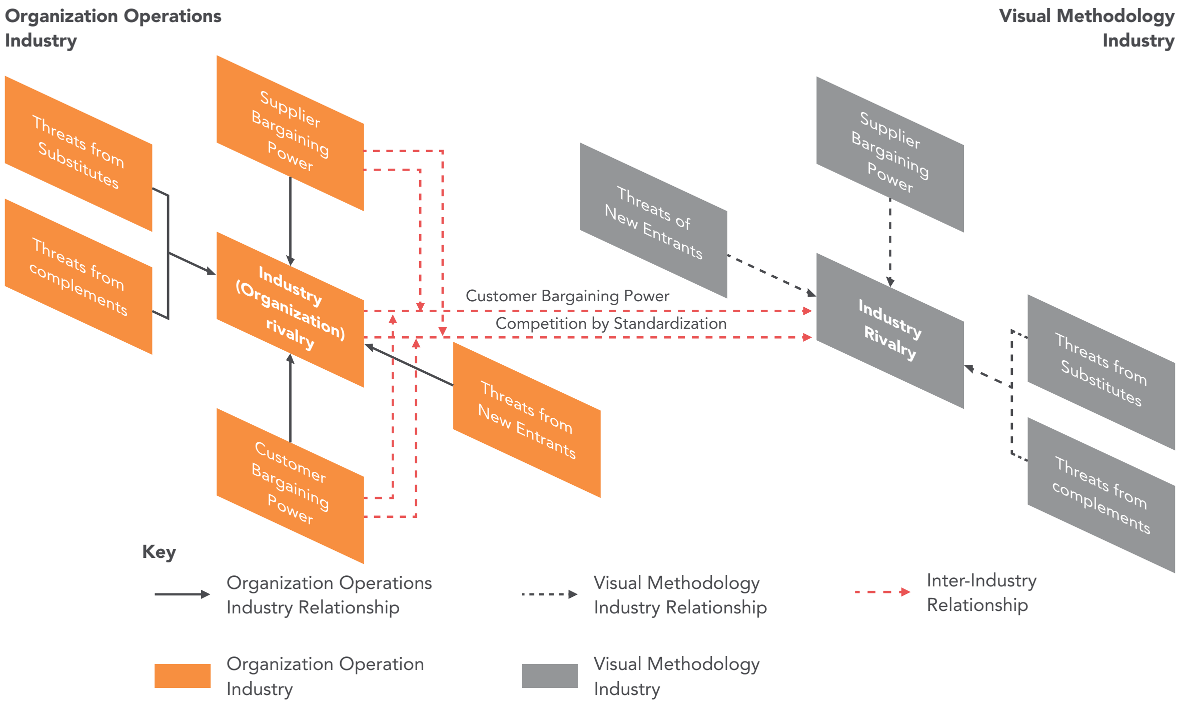



**Figure 10** Interlinked Two Porter's Frameworks for the Competitive Forces Analysis

#### 3.4.1.2 Supplier Bargaining Power

Suppliers are of two categories: 1) contributing organizations to the visual methodology standardization and 2) tool vendors. The contributing organizations are generally influential actors (academic or industrial) in their own industries (e.g. defense, space, automotive, banking). The contributing organizations are practically in control of the standardization processes, though they may still seek a democratic process. The tool vendors may play two roles as supplier and as customer (user) of the visual methodologies. However, the supplier role is more prominent than the customer one as the vendors provide the tools, which can be considered the product for the end consumers (e.g. organizations using the visual methodology for enterprise engineering). Concerning this latter type of suppliers, the current panorama resembles an oligopoly with four large tool suppliers (IBM, No Magic, Sparx, Artisan) with roughly homogeneous market share, and many small players often originating from university start-ups (e.g. Archi [43]) or research groups (e.g. DEMO [34]) [44].

#### 3.4.1.3 Threat of New Entrants

The industry is protected by the barriers of: 1) strong economy of scale; 2) brand value of existing industry players; 3) bargaining power of current players on the customers; and 4) established relationship between industry actor and existing suppliers.

#### 3.4.1.4 Threats from Complements

Theoretically, complements – in the form of software or software/hardware integration – may threaten existing industry actors. Practically, rather than threatening the entire industry, a complement may likely provide the opportunity for a new actor to contribute to one of the existing standardization organization, leveraging on the acquired power/relevance of the complement features and capabilities.

### 3.4.2 COLLABORATIVE FORCES

These forces aim to increase organizational value by leveraging on the visual methodologies features and capabilities. These forces are directly or indirectly sustained by the organization stakeholders, whom can be distinguished in 1) external stakeholders – e.g. regulators, certification agencies, owners/shareholders, partners, suppliers, and customers[5]; and, 2) internal stakeholders – employees (e.g., enterprise modeler, enterprise architect, IT staff, other employee) and managers. The stakeholder list has been derived from a harmonization of the

TOGAF's enterprise architecture roles with common organization roles. The force analysis develops in three steps: 1) the power/interest classification of these stakeholders for both the visual methodology selection and for the visual methodology use in the organizational (re-)design[6]; 2) the identification of stakeholders' needs and derivable value from the visual methodology; 3) the identification of the stakeholders' responsibilities for the possible activities using the visual methodology.

#### 3.4.2.1 Stakeholder power/interest classification

The classification covers two areas of influence/interest: the selection of the visual methodology (analyzed in Table 1) and the use of the visual methodology (analyzed in Table 3). The tables below are only intended to be initial guidelines for structuring the power/interest classification of the relevant stakeholders. Depending on the organizational context, the classification may need to be further expanded or amended.

| | | Interest | | |
|---|---|---|---|---|
| | | Low | Some | High |
| Power | High | - | CxO, Senior Manager | Manager of the EA Function |
| | Some | Regulators Owners/ Shareholders | Junior Manager | Enterprise Architect, Enterprise Modeler |
| | Low | Customers / Suppliers / Partner, Certification Agencies | HR manager, Other Employee, Customers Suppliers | IT Staff, Customers / Suppliers / Partner |

**Table 1** Stakeholder Power/Interest Map on the Selection of the Visual Methodology

In general, executive managers are primarily interested in the exploitation of the visual methodology for organizational activities. Conversely, technical managers and line employees are primarily concerned with the selection of the methodology that can best support them to satisfy the executives' needs. External stakeholders tend not to be directly involved in the use of the methodology, but they may have more interest and power on the methodology selection as they are primarily concerned with regulation compliance and with collaboration.

| | | Interest | | |
|---|---|---|---|---|
| | | Low | Some | High |
| Power | High | - | - | CxO, Senior Manager, Manager of the EA Function |
| | Some | - | Junior Manager | Enterprise Architect, Regulators, Owners/ Shareholders, Certification Agencies |
| | Low | Customers, Suppliers, Partners | IT Staff, Other Employee Customers, Suppliers, Partners | Enterprise Modeler, Customers, Suppliers, Partners |

**Table 2** Stakeholder Power/Interest map on the (Visual) Organization Architecture

In the above table, customers, suppliers, and partners have been included in multiple cells as these may respectively be positioned in multiple cells – in which case they should be further distinguished.

### 3.4.2.2 Stakeholders Needs and Value

Similarly to the above stakeholders classification, this section is only provided as initial guideline for further extension and amendment in the application of the meta-process. The list of needs and values is similarly based on the stakeholder template map introduced by TOGAF [17], which indicates the stakeholders' typical needs from enterprise engineering activities. Moreover, for each stakeholder, the value has been derived from the respective needs and from the common activities developed by the stakeholder. Table 3 shows the resulting needs and values for all the above identified stakeholders.

| Stakeholder | Needs | Value |
|---|---|---|
| CEO | Define business strategy, considering also the margins for its implementation | How enterprise architecture supports the business strategy and if there are any gaps. Support for enterprise transformation. |
| COO | Operational and strategy implementation concerns at architecture level | How enterprise architecture supports the business operations and if there is any margin for improvements/ rationalization. Support for enterprise transformation. |
| CIO | Define and verify IT strategy with respect to the business strategy | How IT supports the business drivers (presence of gaps).<br><br>How current IT can drive further the business strategy |
| CSO | Define and verify security policies and their relationship with the architecture | How the enterprise architecture satisfies the security policy, if any gap exists, or any improvement can be undertaken to increase quality or lower costs |
| CxO | Architectural concerns | Translation of high-level drivers into the enterprise architecture to advance the business |
| Manager | Verify/validate CxO options with respect to the as-is architecture. Oversee and execute transformation programs and projects | As respective CxO role, in addition to a more detailed level of details |
| Regulators / Certification Agencies | Verify compliance between model and organizational reality | Tracing documentation and policy on the enterprise processes and products |

| Stakeholder | Needs | Value |
|---|---|---|
| Owners / Shareholders | Understand how the organization is structured and how it operates | Overall view of the organization |
| Enterprise Architect | Propose enterprise architecture transformation plans | Map the as-is and to-be status of the organization. Present tentative transformation implementation to managers and governance board |
| Enterprise Modeler | Represent enterprise architecture in visual models and highlight inconsistencies | Map the as-is and to-be status of the organization. Support visual transformation of the enterprise architecture |
| IT Staff | Support the IT transformation of the architecture | Understand as-is and to-be enterprise architecture |
| HR Staff | Support organization development through human resource policies and training programs | Overall view of the available set of skills and their allocation on the organization units and functions |
| Customers/ Supplier/ Partners | (May need to) Access part of the enterprise architecture to evaluate impact of possible integrations | Understand how to integrate with the organization. Be reassured about the quality of services or products offered (at high level) |
| Other Employees | Be informed about the current status of the organization and of the planned/ongoing transformation | Visualize the as-is and to-be enterprise architecture. Identify own role and contribution to the enterprise transformation and to its strategy/operations. |

**Table 3** Stakeholder Needs and Expected Value from the Visual Methodology

### 3.4.2.3 Stakeholders Responsibilities (RASCI – Responsible, Accountable, Contributor, Support, Informed)

The responsibility identification finalizes the overall picture of the collaborative forces. With respect to the power/interest and needs/values, the responsibilities provide complementary information that combines the possible uses – in the form of organization design tasks – and the respective stakeholder responsibilities for these. Similarly to the previous collaboration point, two distinct groups of tasks are distinguished in: i) tasks concerning the management of the visual methodology during its lifecycle (detailed in Table 4); and, ii) tasks concerning the use of the visual methodology (detailed Table 5). These tables show that executives are accountable for the tasks that are directly linked to the generation of business values, whereas other stakeholders only support them in the implementation of the tasks. Moreover, when the tasks are not directly linked to value creation for the business, non-executive stakeholders are held accountable also for the tasks output aside from the task implementation.

| Tasks (from Burton's process) | Stakeholders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CxO | Manager | Regulators / Certification Agencies | Owners / Shareholders | Enterprise Architect | Enterprise Modeler | IT Staff | HR Staff | Other Employees | Customers / Suppliers / Partners |
| **Selection** | A | C | I | I | R | S | I | I | I | C |
| **Methodology Governance** | C | A | I | I | C | I | I | I | I | I |
| **Infrastructure Governance** | A | R | I | I | S | I | C | I | C | I |
| **Training** | I | C | I | I | C | C | R | A | R | I |
| **Data Entry** | S | S | I | S | A | R | C | I | C | I |
| **Data Exploitation** | I | A | I | I | R | S | I | I | I | I |

**Table 4** RASCI Matrix on the Tasks Related to the Management of the Visual Methodology – (R=Responsible, A=Accountable, C=Contributor, S=Support, I=Informed)

## 3.5 STEP 5: RISK ASSESSMENT AND MANAGEMENT

This step aims to i) assess the intrinsic risks underlying the use of the visual methodology; and, to ii) define countermeasure actions that can mitigate the failures associated to these risks. The step description is based on two non-restricting assumptions that are commonly satisfied in organizational contexts: i) the visual methodology is only used as information capability for enterprise engineering, and ii) the CEO is the sponsor for the selection of the visual methodology. In this book, these assumptions are only introduced to restrict the presentation scope of meta-process definition. Under these assumptions, the risk analysis is framed within the three dimensions – risk assessment, sources of failure, and risk management – of total risk management [45]. The risk analysis is developed in five steps: 1) identification of project sponsors' concerns – to drive the analysis from the business needs; 2) weighting of the methodology contribution to the sponsor concerns – to identify which features and capabilities are most critical from a business perspective; 3) identification of the possible causes that could hinder the benefits realization of the methodology use; 4) identification of the sources of failure from which the risks may originate; 5) risk mitigation and possible contingency activities – to support the methodology selection also from a risk sensitivity perspective which considers the cost/implementation feasibility of these activities.

| Tasks(from Burton's process) | Stakeholders | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CxO | Manager | Regulators / Certification Agencies | Owners / Shareholders | Enterprise Architect | Enterprise Modeler | IT Staff | HR Staff | Other Employees | Customers / Suppliers / Partners |
| **Analysis Scope** | A/R | A/R | - | I | C | I | I | I | I | I/- |
| **Strategy Description** | A | A/S | - | I | R | S | I | I | I/S | I/- |
| **Environment Description** | A/S | A/S | - | I | R | S | I | I | I | I/- |
| **Organization Configuration** | A/S | A/S | - | I | R | S | I/S | I | C | I/- |
| **New Organizational Form** | A/C | A/C | - | I | R | S | C | C | C | I/- |
| **Task Design** | A/S | A/S | I | I | R | S | S | C | C | I/- |
| **People** | A/S | A/S | I | I | R | S | I | C | I | I/- |
| **Leadership and Organizational Climate** | A/S | A/S | - | I | R | S | C | C | C | I/- |
| **Coordination, Control, and Information and Knowledge Systems** | A/S | A/S | - | I | R | S | C | C | C | I/- |
| **Incentives** | A/S | A/S | - | I | R | S | I | C | I | I/- |
| **Architecture Design** | A/C | A/C | - | I | R | C | I | C | I | I/- |
| **Sequence of Changes** | A/C | A/C | - | I | R | S | I | C | I | I/- |
| **Change Implementation** | A/C | A/C | - | I | S | S | S | S | S | I/- |

**Table 5** RASCI Matrix on the Tasks Related to the Use of the Visual Methodology – (R=Responsible, A=Accountable, C=Contributor, S=Support, I=Informed)

### 3.5.1 IDENTIFICATION OF THE SPONSOR'S CONCERNS

The CEO is assumed to be the sponsor of the visual methodology selection for the entire organization. However, other possible sponsors could be considered among the stakeholders identified in the previous sections – e.g. governance board, CIO, etc. – and their perspective can be seamlessly integrated in the rest of the risk analysis. In the Gartner's Common Requirements Vision [46], the two prominent activities that an enterprise architecture capability supports are "i) establishing a shared vision and ii) bringing all stakeholder groups behind that vision". These activities are central to the role of CEO, whom however may also be concerned with execution level issues. Table 6 provides a summary list of CEO's top concerns as elicited from recent surveys and research papers. No abstract insight can be derived from this table as these concerns may vary considerably depending on the overall socio-technical and economic environment. These concerns should only be considered as a starting point when applying the meta-process. A PESTEL (Political, Economic, Social, Technological, and Environmental) analysis may still need to be undertaken to identify further concerns in the organizational context and to validate the ones in Table 6. Nevertheless, the organizational context is also essential to prioritize these concerns depending on their business relevance.

| Concerns | References |
|---|---|
| Growth | [47][48][49] |
| Matching technology to type of growth needed | [47][48] |
| Talent management | [50][48][49] |
| Operating in Global Market Place | [50][47] |
| Regulation and Legislation | [50][48][49] |
| Work-life balance | [47] |
| Agility | [47][51] |
| Digitalization | [47] |
| Social and environment concerns | [47] |
| Making technology a competitive advantage | [47] |
| Continuous enhancing client service | [47] |
| Cyber Security | [47][49] |
| Mobile access | [53] |
| Dealing with complexity | [52] |
| Scale Leverage | [51] |
| Home New Business Models | [51][49] |

**Table 6** CEOs' Top Concerns from Recent Surveys and Literature

### 3.5.2 MATCHING VISUAL METHODOLOGY FEATURES AND CAPABILITIES TO CONCERNS

Visual methodologies may offer a rich set of features and capabilities that can enable the enterprise engineering activities. These features and capabilities can be distinguished in four types:

1. Representation of the existing enterprise or organizational elements;
2. Traceability from the entities and other relevant concepts from the external environment onto the enterprise architecture model;
3. Integration with enterprise architecture models from third-parties (e.g. customers, suppliers, business partners);
4. Data linking with the visual representation (e.g. parameterization of the model from the IT system usage and business intelligence analysis on the visual model).

Features and capabilities should be prioritized with regard to their business relevance against the above identified sponsors' concerns. Table 7 shows the detailed mapping between the concerns and the above types of features and capabilities. The table highlights that types 1 and 2 tend to be more relevant than types 3 and 4, for the identified concerns. However, should the available feature and capabilities be improved in the future, as research and practice progress, Table 7 may need to be updated.

| Concern | Features and Capabilities {Type=1,2,3, or 4} | Comments | Relevance |
|---|---|---|---|
| Growth | Visual representation of external environments, current products and market segments {1,2,4} | Identification of strategic positioning within the range of market opportunities though customer preference trends | High |
| Matching technology to type of growth needed | Only traceability between the desired enteprise architecture and the supporting technologies {1,2,3} | Integration of the description of the organization architecture with the IT architecture<br>Technology as part of the business is not covered | Medium |
| Talent management | Representation of current personnel and of their skills set. Identification of skill gap for current and future organization {1,2} | (see left box) | High |

| Concern | Features and Capabilities {Type=1,2,3, or 4} | Comments | Relevance |
|---|---|---|---|
| Operating in Global Market Place | Representation of the external environments, current products and market segments, including also geographical partitioning. Identification of the enterprise architecture and the integration among the several locations {1,2,3} | Missing intangible cultural insight on the "way" of doing business, on the regional economic trends, etc. | Medium |
| Regulation and Legislation | Traceability of the regulatory requirements on the entire enterprise architecture model {1,2} | (see left box) | High |
| Work-life balance | NA | NA | Not supported |
| Agility | Representation of the as-is enterprise architecture {1} | Change management and development of a dynamic capability is outside the scope of the enterprise architecture function | Medium |
| Digitalization | Representation of the tasks and processes (manual and automatic) {1} | Supports the identification of automatable tasks. It does not contribute to the definition of new digital models, but it may be helpful in their implementation | Medium |
| Social and environment concerns | Traceability of safety and quality requirements on the quality control processes in the enterprise {1,2} | Customer sensitivity to social and environmental issues as well as other intangible aspects are not captured | Medium |
| Making technology a competitive advantage | Business intelligence data input/data extraction into/from the enterprise architecture {1,4} | It provides only a way to organize organization data and further tools and methods are needed to collect and exploit these data for business intelligence purposes | Medium/ Low |

| Concern | Features and Capabilities {Type=1,2,3, or 4} | Comments | Relevance |
|---|---|---|---|
| Continuous enhancing client service | Traceability from services and products to organizational elements; {1,2}<br>Integration with partner's EA models {1,2,3} | Visualizing the process supporting the services. Though, trends in customer preferences are not represented | High |
| Cyber Security | Representation of the enterprise architecture security properties applied to human and IT systems. {1,2} | Basic elements to support overall security analysis. Further tools and methods may need to be used to punctually assess the security levels | Medium |
| Mobile access | Traceability from customers to services and products used and then to enterprise architecture elements. {1,2} | Visualizing the organizational elements involved in the process and services consumed by the customers/ suppliers for whom mobile access is required | Medium |
| Dealing with complexity | Structured visual representation of the entire enterprise architecture. {1} | Unambiguous and easily understandable visualization of the enterprise. Further business intelligence tools may be required for more insights | Medium |
| Scale Leverage | As above | Visualization can support the identification of organization design | Medium |
| Home New Business Models | As above | As above | Medium |

**Table 7** Matching Features and Capabilities to the Prioritized Concerns

Asides from the top-down derivation of the enterprise architecture capability, bottom-up questions may complement and verify the content of Table 7, when applying the meta-process. For example, questions such as [54]:

- "What is the primary purpose of EA in this organization?"
- "What is the interplay between EA, Strategy and Portfolio Management? How well do we understand the current business? What new processes and responsibilities

need to be established in order to create a future-oriented high-level business system design?"
- "How will this EA content be used to initiate, govern and enable project delivery?
- "What can other practices contribute to the development and management of EA?"

### 3.5.3 FAILURES UNDERMINING THE BENEFITS REALIZATION

After having prioritized the visual methodology features and capabilities, the risk assessment proceeds with the identification of the failures – organizational, external, technical, and human – and the causes that could undermine the benefit realization for the features and capabilities. For the sake of conciseness, this analysis only addresses the types of features and capabilities defined above. For these types, the possible failures are identified in Table 8. This table highlights that: organizational and human failures are mainly related to project management and change management activities; external failures and technical are mainly related to failures of the methodology's ecosystem or misalignment with the organizational needs. From Table 8, the possible causes are identified and respectively listed in Table 9. Table 9 can then be used to derive the possible risks[7]:

1. Inability to effectively use the visual methodology,
2. Reluctance to cooperate and share data,
3. Unawareness of hidden costs for model interoperability and integration,
4. Loss of power/relevance in standardization activities,
5. Loss of popularity/support of the visual methodology,
6. Lack of investment from IT suppliers,
7. Conflicting interest in standardization activities,
8. Skill identification and enhancement.

| Type of Feature or Capability | Organizational Failures | External Failures | Technical Failures | Human Failures |
|---|---|---|---|---|
| Enterprise representation | Lack of collaboration in the representation of the enterprise EA artifacts remain obscure to non-EA staff | Inability to steer the EA standard meta-model to suit the organizational needs | Inadequacy of the meta-model to represent the enterprise aspects Inability to customize the EA meta-model | Lack of skills or understanding of the use of the visual methodology |

| Type of Feature or Capability | Organizational Failures | External Failures | Technical Failures | Human Failures |
|---|---|---|---|---|
| Elements Traceability | Lack of collaboration in the representation of the enterprise | As above | Inadequacy of the meta-model to represent and to visualize these relationships | As above |
| Model Integration | Lack resource allocation for model conversion<br>Sub-optimal selection of the visual methodology | Lack of documentation and software support for the editing and conversion of the model<br>Instability of the EA meta-model specification | Lack of interoperability of the media formats of the visual model<br>Lack of semantic compatibility and convertibility between the meta-models (information loss) | Lack of skills or understanding on how to covert one model into another format<br>Lack of motivation in performing highly technical and routing conversion tasks |

| Type of Feature or Capability | Organizational Failures | External Failures | Technical Failures | Human Failures |
|---|---|---|---|---|
| Data input and exploitation | Lack of collaboration in the representation of the enterprise<br>Breaches of organizational privacy policy | Lack of availability of third-party tools that integrate data input and exploitation functions with the EA model | Difficulties to match the EA model to systems for the collection of performance measures<br>Difficulties to derive meaningful and relevant data from the EA model | Difficulties to understand how to link the EA model to performance metrics<br>Lack of skills in the use of the tools for business intelligence on the organization architecture model |

**Table 8** Identification of Possible Failures for

| Type of Feature or Capability | Organizational Failures | External Failures | Technical Failures | Human Failures |
|---|---|---|---|---|
| Enterprise representation | **All staff**: Visual methodology unintuitive, too complex, not understood or requiring to share personal data | **Competitors**: acquiring prominent roles in standardization boards | **External stakeholders**: conflicting standardization interest or low maturity of specifications; lack of use of standard technologies for the meta-model definition; lack of domain/industry-specific focus | **External stakeholders**: lack of formal documentation, training programs, and certification<br>Human resources: training budget and programs |
| Elements Traceability | As above | As above | As above | As above |

| Type of Feature or Capability | Organizational Failures | External Failures | Technical Failures | Human Failures |
|---|---|---|---|---|
| Model Integration | **Decision makers**: not aware of the costs/effort involved in the model conversion Customer, Supplier, Business Partner: requiring different model | **Competitors**: increase popularity of other languages, shrinking the current community **External stakeholders**: conflicting standardization interest or low maturity of specifications | As above | **External stakeholders**: conflicting standardization interest or low maturity of specifications; lack of use of standard technologies for the meta-model definition; lack of domain/industry-specific focus Human resources: lack of IT service staff |
| Data input and exploitation | As in "Enterprise Representation" Staff in EA function violating privacy regulation | **IT Suppliers**: decide not to invest in technology integration due to more prominent role of other standards | As above | **External stakeholders**: conflicting standardization interest or low maturity of specifications; lack of use of standard technologies for the meta-model definition; lack of domain/industry-specific focus **Human resources**: training budget and programs |

**Table 9** Identification of Possible Causes Leading to the Above Failures – Each Cell Contains the Causes for the Failures in the Respective Cell in Table 8

### 3.5.4 RISK MITIGATION AND CONTINGENCY ACTIVITIES

Finally, once the risks are assessed, countermeasures can be defined to reduce the likelihood of risk occurrence – mitigation activities – and to minimize the impact after the risk occurred – contingency activities. Table 10 shows an initial list that is purposely not intended to be fully extensive as it only covers activities that can be commonly implemented within any organizational context. Furthermore, the actual cost/effectiveness and feasibility should be assessed against the organizational context.

Overall, the mitigation activities aim to ensure the preparation of the employee skills and of the employee collaboration in the organizational design activities. Conversely, the contingency activities aim to allocate internal budget to maintain technical compatibility with solutions offered by other methodologies.

| Risk | Mitigation Activity | Contingency Activity |
|---|---|---|
| Inability to effectively use the visual methodology | Develop training, develop alternative user friendly data input interfaces | - |
| Reluctance to cooperate and share data | Ensure confidential access to the enterprise model, similarly to other analogous organization documents. Communicate this directive widely in the organization | - |
| Unawareness of hidden costs for model interoperability and integration | Involve technical staff in accurate estimations of effort, time, and costs for the development of IT solutions | - |
| Loss of power/ relevance in standardization activities | Align with a coalition | Reassess the methodology selection process and consider the adoption of an alternative visual methodology |
| Loss of popularity/ support of the visual methodology | Develop a community of practice through customers, partners, and suppliers | Invest on internal IT capabilities for model exploitation and/or model conversion to other visual methodologies |
| Lack of investment from IT suppliers | Develop a community of practice through customers, partners, and suppliers | Invest on internal IT capabilities for model exploitation and/or model conversion to other visual methodologies |

| Risk | Mitigation Activity | Contingency Activity |
|---|---|---|
| Conflicting interest in standardization activities | If participating in standardization boards: form a coalition in the standardization board. | If not participating in standardization boards: 1) Invest in highly reconfigurable conversion capabilities towards other EA methodologies; and/or 2) reassess the methodology selection |
| Skill identification and enhancement | Consult with experts in the community or practice<br>Develop training programs | Recruit expert staff |

**Table 10** Possible Risk Mitigation and Contingency Activities

## 3.6 STEP 6: TRADE-OFF ANALYSIS AND FORMULATION OF RECOMMENDATIONS

This step concludes the meta-process definition with the trade-off analysis and the formulation of the recommendations for the methodology selection. Concerning the trade-off analysis, this step does not prescribe any single or multi-criteria decision method or framework as the manager should have the option to select the most suitable one for the specific organizational context, decision factors, and time for the overall scope of the evaluation. Concerning the recommendation, this should not only be formulated on the results of the trade-off analysis but also on the overall understanding of the information items produced in the application of the meta-process. Some decision factors may be of subjective nature and therefore may require an interpretation beyond the numerical values that are used in a trade-off analysis. For completeness of presentation, a quantitative (yet subjective) trade-off analysis and a recommendation are presented for a simple application example below. The example also present the derivation of the meta-process' information items from the organizational context.

# 4 EXAMPLE OF META-PROCESS APPLICATION

The example is structured in two parts: i) the description of the organizational context, and ii) the application of the meta-process, step by step. As the example is for illustrative purposes only, it primarily focuses on the description of how to use the meta-process definition in an example organizational context. In particular, the example does not rely on empirical quantifications of the decision factors as these quantifications are beyond the scope of this book. Moreover, such empirical quantification may be not fully justified from a business perspective for two reasons: 1) market data may not be easily available; and, 2) organizational forces may be inherently unquantifiable. ***A caveat:*** the meta-process application relies on several assumptions – e.g. information requirements assessment is only based on the concept or trade-off criteria are fully independent. These assumptions are introduced only for conciseness purposes and are discussed below where introduced as they are not a limitation to the meta-process but only a simplification in the presentation of the example.

## 4.1 ORGANIZATIONAL CONTEXT

The organizational context is the fictive selection of a common format for international and EU organizations, which receive inter-governmental funding to provide in-house expertise to coordinate policy implementation with the support of scientific communities, industrial partners, and other international organizations (when needed), to design and delivery products and services – later referred as core activities – related to the organization domain, which can range from space to defense, from environment monitoring to IT networking security, for example. Particularly, the context can be described from a business perspective – covering aspects such as influence/power and business inter-relationships among stakeholders – and from a technological perspective – covering the technology aspects of the available methodologies and of the stakeholder preferences.

From the business perspective, the context consists of: 1) one international or EU organization, which acts as managerial and technical facilitator between policy makers, on one side, and the policy implementers, on the other side; 2) one designated manager charged with the evaluation of visual methodologies to formulate a recommendation to the governance board; 3) a number of equally powerful yet cooperating partners who collaborate with the organization in the implementation of the core activities; 4) three prime industrial suppliers that develop and coordinate key parts of the systems supporting the core activities; 5) one-two dozens of minor industrial suppliers that implement individual sub-systems through the prime suppliers; 6) three groups of customers: funders, other international organizations, and end users of the services and products delivered. Furthermore, the organization is already provided with IT capabilities and is already using visual methodologies for the engineering activities supporting the core activities.

Differently, from the technological perspective, the organizational context is mostly summarized by the background section of the visual methodologies and related technologies. Three additional details are: 1) the organization already employs the OMG's visual methodology for the design and delivery of the organizational products and services; 2) similarly, suppliers are involved in engineering activities and use the OMG's visual methodology; 3) customers are mainly involved in business-level activities and tend to prefer the Open Group's visual methodology, though customers have less established practices and tend to be more fragmented in size, scope, and role.

Within this context, the organization may need to evolve and adapt to several changes of the socio-political and economical environment. For example, the organization may be assigned a different role by the executive arms of the countries or communities within which jurisdiction the organization operates; or the organization may need to implement new products and services demanded by the end-user communities or by the funders; or simply, the organization may need to adapt in response to changes in the funding availability.

## 4.2 INFORMATION REQUIREMENTS COVERAGE ASSESSMENT

Table 11 shows the summary results coverage assessment of the information requirements identified in section 4.2. Below, the following coverage values are conventionally defined: 1) complete (full coverage of entities); 2) very good (missing 1–4 entities); 3) partial (missing from 5 to 10 entities); 4) limited (missing more than 10 entities). The evaluation relies on the following assumptions: 1) an entity is considered to be available if a more abstract entity is available in the standard (e.g. university is considered available if the concept organization is available as an attribute can be easily introduced to distinguish a university from a different type of organization); 2) attributes, relationships, or viewpoints are not considered as they may be introduced with relatively minimal effort with full compliance to the standards, thus without significantly affecting interoperability or integration with standard models; 3) OMG coverage inherently considers the integration of the family of existing specifications, such as BMM or VDML, with UPDM.

| Question Set from Burton's Process | Relevance to the Organizational Context | OMG | Open Group |
|---|---|---|---|
| | | Coverage | Coverage |
| Getting Started | High | Very Good | Complete |
| Strategy Description | High | Partial | Very Good |
| Environment Description | Medium | Partial | Very Good |
| Firm Configuration | Medium | Partial | Complete |
| New Organizational Forms | Medium | Complete | Complete |
| Task Design | High | Complete | Complete |
| People | Medium | Complete | Complete |
| Leadership and Organizational Climate | Medium | Very Good | Very Good |
| Coordination, Control, IS and KS | Medium | Very Good | Complete |
| Incentives | Low | Very Good | Very Good |
| Architecture Design | High | Complete | Complete |
| Architecture Implementation | High | Very Good | Complete |

**Table 11** Information Coverage Evaluation

Both methodologies present a high level of compliance with the information requirements, though they both lack coverage on concepts related to the market description and to the incentive schemas. Overall, the Open Group presents a higher level of information coverage, especially on the most relevant question sets for the organizational context. This difference can be captured by the quantitative measure of the number of fully completely covered question sets: 4, for the Open Group, and, 2 for the OMG.

## 4.3 METHODOLOGY RELATIVE POSITIONING

The section "Background" provides sufficient details for the relative positioning of the OMG's and Open Group's visual methodologies with respect to the three managerial concerns of value origin, value distribution over the lifecycle processes, and value scope. Although a fully detailed classification using the above schema may prove useful, the classification is omitted in favor of the approximated concern diagrams of Figure 11. These diagrams already provide some visual insights on the key differences between the OMG's and the Open Group's visual methodologies. In particular, the OMG's methodology appears to leverage more effectively on the respective ecosystem, whereas the Open Group's one appears to bring more value in respect of the methodology itself. Implicitly, this positioning is also confirmed by a) the description of the organizational context – in which the organization already performs enterprise architecting or system modeling activities for the products and services to be delivered; and by b) the above information requirements coverage assessment – which highlights the higher relevance of the Open Group methodology.

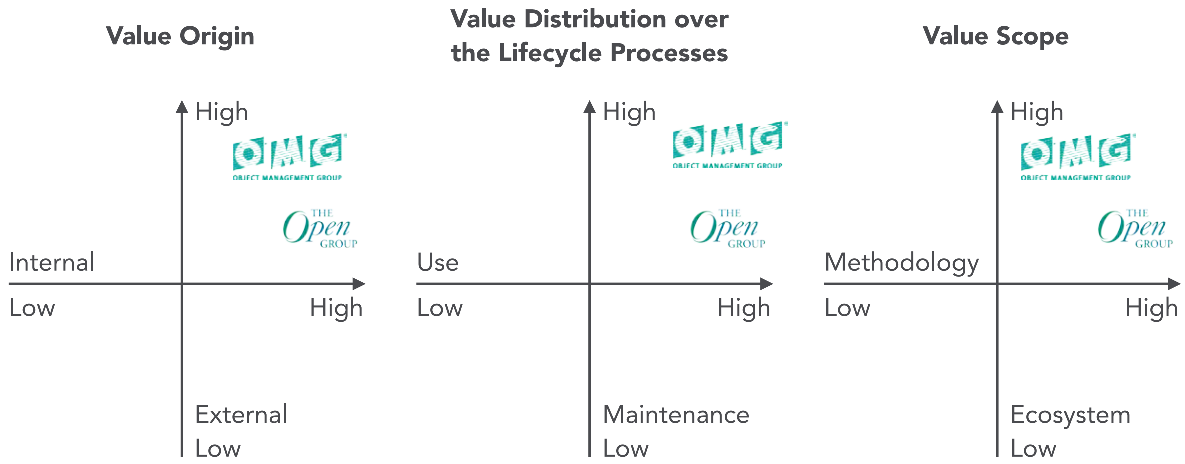



**Figure 11** Concern Diagrams for the Methodologies Relative Positioning[8]

## 4.4 ORGANIZATIONAL FORCES ANALYSIS

The assessment of the competitive forces is shown in Figure 12, which represents the instantiation of the interlinked Porter's framework for the above organizational context. The figure also indicates a subjective power quantification of the individual forces. In the organizational context, there is practically no industry rivalry as the organizational scope and goals are mandated by governmental authorities, which (as funders and customers) have also a high level of bargaining power on the organization. However, two other types of customers should be considered: other similar organizations – these have medium bargaining power as they could indirectly leverage the governmental authorities – and end-users – with medium/low bargaining power. Similarly, the limited number of prime contractors, as well as the required EU or international regulations to work with the organization (e.g. accreditation, geographical funding return criteria, etc.), also elevate their bargaining power to a high level. Threats from substitutes are low as the organization is assigned a unique scope and role within the industry, implying no alternative or complementary products or services that can practically impact its position, unless unexpected major yet unlikely systemic causes trig them.

The assessment of the collaborative forces is derived and adapted from the meta-process guidelines of Table 1 to Table 5, as described in Table 12. A more detailed analysis may further distinguish customers in several categories, such as end user or other international organization, for example.

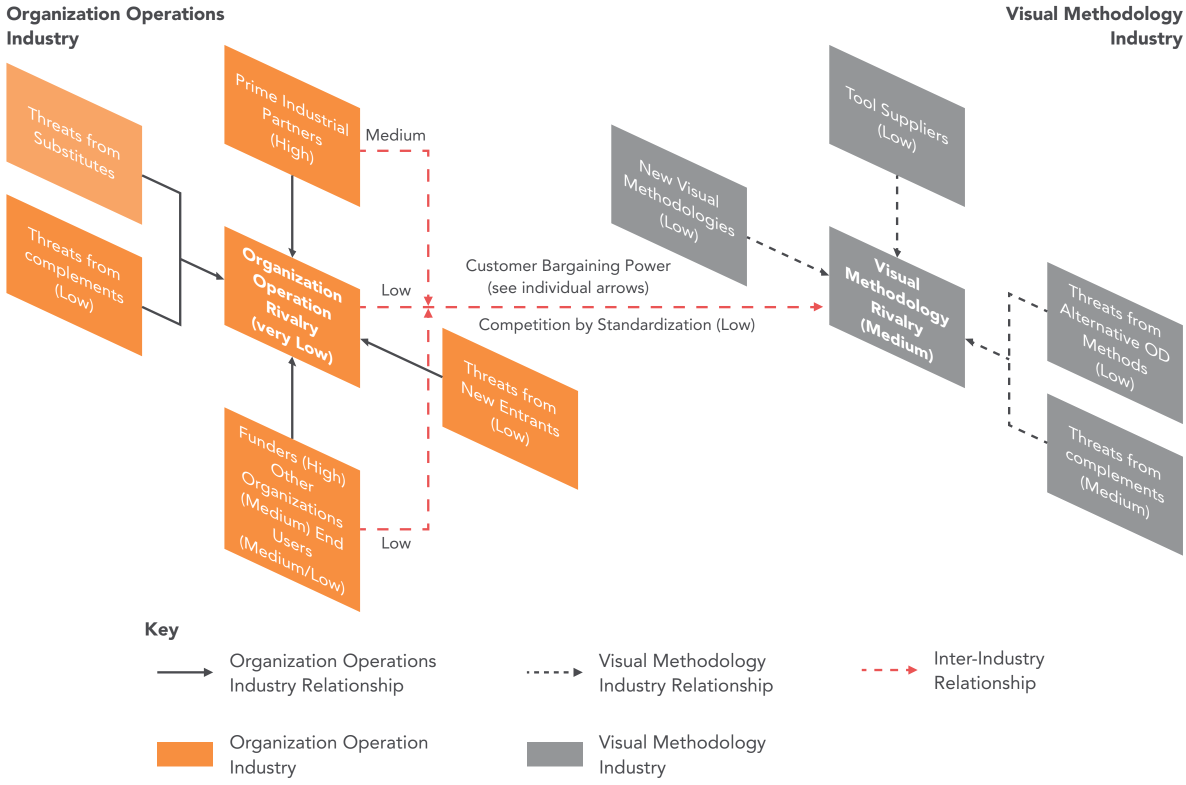



**Figure 12** Competitive Forces Identification and Bargaining Power Assessment

| Table | Tailoring to be applied the table |
|---|---|
| **Table 1** | Customer(s) is only in low(power)/some(interest); supplier is only in some(power)/some(interest) |
| **Table 2** | Funder is in medium(power)/medium(interest), other customers are in low(power)/low(interest), and suppliers are only in low(power)/medium (interest) |
| **Table 3** | Owner and regulator roles are to be joined in the customer funder |
| **Table 4** | Unchanged |
| **Table 5** | Unchanged |

**Table 12** Tailoring of the Meta-Process Guidelines for the Assessment of Collaborative Forces

## 4.5 RISK ASSESSMENT AND MANAGEMENT

This step can be tailored to the organizational context by: a) selecting and prioritizing the sponsor's concerns; b) pondering methodologies risks with respect to these concerns and to the business priorities; and, c) assessing the feasibility and convenience of the risk mitigation and contingency actions with respect to the organizational context.

*Identification of the Sponsor's Concerns.* In the organizational context, the project sponsor is presumably the governance board – acting on a similar role to the CEO, who needs to respond to the funder regarding two aspects: 1) compliance to regulations and 2) efficient use of public funds. Consequently, the first aspect can give origin to the concerns "regulation and legislation" and to "social and environment concerns" and "work-life balance". Differently, the second aspect can give origin to the concerns "talent management", "Agility", "digitalization", "continuous enhancing client service", "dealing with complexity", and "scale leverage". The remaining concerns are of low relative interest and are therefore omitted from the evaluation.

*Matching Features and Capabilities to the Concerns.* Table 7 is sufficiently general to be used as a starting point. Specifically, the matching can be simply defined by selecting only the relevant rows for the identified sponsor' concerns.

*Failures Identification.* Table 8 and Table 9 can be taken as starting points as they already offer a comprehensive list of failures. Table 13 shows the context-specific assessment results for the above selected features and capabilities. To reduce evaluation biases, the assessment is comparative, i.e. it identifies the relative likelihood of failure, for example: much greater (>>), greater (>), or approximately similar (=). The results can be intuitively justified by four observations on the organizational context: 1) in-house expertise on the OMG methodology as they are use these methodologies already for the core activities; 2) higher business-orientation of the Open Group with respect to OMG; 3) wider set of available tools and technologies for the OMG methodology; 4) higher degree of standardization of the file formats to electronically represent the visual models.

| Feature or Capability | Organizational Failures | External Failures | Technical Failures | Human Failures |
|---|---|---|---|---|
| Enterprise representation | OMG>>OG | OMG=OG | OMG<OG | OMG<OG |
| Elements Traceability | OMG<OG | OMG=OG | OMG>OG | OMG<OG |
| Model Integration | OMG=OG | OMG=OG | OMG<<OG | OMG=OG |
| Data input and exploitation | OMG<OG | OMG<<OG | OMG>OG | OMG=OG |

**Table 13** Failure Likelihood (derived from Table 8 and Table 9).
(OMG = Object Management Group; OG = The Open Group)

*Risk Mitigation and Contingency Activities*. Table 14 shows the relevant risks selected from Table 10. Table 14 also provides a comparative assessment on the cost/implementation easiness or feasibility of the mitigation and contingency actions. The comparative assessment is expressed in terms of the symbols: >> (much greater), > (greater), and = (equal). The assessment results can be intuitively justified by the same observations in the above failure identification, and by the larger community of practice of the OMG methodology.

| Risk | Mitigation | Contingency |
|---|---|---|
| Unable to use the visual methodology | OMG=OG | - |
| Reluctance to cooperate and share data | OMG>OG | - |
| Unawareness of hidden costs for model interoperability and integration | OMG>OG | - |
| Loss of power/relevance in standardization activities | OMG=OG | OMG=OG |
| Loss of popularity/support of the visual methodology | OMG>OG | OMG>OG |
| Lack of investment from IT suppliers | OMG>OG | OMG>OG |
| Conflicting interest in standardization activities | OMG>OG | OMG>OG |
| Skill identification and enhancement | OMG=OG | OMG=OG |

**Table 14** Relative Feasibility of the Risk Mitigation and Contingency for the OMG's and the Open Group's (OG) methodologies

## 4.6 TRADE-OFF ANALYSIS AND FORMULATION OF RECOMMENDATIONS

The meta-process does not prescribe any decision method or framework for the trade-off analysis. The example adopts the framework introduced in [55], which has been specifically designed on the basis of practical experiences and applied research results. This framework has been selected as it offers a coherent balance of theoretical/practical details with respect to the meta-process definition and to the organizational context considered. The framework consists of eight components – from the problem definition to the decision – and provides some guidelines on the selection of the decision rule.

*Component 1: Problem definition*. The manager needs to select a visual methodology for organizational design. Interests of internal and external stakeholders may conflict or only differ. Moreover, the selection may not be fully reversible or convertible to a different visual methodology unless further investments are undertaken. However, in this example, all costs are omitted from the analysis as the costs can be reasonably assumed to be identical for each of the possible alternatives.

*Component 2: Alternatives*. Two alternatives are considered: the OMG's visual methodology or the Open Group's visual methodology. As mentioned in the section "Background", the evaluation does not punctually considered the individual standards, languages, and methods that compose the respective ecosystems. Within each ecosystem, integrateability and interoperability are by default designed-in for any sub-part composing a visual methodology.

*Component 3: Criteria*. Example decision criteria can be identified from the organizational context and from the information items developed in the meta-process application. The following criteria are considered: internal stakeholders satisfaction – from Table 12; external stakeholder satisfaction[9] – from Figure 12; information coverage – from Table 11; the overall value – as combination of the diagrams in Figure 11; and risk – as combination of risk likelihood in Table 13 and easiness/feasibility of risk mitigation/contingency in Table 14. Within the organizational context, the criteria's attributes – directional, conciseness, completeness, and clearness – can be defined as follows:

- Directional: the preference is to achieve the highest value for each of the above criteria, except for risk which is to be minimized.
- Conciseness and completeness: these can be reasonably assumed to be the minimum set of criteria, providing a negligible or identical cost for the adoption and use of the two visual methodologies.
- Clearness: the criteria can be measure as follows:

- External stakeholder satisfaction: bargaining power-weighted degree of the alignment between the selected methodology and the methodology adopted by the individual classes of external stakeholders in Figure 12;
- Internal stakeholder satisfaction: degree of methodology alignment with internally used visual methodologies;
- Information coverage: an overall weighted measure of the average information coverage as identified in Table 11, with respect to the business relevance;
- Overall value: a quantitative (ordinal and subjective) measure of the value that can be originated from the visual methodology, from Figure 11.
- Risk: a quantitative (ordinal and subjective) measure of the risk exposure, starting from Table 13 and Table 14.

*Component 4 and 5: Evaluation and Decision Matrix*. The criteria evaluation consists in the assignment of a maximum of 10 points for both alternatives, i.e. the sum of the points assigned must be 10 for each of the evaluation criteria. Table 15 shows the resulting decision matrix, including its normalization by total percentage in round brackets.

| Criterion | Comparative Evaluation (Normalized) | |
|---|---|---|
| | OMG | Open Group |
| Competitive stakeholders satisfaction | 5 (0.5) | 5 (0.5) |
| Collaborative stakeholder satisfaction | 6 (0.6) | 4 (0.4) |
| Information coverage | 4 (0.4) | 6 (0.6) |
| Overall value | 6 (0.6) | 4 (0.4) |
| Risk (-) | 3 (0.3) | 7 (0.7) |

**Table 15** Decision Matrix, with Normalization (between brackets). Risk Contributes Negatively.

Intuitively, the comparative evaluation is derived from the following observations:

- competitive stakeholders satisfaction: contrasting interests of suppliers and funders, which is further mitigated by the previous observation;
- collaborative stakeholders satisfaction: familiarity of internal staff with OMG methodologies and wider OMG tool availability for model transformation and model visualization to business users;
- information coverage: quantitative yet partially subjective assessment of the respective weighted information coverage;
- overall value: the overall value appears to be similar, with the OMG presenting a slight advantage for the customizability and the tooling offer;

- risk: quantitative measure that can be derived visually from the number of signs '>' and '>>' in Table 13 and Table 14.

*Component 6:* Weights. The weights are determined using the naïve approach of the trade-off framework. The naïve approach consists in the prioritization of the criteria and the assignment of a number of importance points.

| Criterion | Ordinal Ranking | Importance Points | Cardinal Weights |
|---|---|---|---|
| Competitive stakeholder satisfaction | 2 | 2 | 0.22 |
| Collaborative stakeholder satisfaction | 3 | 1 | 0.11 |
| Information coverage | 3 | 1 | 0.11 |
| Overall value | 1 | 3 | 0.33 |
| Risk (-) | 2 | 2 | 0.22 |

**Table 16** Weights for the Trade-off Criteria

The underlying rationale is to be sought in the organizational context, and specifically on the following observations: 1) key integration needs for the provisioning of services and products; 2) slightly inwards organizational interest in the use of the visual methodology; 3) good availability of internal funding for the customization of the visual methodology; 4) value that can be generate in support of organizational goals and strategy; 5) moderate to low risk attitude in the organization.

*Component 7: Synthesis.* Applying the weights (Table 16) to the decision matrix (Table 15), the manager can derive Table 17, which contains the quantitative result of the trade-off analysis.

| Visual Methodology | Quantitative Evaluation (with respect to the organizational context) |
|---|---|
| OMG | 0.363 |
| Open Group | 0.187 |

**Table 17** Quantitative Results of the Trade-off Analysis

Consequently, the OMG's visual methodology appears to be distinctively more suitable than the Open Group's one in the above organizational context. However, this quantitative measure should not be accepted without any further critical consideration as this measure is partially based on subjectively measured values and on a number of assumptions. In particular, two considerations are to be discussed: 1) technical vs business nature of the organizational design activity; and, 2) risk. Concerning the organizational design activity, the expected strategic direction of the OMG and Open Group should be pondered to evaluate also the methodology suitability in a temporal horizon of five years. Concerning the risks, the trade-off analysis considers a relatively unbalanced value of low risk for OMG and high risk for Open Group. This value inherently originates from the (only) partially identified use of the visual methodology for the organization design. Should the use of methodology be identified with higher certainty, the risk value could be reduced as the risk value inherently considers if and how a visual methodology is unsuitable for the expected use.

*Component 8: Decision*. Finally, the manager assesses the above evaluation and synthesis to formulate the following recommendations to the governance board:

Within our organizational context, the OMG's visual methodology appears to be more suitable than the Open Group's one as the OMG's methodology can leverage on: i) internal expertise; ii) a wider community of practice – in terms of user base and application domains; iii) a wider standard and customization options; and, iv) a better integration with suppliers.

However, should the organizational design only involve business-level organizational activities (i.e. not involving systems, software, and hardware), the Open Group methodology may result a better choice, pending an accurate identification of the expected current and future uses of the methodology for the overall enterprise engineering, asides from the organizational design.

It is also recommended to allocate a contingency budget that may be primarily needed to customize the OMG methodology or to develop exploitation tools for the Open Group methodology. As such, the contingency budget can be reasonably expected to be larger if the Open Group's methodology is selected instead of the OMG's one.

# 5 CONCLUSIONS

Visual methodologies are key enablers for organizational design as they facilitate human communications and the decision making by means of graphical and comprehensive representations of the organizational elements and their inter-relationships. However, evaluating the most suitable visual methodology may not be a trivial problem for the technological offer as well as the managerial intricacies that may affect the methodology selection and use. Moreover, technical incompatibilities prevent the effortless and costless reversibility of the methodology selection.

The book has introduced a meta-process that can guide a manager in the structuring of the relevant information for the methodology evaluation and selection. The meta-process consists of six steps: 1) identification of the visual methodologies to evaluate – not discussed in the book, 2) information requirements coverage assessment of the methodologies; 3) methodologies relative positioning; 4) analysis of organizational forces influencing the methodology selection; 5) risk assessment and management for the methodology use; and 6) trade-off analysis and formulation of recommendations. The meta-process definition is developed under the assumption of CEO sponsoring the methodology evaluation for an entire organization that only uses the methodology as information capability for organizational design. The meta-process may need minor amendments when applying the meta-process to an organizational context that does not satisfy this assumption.

An example of the meta-process application is also included to describe how to evaluate and to select the most suitable visual methodology between the Object Management Group's and the Open Group's ones. The example considers a common organizational context for international or EU organizations. Under a number of assumptions introduced for presentation conciseness – e.g. identical costs for the adoption of the visual methodologies or limited types of information requirements assessed – , the example also inherently describes how to analyze the organizational context; how to tailor the meta-process; how to apply a multi-criteria decision method for the trade-off analysis; and how to formulate the final recommendations.

Asides from solving a practical problem, the book results have much wider reusability and applicability potential in the area of visual methodologies. In particular, the meta-process can be promptly re-used for at least three other applications: 1) product engineering for visual methodologies; 2) market analysis for visual methodologies; and, 3) strategic positioning of the visual methodology ecosystems. The product engineering application can exploit the entire results with i) the requirements identification of new features and capabilities for a visual methodology; and, with ii) the gap analysis between these requirements and the available features and capabilities. Similarly, the market analysis application could exploit the same benefits of the product engineering application with the different purpose of identifying the technical gap – e.g., information requirements and tooling – uncovered by the current market. In addition, this application could complement the entire market gap – asides the technological one – with the positioning of the visual methodology with respect to the classification schema and to the organizational competitive and collaborative forces. Finally, the strategic positioning application could leverage on part of the book' contribution to identify the positioning of the individual visual methodologies and to support the definition of a market and development strategy for these methodologies.

# 6 LIST OF ABBREVIATION

| | |
|---|---|
| BMM | Business Motivation Model |
| BPMN | Business Process Modeling Notation |
| CEO | Chief Executive Officer |
| CIO | Chief Information Officer |
| COO | Chief Operation Officer |
| CSO | Chief Security Officer |
| CxO | Chief-level Officer |
| DEMO | Design & Engineering Methodology for Organizations |
| DoDAF | Department of Defense Architecture Framework |
| EA | Enterprise Architecture |
| ESA-AF | European Space Agency Architecture Framework |
| EU | European Union |
| FEAF | Federal Enterprise Architecture Framework |
| HR | Human Resources |
| IDEF | Integration DEFinition |
| IS | Information System |
| IT | Information Technology |
| IT4IT | Information Technology for Information Technology |
| MODAF | Ministry of Defence Architecture Framework |
| MOF | Meta-Object Facility |
| OD | Organizational Design |
| OMG | Object Management Group |
| PESTEL | Political, Economic, Social, Technological, and Environmental |
| RASCI | Responsible, Accountable, Contributor, Informed |

| | |
|---|---|
| SOA | Service Oriented Architecture |
| SysML | System Modeling Language |
| TEAF | Treasury Enterprise Architecture Framework |
| TOGAF | The Open Group Architecture Framework |
| UML | Unified Modeling Language |
| UPDM | Unified Profile for DoDAF and MODAF |
| USD | United States Dollar |
| VDML | Value Delivery Modeling Language |
| YAWL | Yet Another Workflow Language |

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# ENDNOTES

1. At the time of writing, only two domain-specific initiatives are present, on the Future Airborne Capability Environment and on the Health Care.
2. Generic and reusable architecture templates.
3. See the glossary for a definition of these terms.
4. Checklists may further help contribute to make the punctual assessment also accurate and valid.
5. This analysis considers the collaborative interests instead of competitive ones for both customers and suppliers.
6. N.B.: Amendments may be needed when applying the selection methodology to the actual organizational context.
7. In the application of the meta-process, each risk should be assessed against the environmental and organizational context to identify a qualitative level of likelihood and impact.
8. The concern value distribution over the lifecycle processes does not consider the methodology adoption as this is of limited duration with respect to the others lifecycle processes (use and maintenance).
9. These two groups of stakeholders must be independently considered as they have different (and perhaps conflicting) power, roles, and preferences.