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State of the Art in Enterprise Architecture Management

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About sebis

sebis is the chair "Software Engineering for Business Information Systems" at the Institute for Informatics of the Technische Universität München. *sebis* is partially funded by the Ernst Denert-Stiftung and headed by Professor Dr. Florian Matthes. The main research areas of *sebis* are:

- Software and System Cartography: Enterprise application landscapes are complex intangible structures created, utilized, financed, and managed by people with vastly different backgrounds and objectives. Software cartography supports the communication between these stakeholders by intuitive and precise visual maps and thus contributes to an improved understanding and management of enterprise architectures.
- Innovative technologies and software architectures for information and knowledge management (enterprise solutions, groupware, and social software).
- Security for business applications.

sebis is using software engineering methods (model construction & abstraction, analysis & design, construction & evaluation) and is working in close relationship with industrial partners and with organizations from the public sector.

Florian Matthes holds the chair Software Engineering for Business Information Systems at the Technische Universität München. The current focus of his research is on enterprise architecture management, social software, and model-driven web application engineering. He is co-founder of four high-tech software and service providers (CoreMedia, infoAsset, 20six, 21publish) with more than 160 employees.

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EA management is a relatively new and hence constantly evolving discipline, which targets at establishing methods for aligning business and IT on a company-wide level. As state of the art and trends in this discipline are widely diverse in the industry, we compiled this report as a comprehensive insight into the current state of the practice and the roles, which it is going to take in the future.

This report is based on the results and findings of a survey, which was conducted from 2006 to 2008 to answer the following questions about the state of the art in EA management in Europe:

- What definitions of EA management exist and are used in practice?
- To what extent is business considered in EA management?
- What kind of governance is in plan for EA management?
- What EA frameworks are used in practice and can they satisfy their users?
- What strategies are used to gather information on the EA?
- What is the role of visualizations in managing the EA?
- What are the problems obstructing communication between business and IT?
- What EA management tools do practitioners use and what is their role?
- How does EA management relate to service oriented architectures?

- What role do metrics and KPIs play in EA management?

The survey is based on a twofold approach. At first, guided interviews were conducted with 22 enterprise architects, which were recorded, transcribed, and evaluated. This analysis resulted in quotations and textual information on EA management approaches used in the companies of the interview partners. Second, an extensive online survey, which had a return rate of about 50%, was conducted with 31 participants.

The following companies participated in the survey: Allianz Group IT, AXA, BMW Group, BSH Bosch Siemens Hausgeräte, Credit Suisse, Deutsche Bahn, Deutsche Börse Systems, Deutsche Post, Deutsche Telekom, FIDUCIA, HVB Information Services, Kronos, Kühne+Nagel, Münchener Rück, O2 Germany, Siemens CIO, Siemens PG, and Zollner Elektronik.

The remainder of this report is structured as follows. Section 2 gives an overview about the survey participants and their background, followed by Section 3 presenting the findings of the survey structured along ten topics complementing the questions about the EA management state of the art.

These findings are supported by quotations of practitioners, which we gathered in the interviews of the survey. The technical report concludes with an outlook on how to address typical, recurring problems in EA management utilizing the EAM Pattern approach.

Results included in this first chapter are solely based on the online survey, whereas the following chapter shows results from both the online survey and the guided interviews.

In order to obtain an overview about the industry sectors, which the participants belong to, they were asked to classify their company in one of the following eight categories. The distribution is shown in Figure 2.1.

- **Production:** Production of physical goods from raw materials.
- **Service:** Offering of intangible assets (non-financial).
- **Commerce:** Act as a negotiator between a producer and a consumer, e.g. a department store.
- **Finance:** Banks and other financial organizations.
- **Information Industry:** Companies which primarily draw profit from selling intellectual property.
- **Public Utility:** Electricity suppliers, water suppliers, etc.
- **Transport and Logistic:** Companies drawing profit from transporting goods.
- **Miscellaneous:** The company could not be classified based on the offered categories.

To get an overview about the level of knowledge of the survey participants, they were asked three questions:

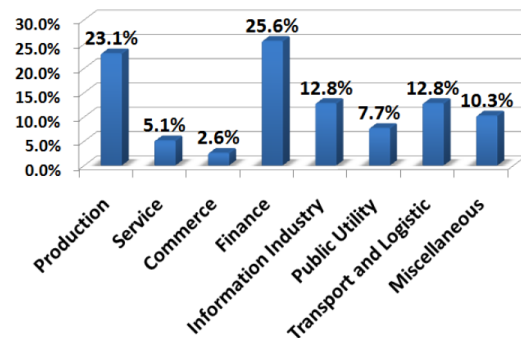


Figure 2.1: Which sector does your company belong to?

- How do you estimate your IT-knowledge? (Question 1)
- How do you estimate your knowledge concerning the business, which you support or execute? (Question 2)
- How do you estimate your level of knowledge in EA management? (Question 3)

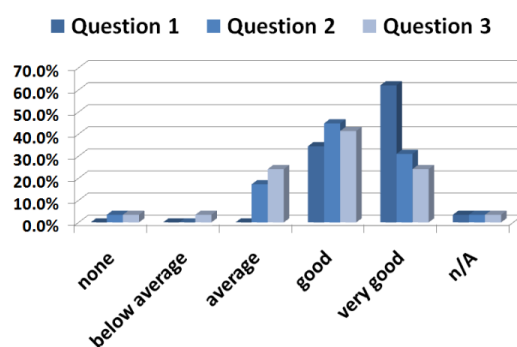


Figure 2.2: Overview personal knowledge

Figure 2.2 shows the answers to these questions. It has thereby to be noted that the estimation of the IT knowledge is mostly "very good",

while business knowledge and EA management knowledge is mostly "good".

The participants of the survey were all part of the IT departments of the respective company with about 20 % being employed at the CIO level. The remainder of the participants is divided in IT and technology development, as well as IT operations. Figure 2.3 shows this categorization more in detail.

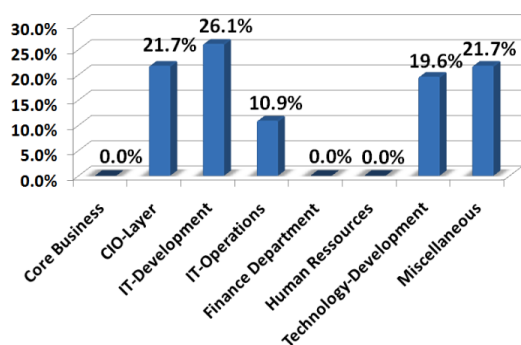


Figure 2.3: Responses to the question: Categorize your work into the following schema.

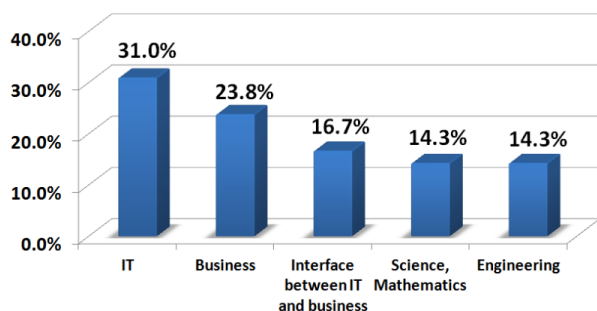


Figure 2.4: Responses to the question: What was the focus of your education?

Knowledge and experience in EA management depends on the background of the participant. This has been considered in a question concerning the education of the participants. Most of the participants had an IT related education like informatics, followed by business related education like business administration. An interesting point is that participants with a business

informatics related background follow on third place. Mathematics and engineering related education represent the smallest fraction. More detailed information is given in Figure 2.4.

The size of the application landscape in a company may influence the importance of EA management in this company. Therefore, the participants of this survey had to indicate the size of their company's application landscape. Figure 2.5 shows the results of this question.

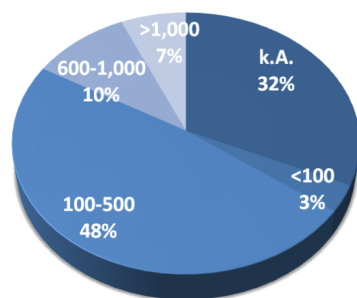


Figure 2.5: Responses to the question: How large is your application landscape (Number of deployed applications)?

The last question targets the maturity of the company in respect to its application landscape. Thereby, the degree of standardization and modularization has been analyzed. Participants could choose from the following list of answers, which are loosely inspired by [WR04].

- A: IT is characterized by applications focused on support for specific areas, for which it is optimized.
- B: A homogeneous, standardized infrastructure is the execution environment of the applications.
- C: IT supports standardized processes in the organization and enables the processes to use data owned by the different applications.
- D: IT is based on process- and application-components, which can be

used in a modular way and thus provide flexibility.

About one third of the companies use business applications optimized to support specific business processes. The least participants answered that their company uses application components, which are modularly reusable. Detailed results are shown in Figure 2.6, where the letters *A-D* refer to the options from above.

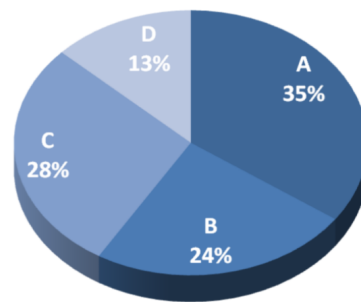


Figure 2.6: Responses to the question: Which of the following statements describes your enterprise best?

Findings of the survey

3.1 Searching for a Definition of EA Management

Even though EA management is an emerging topic, which is addressed by nearly every globally acting company, no common established definition yet exists. Nevertheless, most definitions, which can be found in literature and were gathered during the interviews with our survey participants, emphasize the following aspects:

Alignment: The goal of the process of EA management is to improve the alignment of business and IT. Thus, especially the strategies and business goals of an enterprise need to be considered to manage the evolution of the EA.

Holistic view: EA management is concerned with various aspects of the enterprise, e.g. organizational units, business applications, projects, which can be organized in different layers – ranging from business to infrastructure layer. Thereby, the interconnections between these layers are of vital importance for the process of EA management, not only the elements itself.

One important part [of EA management] is [the set of] interconnections between the different layers (especially between the business and IT layers).

An Enterprise Architect from the Service Industry

Process character: EA management is a continuous, iterative process, which on the one hand needs input from other enterprise-level

management processes, e.g. project portfolio management, strategies and goals management, and on the other hand provides input for these management processes. Thus, it acts as a *glue* to align enterprise-level processes.

EA management evolves from an reactive procedure to an active enabler and driver of the business

An Enterprise Architect from the Production Industry

In addition to the similarities of EA management definitions regarding the contained aspects as alluded to above, a common sense concerning typical tasks for EA management exists. Whereas standardization and homogenization can be regarded as internal tasks, further responsibilities subsist, which emerge from external influences, e.g. regulations, laws, and competitors. Nevertheless, communication is seen as a central challenge in EA management.

The greatest challenge in the context of EAM is to convince people to replace an established solution, irrespective if it is a good one or only a worse workaround, by another, in order to support the entire company. This is the challenge we have to address in the next years.

An Enterprise Architect from the Production Industry

The quotation given above describes the interpersonal problems arising in EA management, which can only be addressed by communicating the benefits of the chosen approach.

Furthermore, EA management is an ongoing endeavor, which needs sufficient time in advance (some years) until return of investments are visible. In addition, these returns can hardly be measured quantitatively, as the highly complex management body mostly delivers only qualitative results.

[The greatest challenge of EA management is the] calculation of business cases in respect to EA management endeavors

An Enterprise Architect from the Finance Industry

Concludingly, it can be said that, although no commonly accepted definition of EA management exists, a common understanding of what EA management is about is widely given. Below our definition of EA management is provided, which centers around the commonalities from above:

EA management is a continuous, iterative (and self maintaining) process seeking to improve the alignment of business and IT in an (virtual) enterprise. Based on a holistic perspective on the enterprise furnished with information from other enterprise level management processes it provides input to, exerts control over, and defines guidelines for other enterprise level management these processes.

The EA management process consists of four interconnected distinct phases: plan, execute, control, and maintain. During planning envisioned EA scenarios are created, evaluated, and finally decided upon. The execution phase provides EA deliverables, which are used to steer, guide, and influence other enterprise level management processes. In the control phase performance is measured on enterprise level and aggregated to key performance

indicators. These measurement results and indicators are used in the maintenance phase to improve the overall EA management process as well as to adapt and shape the roles and bodies involved.

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3.2 The *E* in EA Management

Literature and presentations mention the problem of EA management being mostly an *IT-only* endeavor, which thus fails to provide its full benefit e.g. in respect to mutually aligning business and IT. The following quotation emphasizes this issue from a practitioners point of view.

EA is a hype topic. If we look at it in detail, we can see that most companies do not care about aspects, which go beyond technological aspects. As long as EA is only an IT topic it is doomed to fail, as it is expensive to collect the data and the benefit can only be gained if business is incorporated in the endeavor in a way that they understand what EA management is all about.

An Enterprise Architect from the Finance Industry

The following questions try to shed a light on the perception of the role of business in EA management in practice as well as on its driving forces.

As an introduction we asked *who was the driver for EAM in your enterprise?* Figure 3.1 shows the results of this question.

70% of all respondents of the survey said that IT is the driver of EA management in their company. In contrast only 22% see the combination of business and IT in the lead in EA management. This supports the statement of the

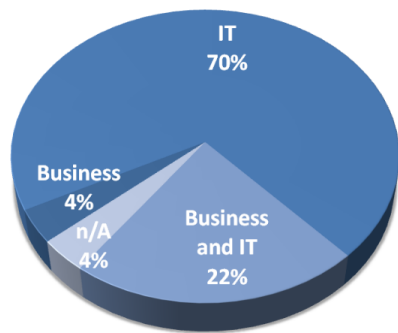


Figure 3.1: Drivers for EA Management?

above quotation, that business is not sufficiently involved in current EA management projects. Therefore, we asked the participants of the interviews, *if business was sufficiently included in the EA management endeavor in their enterprises?*

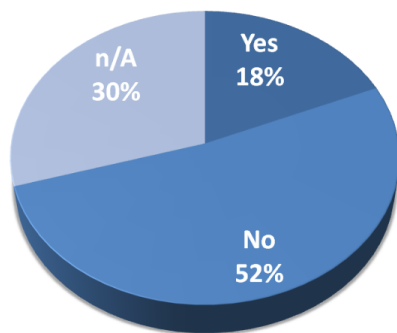


Figure 3.2: Is the business sufficiently involved into EA Management?

The results are illustrated in Figure 3.2. More than half of all respondents answered that the business was not sufficiently incorporated in the current EA management approach. As a result it can be summarized, that EA management mostly is an IT topic in current approaches.

One of the task of EA management should be the definition of targets and rules for the future development of the EA. This rules also have to be enforced. As we had often been reported issues with the enforcement of rules, we asked the following question to analyze the situation in more detail: *Where in your organizations are*

the goals for the future evolution of the application landscape set? The possible answers were the following:

- A: Different persons/groups try to set goals, but have no formal power for enforcing them.
- B: A person/group (e.g. IT-architects) tries to set goals, but has no formal power for enforcing them.
- C: A person/group with the necessary power for enforcing them sets goals.
- D: Different persons/groups with the necessary formal power set goals.

The results are shown in Figure 3.3.

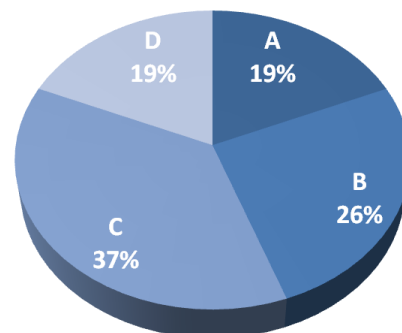


Figure 3.3: Where are the targets for the future evolution of the application landscape set up in your organization?

Nearly 40 % of the participants selected answer C, indicating that usually it is a person or group with appropriate formal power, which sets such goals. The interesting result of this question is that an almost equal part of the participants answered that a person or group, which *did not possess formal power to enforce them* (answer A and B), sets the goals. This situation is most likely to lead to goals, which are set but never read as they are not enforced at all.

3.3 Governance and EA Management

Governance, no matter whether IT, business, or both are concerned, is a topic, which attracts rising attention from practitioners as well as research groups. Thereby, a variety of definitions for corporate governance as well as for IT governance currently exists. According to [MW05] corporate governance is responsible for the establishment of the *legal and factual organizational framework for managing and controlling enterprises*. Complementary, [In05] defines IT governance as follows: *IT governance is the responsibility of executives and the board of directors, and consists of the leadership, organizational structures and processes that ensure that the enterprise's IT sustains and extends the organization's strategies and objectives*. Subsuming, the establishment, enforcement, and improvement of committees (e.g. architecture boards on different management levels), roles (e.g. enterprise architect, business architect, project manager), and responsibilities (for financial, temporal, or information aspects) can be regarded as the central tasks of governance.

Governance has to be distinguished from the associated management task – management makes decisions, governance determines *who* contributes to the decisions and *who* makes them. The following quotation of [WR04] illustrates the relation between management and governance.

The difference between management and governance is like the difference between a soccer team running harder and practicing longer and the team stepping back to analyze its composition and game strategy.

Ross and Weill, 2005

The governance structures play an important role in the execution of the EA management

process, as they can e.g. act as quality gates in the transformation process of the enterprise to ensure the fulfillment of given guidelines or standards. As an example, in a project management process it might be obligatory that each project has to undergo an architectural review, which checks the conformity of the envisioned future architecture to guidelines. Thereby, two different ways of escalation in case of a nonconforming envisioned architecture are commonly used – *horizontal* and *vertical escalation*.

- In a horizontal escalation, the decision on the project's future remains on the management level, where the non-conformance has been detected. Enforcement can be achieved via budgeting. Thereby, the project manager is allowed to implement the project with the non-conforming architecture, but has to reserve funds for the costs of a later project, which transforms the architecture according to the defined standards and guidelines, in the total project budget.
- In case of an vertical escalation, the decision about the project's future is handed over to a committee on a higher management level. Thereby, the project manager of the non-conforming project is demanded to explain the reasons for his deviation to the higher management.

Within the process of establishment and improvement of governance structures, our respondents stated the following topics as the most challenging ones:

- First of all, the top management must back the establishment of governance committees as well as support the decisions taken by them and the enterprise architects in order to ensure the binding character of their results.

- The right balance between establishing the necessary governance structures and avoiding abundant bureaucracy must be found to ensure a fast, understandable, and reproducible decision making process and the enforcement of given standards.
- In order to set up a schema of defined responsibilities, the processes must be documented first.

Especially the question of the right balance seems to be a challenging one. This is also reflected by the following statement of one of our industry partners:

There are committees and boards established within our company in order to discuss architectural decisions. Some colleagues even say, there are too many of them!

A Project Manager from the Finance Industry

Altogether, a tendency in favor of business requirements in the context of governance exists. This means that business requirements overrule requirements from EA management. This tendency is nevertheless regarded by the business and architecture people to be an important one.

3.4 EA Frameworks offer only minor Assistance

Enterprises seeking to establish EA management often start by searching for accepted standards in order to get deeper insights into the topic and to avoid known pitfalls. Thus, sooner or later, they will come across *EA*

frameworks, e.g. Zachmann [Za87, JZ92], The Open Group Architecture Framework (TOGAF) [Th07, Th09], or the Department of Defense Architecture Framework (DoDAF) [DD04]. In addition, further frameworks exist in the tools available for EA management, e.g. ARIS or planningIT [Ma08].

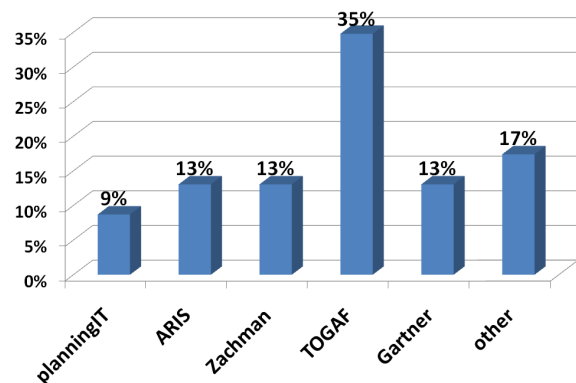


Figure 3.4: Awareness level of existing frameworks

According to the results of our survey [Ma08], there seems to be nobody who uses a framework out of the box (see Figure 3.5). Initially many organizations look at Zachman or TOGAF to get a first overview on EA management (see Figure 3.4). TOGAF constitutes the most prominent approach, which is used by a majority of our respondents to provide ideas for the development of an enterprise-specific approach. The major drawback of TOGAF is, according to our respondents, the extensive description, which covers about 800 pages.

After an intensive phase of familiarization and an initial workshop, where TOGAF was presented to the involved stakeholders, we decided: Thanks, too complicated for us.

An IT Architect from the Service Industry

In addition to TOGAF, our respondents regard the Zachmann framework to be especially help-

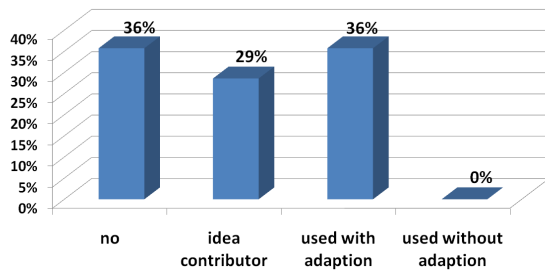


Figure 3.5: Usage of frameworks during the establishment of EA management

ful to present the idea, of EA management to involved stakeholders in general and the top management in particular, as the following quotation points out.

The topic EA management was presented three times to the management, it was rejected twice. The third time, the Zachman framework was used to explain the endeavor and what EA management stands for as well as what it means to have an holistic view on the enterprise. This time, we received a *go* from the management. Now, we use the Zachmann framework as a static model, which is pinned on walls in many rooms without far-reaching consequences.

An IT Architect from the Service Industry

In summary, the majority of our respondents use an EA management approach, which is individually developed, sometimes based on inputs gathered from existing frameworks. Reasons for the development of enterprise-specific EA management approaches are according to our respondents the individual way of thinking, which exists in most enterprises. Furthermore, the frameworks appear theoretical and impossible to implement.

I will not say the existing frameworks are freaky theoretical, but far far away from the possibilities we have in our enterprise to implement them.

A Project Manager in the Finance Industry

3.5 The information gathering process

One important issue in EA management is gathering information as well as their maintenance. Thus, initially the question, *which* information should be gathered is more important than *how* to gather it, as gathering information, which is not really needed to address the pain points of the enterprise, will lead to labor-intensive and time-consuming tasks, annoying a great amount of information stewards¹. In addition, the information stewards performing these labor-intensive tasks are not identical with the stakeholders benefiting from the gathered data and thus cannot see the advantage of the work they are demanded to perform. These circumstances may lead to a decreasing acceptance and a lack of support of the EA management endeavor.

In order to establish a successful EA management approach including an active EA information gathering and maintenance process, the following pitfalls should be avoided according to our industry partners:

- Consider carefully, which major pain points of the enterprise should be ad-

¹We refer to the term of an *information steward* to describe the members of a company who are involved with the information gathering and maintaining process. The crowd of information stewards may have an intersection with the group of stakeholders, which have a certain concern that is addressed by the EA management process.

dressed by the EA management initiative and which information is needed. Otherwise, you will start with 20 information concepts and end up with 500.

- Think about the process, to gather the necessary information in advance. If you start walking around with MS Excel or MS Word, you perhaps will end up with thousands of sheets you don't know how to consolidate in the end.
- Remember to spend some thoughts about whom to ask for the information. If you do not clearly define, who the information stewards are, and if they are not convinced of the benefit of their work, your endeavor will die after the initial phase.
- Keep in mind to think about how to visualize the information, how to analyze it in order to enhance the situation, and how to maintain the information.

The aforementioned pitfalls mainly refer to the initial EA management tasks of developing an enterprise-specific information model and storing the respective data in a repository. According to the experience of our industry partners, the development of an information model requires the involvement of several stakeholders from different areas (e.g. business, IT, strategies, projects). As this approach leads to several iterations, it has to be ensured that the information model does not grow infinitely. The following statement of one of our interview partners provides a solution to that problem.

The enterprise architects initially created our information model and we then asked in several iterations the department members to *delete* concepts from the model, which they think are not of importance.

An IT Strategist from the Transport and Logistics Industry

Once the initial decision, which information should be gathered, is made and an information model conforming to that decision has been built, the maintenance process has to ensure an adequate data quality. In this context, different approaches to ensure the actuality of data exist:

- *Projects have to update the information.* As projects are the means to change the architecture of an enterprise, the project manager is responsible for updating changed artifacts.
- *Data is updated in certain intervals* (e.g. every year, twice a year, monthly). There exist defined points in time, at which the responsible information stewards have to check the accuracy of the data they are responsible for.
- *Data is always kept up to date.* The responsible information stewards (business application owners, etc.) ensure that the information is up to date.
- *Data is automatically updated via a system.* To a certain extent information, especially infrastructure information, can be kept up to date via specialized tools (e.g. CMDBs).

Figure 3.6 provides an overview, which of the aforementioned methods of information gathering and maintenance are used to what extent among our industry partners. The possible answers were:

- A: Automatically, e.g. by source code analysis, crawler
- B: In periodic cycles (annually, twice a year, monthly,...)
- C: Continuously, in the context of projects
- D: Continuously through e.g. application or process manager

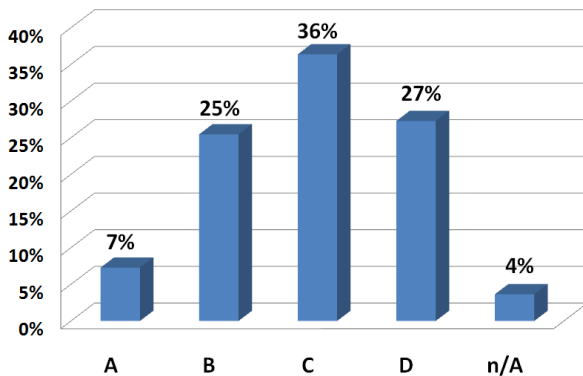


Figure 3.6: How is information of the EA management currently maintained in your enterprise? (for the meaning of the letters refer to the option description above)

We tried the three methods [via projects, defined points in time, and the information stewards], which were planned, documented, and communicated within the departments but none of them survived longer than two months.

The Team Leader of Enterprise Architecture from the Transport and Logistics Industry

We experienced a high interest among our interview partners regarding a process for automated information gathering via CMDBs or systems management tools. While 33% of our industry partners already use CMDBs or systems for automated information gathering and maintenance of infrastructure data, further 33% is planning to automate the maintenance via such systems in the near-time future (cf. Figure 3.7).

As 0% of our industry partners are totally satisfied with their data quality (cf. Figure 3.8) some of them developed incentives for the information stewards to support the maintenance process.

- A: No, not sufficient regarding topicality
- B: No, the correctness is not sufficient

- C: No, the completeness is not sufficient
- D: Yes, the data quality is sufficient
- E: n/A

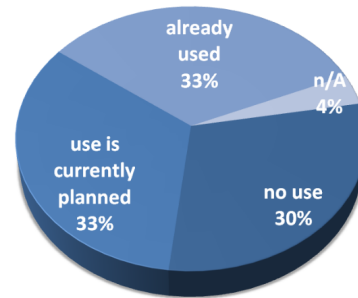


Figure 3.7: Is infrastructure information automatically gathered in your enterprise, e.g. from a CMDB?

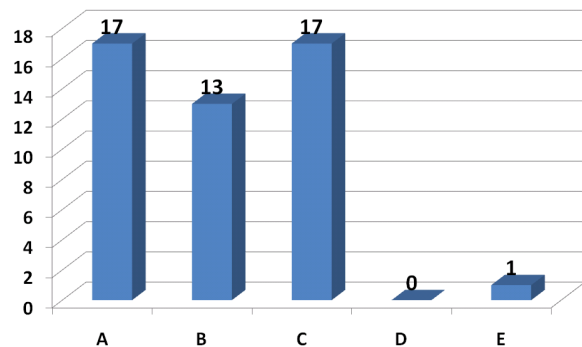


Figure 3.8: Are you satisfied with data quality?

Among these incentives are e.g. the establishment of a benchmarking process for data quality to make it comparable between the different departments or organizational units or the tagging of last-modification dates of data. Furthermore, visibility for other departments can additionally influence the willingness to update data as illustrated by the statement below:

Sometimes, staff members from departments even ask for the questionnaire, as they want to be present on the visualizations of the landscape due to marketing reasons.

The Team Leader of Enterprise Architecture from the Transport and Logistics Industry

Nevertheless, the process of information maintenance heavily depends on the culture and willingness of the information stewards involved, as stated by our EA practitioners below:

EA management is based on heroism, if you have a lot of heroes at hand you will discover no problems. Nevertheless, heroes don't want to do the same all day.

Head of IT Strategy from the Transport and Logistics Industry

There are departments, which always provide their updated information, but there are others, which have another culture and do not think its necessary to update the information.

An Enterprise Architect from the Finance Industry

3.6 Visualizations as a Communication Basis

A picture says more than thousand words is a widely known proverb. It is also applicable to EA management, as visualizations are a powerful tool to illustrate complex relations and unquestioned as a means for communication among practitioners.

We first tried to start a discussion on the available information about the EA based on textual information, but quickly realized that we needed a graphical representation. Utilizing the graphical representation, we found out that we then could talk about things we had not even realized before.

An Enterprise Architect from the Service Industry

The aforementioned importance of visualizations in EA management was seen by all of our participating partners, leading to a "yes"-response of 100% on the question *Do you see a general need for visualizations in the context of EA management?* Further detailing on the importance, 44% of the people involved in EA management stated, that they received the needed information from visual sources (cf. Figure 3.9), notwithstanding the fact that no established best practice notation for those visualizations yet exists.

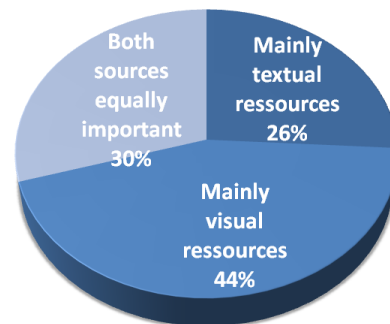


Figure 3.9: From which source do your employees get the information about EA?

One possibility heavily discussed in the context of EA management is the Unified Modeling Language (UML) (cf. [Ob04, OM05]). Whereas its practicability and usability in the context of software engineering is unchallenged, it is considered to be too detailed and complex to be intuitively understandable to the top-level

management and other non-technical stakeholders involved in EA management. Herein, most EA practitioners agree that more simple notations (realized e.g. as MS PowerPoint presentations) are more suitable to provide a high level overview.

The UML is used in many different departments and on various abstraction levels to represent the EA or parts thereof. The acceptance in the projects to maintain information available in UML is given. Nevertheless, you will never find an UML diagram in our presentation prepared for the higher management.

The Head of IT Architecture from the
Public Utility Industry

If an notation other than the UML is used to illustrate certain aspects of the EA, the semantics of the symbols and possible meanings of certain positionings have to be explicated as stated below.

Legends are important for the understandability of visualizations.

An IT Architect from the Production
Industry

Most visualizations in the context of EA management are used to start discussions about certain aspects and to provide a communication basis for stakeholders with different backgrounds.

Visualizations of the EA are pinned to the walls of many meeting rooms and are taken along by colleagues to important meetings. It is vital that these visualizations are present in the mind of the people, as they provide a common basis for discussions.

A Business Architect from the
Information Industry

In order to provide this common information basis the visualizations should contain and link business as well as technological aspects. According to our EA practitioners, especially the visualization of key performance indicators (KPI) and metrics is of vital importance as they can condense, quantify, and aggregate information.

Portfolio diagrams and possibilities to visualize metrics and KPIs are of vital importance for us to get the business people involved.

An Enterprise Architect from the Finance
Industry

Nevertheless, EA experts tend to show too much information, thus creating complex visualizations that are not intuitively understandable to people not used to that kind of illustration. A mechanism to hide certain information on visualizations – e.g. the layering principle² – can thus be useful.

Understandability is the crucial factor of visualizations. We, as experts, tend to put too much information into our visualization, which demands to much of the viewers.

A Project Manager from the Information
Industry

3.7 On the Importance of Communication

Besides the various problems linked to EA management processes, as information gathering, maintenance, or establishment of governance

²Refer to [Bu07] for more information on the layering principle.

structures, a further challenge is the setup of the EA management process itself. Assure your process is fully documented, explicating to the greatest detail who has to do what at what time. Assure also, that all involved parties are informed. However, if they are not convinced about the benefits of the process, the process will end up dead without solving any problems. In order to ensure acceptance by the stakeholders and information stewards involved, one needs to communicate the necessity and the benefits of such an approach.

It is very important that not only the enterprise architects and the department managers understand the topic EA, every single staff member needs to understand and accept the topic in order to get the EA to be updated regularly. I think it will take one to two years until the topic is really established.

An IT Architect from the Production Industry

The challenge is to get the people on board.

A Business Architect from the Information Industry

For the communication of EA related topics 48% of our industry partners follow the twofold approach of using text-driven documents complemented by visual resources (cf. Figure 3.10).

Enterprise architects are simply communicating people. They have to translate between the business and IT people. What implications does a business decision have for the IT behind the scene and vice visa?

The Head of IT Architecture from the Service Industry

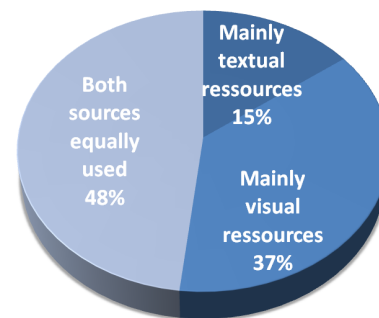


Figure 3.10: How do your employees generally communicate/document the information about the EA?

Furthermore, it is important to have the stakeholder involved in the EA management decision process or at least make the resulting decisions understandable to them.

If the decisions are made in an ivory tower and are only handed over to the people there will be no acceptance.

An Enterprise Architect from the Service Industry

In addition, it is not only important that the decisions are communicated but also documented, which is only achieved at 42% of our respondents' enterprises (cf. Figure 3.11).

Moreover, further impacts which EA decisions might have, should be considered, as transparency of the decisions may not only have positive influences to the involved stakeholders. Social impacts as the one stated below, should also be thought of.

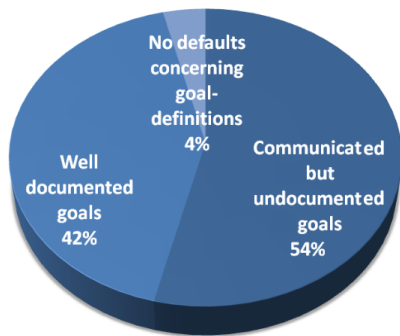


Figure 3.11: How would you estimate the definition of the goals for the evolution of the application landscape?

It is important and difficult to communicate the results of architectural planning. There might be business application owners who lose the business application they are responsible for.

An Enterprise Architect from the Service Industry

3.8 Tools for EA Management

Most of our industry partners regard tool support to be necessary in order to perform EA management. Although the amount of data needed could be stored in a simple database system or even MS Excel files, dedicated tools support is beneficiary to gather, maintain, and visualize this information. This is especially true, if more sophisticated functionalities, e.g. role-based access or collaboration support, are regarded. Especially, the functionalities provided by the tools to create visualizations suitable for different stakeholders from business, IT, or management are considered an important feature of an EA management tool.

I have not found a tool capable of generating different visualizations especially regarding the attribute-based coloring of objects.

The Head of IT Strategy from the Transport and Logistics Industry

The market of EA management tools is still an emerging one, offering a variety of new and established tools. Table 3.1 provides an overview of vendors positioning their tools in the field of EA management. The table ranks these tools (see "Total") according to the interest of the industry partners participating in an extensive survey about EA management tools [Ma08].

The origins of the different tools range from meta modeling tools via business process modeling tools to visualization tools. Accordingly, the different tools emphasize different aspects of EA management. Whereas some tools focus on the methodology or process used to perform EA management, others provide flexible visualization and meta modeling functionalities to support self-developed, enterprise-specific EA management approaches. In addition, some tools provide means for automatic information gathering from different sources (see Section 3.5).

It would be good to have a standardized core information model, that could be used to exchange information between different tools [...].

An Enterprise IT Architect from the Production Industry

No	Name of Vendor	Name of Tool(s)	Total
1	alfabet AG	planningIT	69
2	IDS Scheer	ARIS IT Architect	68
3	Telelogic	Telelogic System Architect	60
4	Troux Technologies	Troux	55
5	IDS Scheer	ARIS ArchiMate Modeler	53
6	Hewlett Packard	Mercury Project and Portfolio Management Center	49
7	Casewise	Corporate Modeler Suite, IT Architecture Accelerator	48
8	IBM	Rational Software Architect	46
9	MEGA International	MEGA Modeling Suite	45
10	BOC	ADOit/ADOxx	44
11	Adaptive	Adaptive EAM	42
12	Metastorm	ProVision	38
13	BEA	AquaLogic Enterprise Repository	37
14	CA	Clarity	35
15	Comma Soft	infonea	35
16	Agilense	EA WebModeler	34
17	QualiWare	EAM Suite	34
18	Embarcadero	EA/Studio	33
19	Primavera	ProSight	33
20	process4.biz	process4.biz	33
21	Avolution	ABACUS	32
22	Sparx Systems	Enterprise Architect	32
23	ASG	ASG Enterprise Management/Rochade	30
24	pulinco	TopEase Suite	30
25	Visible Systems Corporation	Visible Enterprise Products	30
26	BiZZdesign	BiZZdesign Architect, BiZZdesigner	28
27	GoAgile	GoAgile MAP	28
28	Orbus Software	iServer for EA iServer	27
29	BTM Corporation	BTM 360 Product Suite	26
30	INOVA Engineering	MERGE-Tool	26
31	Intelligile	Map Suite	26
32	LogicLibrary LogiScan	Logidex	26
33	Sybase	PowerDesigner	26
34	Enterprise Elements	Elements Repository	25
35	Future Tech Systems	ENVISION VIP	25
36	NetViz	NetViz	25
37	AB+ Conseil	SOLU-QIQ	24
38	Acceptsoftware	Accep360	24
39	Framework Software	Structure	24
40	Knotion Consulting	SYNAP-C Solution	24
41	Select Business Solutions	Select Component Architect	24

Table 3.1: Vendors and tools in the area of EA management

Based on a hypothetical widely-accepted information model, specialized tools for dedicated areas (project portfolio management, IT infrastructure management, etc.) could exchange and integrate information as shown in Figure 3.12. Simplifying the information collection and maintenance process through automated information gathering is a goal worth pursuing in the near-time future for some of our industry partners.

In 3-4 years there will be tools, which are based on an implementation of ITIL and partially update the content automatically.

An Enterprise Architect from the Production Industry

EA management tools will be integrated with ITIL tools to support different analyzes e.g. how does the failure of a system affect my business processes.

An IT Architect from the Production Industry

3.9 The role of SOA

Service Oriented Architecture (SOA) has been one of the major topics in IT management in the last three years. Many articles have been published and many presentations have been given. They present SOA from a different perspectives, emphasize on different aspects, and aim at different results.

EA management is a precondition for SOA. You need the information in order to be able to encapsulate functions the right way.

An Enterprise Architect from the Financial Industry

The quotation above shows the importance of the relationship between SOA and EAM. Therefore, we included the topic in our interviews and in our online survey. In order to emphasize the importance of SOA, we asked the following question in our online survey: *Do service-oriented architectures play a role in your enterprise?* The participants could choose one of these answers:

- A: Yes, currently it is considered to introduce a service-oriented architecture.
- B: Yes, a service-oriented architecture is introduced in a certain part right now.
- C: Yes, a service-oriented architecture is currently introduced enterprise wide.
- D: Yes, the enterprise already uses a service-oriented architecture.
- No

The results of this question are shown in Figure 3.13.

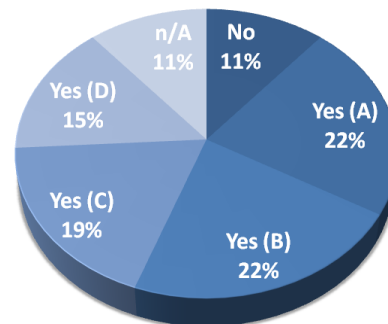


Figure 3.13: Do service oriented architectures play a role in your enterprise?

Only 11 % of the participants answered SOA does not play a role in their enterprise. Every sixth answer stated that the enterprise already uses a SOA. The rest of the answers give evidence that the companies consider introducing an SOA, or that the introduction has already started.

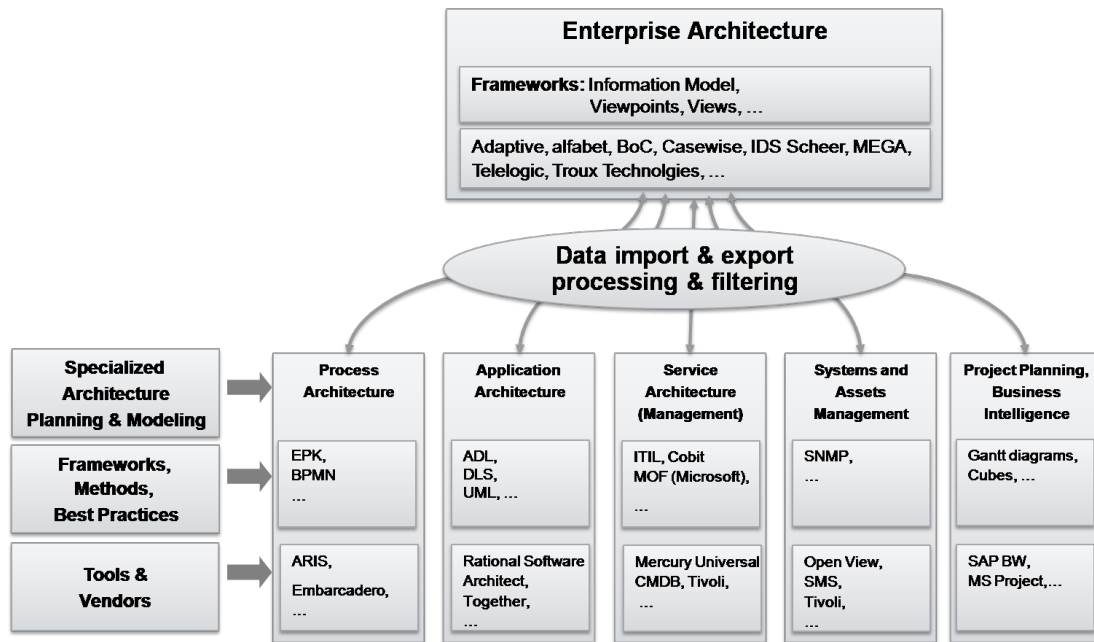


Figure 3.12: Information integration

According to our interviews SOA is about introducing a new layer of abstraction between the IT and the business to support and improve communication and understanding between them. Typically SOA is thereby understood by the participants of our survey as follows.

From an IT perspective, functionalities to support business processes have so far been provided by business application. This task is now accomplished by services. Services may exist on different levels of granularity, ranging from simple database calls up to aggregated services like a service for billing an order, which includes calling other services. The focus on services should foster reuse of services and reduce costs, as functionalities only have to be implemented once and can then be reused by other services. Additionally, the participants of our survey mentioned that the concept of building blocks should enhance flexibility in respect to changes, e.g. in the supported business processes.

Concerning the business perspective, the participants regarded SOA as a way to reorganize the EA with a focus on business support. In this context business processes and business capabilities, which have to be supported by services and are organized in domains are in the spotlight.

The question, "what is SOA all about" received widely spread answers in our interviews, ranging from *SOA is pushed by vendors and will only have minor impact to SOA means modularization of the application landscape*. Sometimes, SOA is further mixed up with *Software-as-a-Service*, meaning to rent a service, instead to buy, or build a software.

Overall, the following statements were made in the interviews

- SOA is nothing new, we have been doing this for a long time.
- We are migrating to SOA.

- We are waiting for experiences of other companies or results of pilot projects.
- Telecommunication companies have embraced SOA early.

Two things are crucial for SOA, standardized business processes and a shared data repository. Business processes need to be standardized and documented for services being able to support them and offer potential for reuse. Thus, the participants had to answer the following question: *The processes in the different units (sections, divisions, regional companies, etc.) of the enterprise are*

- A: standardized and defined.
- B: autonomously, not standardized and not defined.

The results in Figure 3.14, show that 59 % of the participants regarded the business processes in their company to be standardized and given.

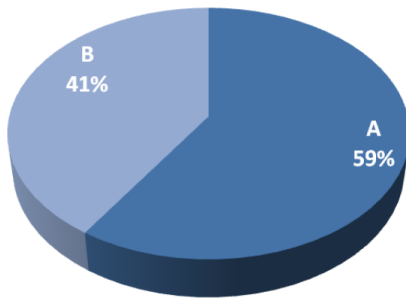


Figure 3.14: Standardization of business processes (the letters A,B are introduced above)

In many companies a high-level aggregation of the business architecture above the business process-level, e.g. via *business domains* is considered an important prerequisite to the implementation of an SOA.

Creating a domain structure is needed for an SOA.

The Head of IT Strategy from the Transport and Logistics Industry

SOA needs a good business architecture and a stable process for further development.

An IT Architect from the Service Industry

This high level business architecture can be used as a framework to structure the service landscape by assigning each service to a domain. This helps to avoid services with overlapping functionality and organizes the whole landscape into manageable pieces.

A business model behind SOA is needed, offered functionality has to be paid.

An Enterprise Architect from the Transport and Logistics Industry

Simply introducing an SOA is not enough, an SOA has to be based on a business model. Running services creates costs, which have to be paid by someone within the company. Aggravating is that a basic principle in an SOA is the re-use of services. Typically, the organizational unit providing a service is not the same which uses the service. Consequently, accounting for running and using services is needed, which also requires to measure e.g. the number of usages, etc. as a basis for billing.

High costs arise for managing dependencies between services and their usage.

An Business Architect from the Information Industry

Charging may be based on processes and their support by services. A lot of data has to be collected to do the billing.

An Enterprise Architect from the Transport and Logistics Industry

After discussing different aspects of SOA, we further analyzed, what the participants of the survey thought about SOA in general. These opinions are discussed alongside the following quotations.

SOA is pushed by vendors.

The Head of Information Technology from the Production Industry

A similar impression has been pointed out by three of the participants and shows that an SOA is not only introduced because there is a need to introduce it, e.g. to increase the agility in supporting new business demands, but that SOA is also introduced because the software products from third parties, which are in use are based on service oriented concepts. This may result in a need to introduce a serviceoriented infrastructure.

Also, the participants at the survey associate some positive effects with SOA:

Gaining new flexibility, driven by process management, is one goal of SOA.

An IT Architect from the Information Industry

Using SOA, a more holistic understanding will emerge from business to applications.

An Enterprise Architect from the Information Industry

Both quotations point to an increased cooperation between business and IT resulting in a more holistic approach to manage the EA.

3.10 Metrics and KPIs

You can't manage what you don't measure.

It is an old management adage that is still accurate today, but in EA management more often than not metrics are only considered to be important but they are not really used in practice. For this reason we analyzed metrics used in the context of application landscape management as a part of EA management.

The initial prerequisite for using metrics in EA management is the inclination of practitioners to use this kind of instrument. This was surveyed via the following question: *Has your organization used metrics in managing the application landscape up to now, or if not, do you regard metric usage possible in your organization?*

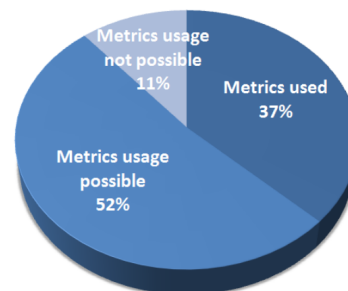


Figure 3.15: Current metric usage in the surveyed organizations

The evaluation results (see Figure 3.15) show that a large share of practitioners indicated that they actually use metrics, while an even larger share saw usage as a future possibility. Only a minority viewed metrics as not sensible. In the questionnaire, the practitioners were also asked to indicate their experience in IT and in EA management, and which kind of education they had received. Further analysis of this data conducted in [La08] suggests that stakeholders with

a business background are more inclined to use metrics.

In order to obtain more detailed insight into the aspects which practitioners would like to address EA concerns by using metrics, the on-line questionnaire provided a set of quality attributes for an application landscape, which could be assigned an importance rating. The following attributes had previously been gathered and refined by us together with practitioners from a financial service company in a project related to application landscape management in 2005 (see [La08]):

- *Maintainability* indicates the effort connected to technical development and maintenance.
- *Flexibility* relates to the question, if changes in business functionalities are swift and inexpensive.
- *Testability* is concerned with the effort of testing the landscape.
- *Performance* considers the fulfillment of service level agreements by the systems of the application landscape.
- *Scalability* relates to the question, how the landscape supports distributing load to additional hardware.
- *Operational Risk* indicates the business risks posed by the application landscape.
- *Operational Cost* advantages in operation are concerned with the expenses connected to operating the application landscape.
- *Installability* refers to the effort of deploying new systems in the application landscape.
- *Functionality* indicates the business support offered by the application landscape.

A question was used to survey information on the attributes' importance. The participants were given the possibility to assign an importance rating to each attribute on a five point scale (1 not interested in – 5 very interested in): *Which attributes of an application landscape would you like to examine using metrics?*

The results of the question are presented in Figure 3.16 as average importance rating assigned to the respective attribute. Business related attributes, as functionality or operational risk were rated high, the more technical quality attributes as maintainability and installability received the lowest ratings. Since stakeholders with a business background tend to favor metrics usage, these ratings are easily explained by the fact that these technical attributes lack direct business relevance.

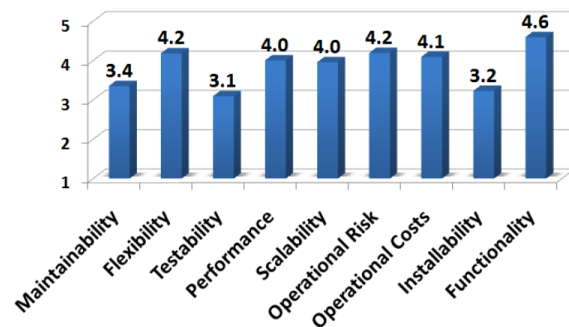


Figure 3.16: Importance values for the surveyed quality attributes

To better understand the expectations concerning the use of metrics in the enterprise, we asked the following question with the options presented below again rated on a five point scale (1 not important – 5 very important): *What properties of metrics are important to you?*

The results shown in Figure 3.17 indicate, that metrics are mainly means of communication and thus should be well understood and have a communicable meaning, while the calculation procedure does not need to be as simple. This warns against the often used "simple counts", as e.g. number of interfaces, of which the

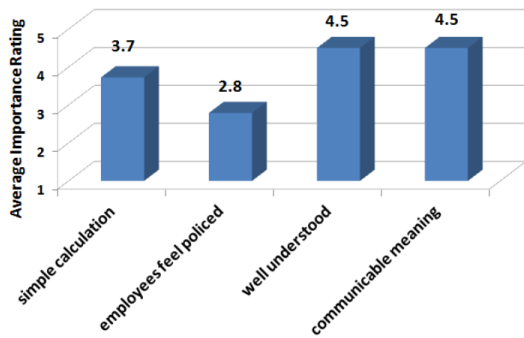


Figure 3.17: Important properties for landscape metrics

implications on business are only vaguely suspected. Metrics, which are sound and simple and have a meaning relevant to business, are needed to bridge the communication gap between the business and IT in managing the EA.

Another important question is the goal practitioners have in mind when using metrics. Four categories of utilization were distinguished: *communicating facts*, *understanding facts*, *decision support*, and *fast overview*. Those categories could again be rated on a five point scale (1 not important – 5 very important). Figure 3.18 gives the results highlighting again metrics as an instrument to facilitate communication.

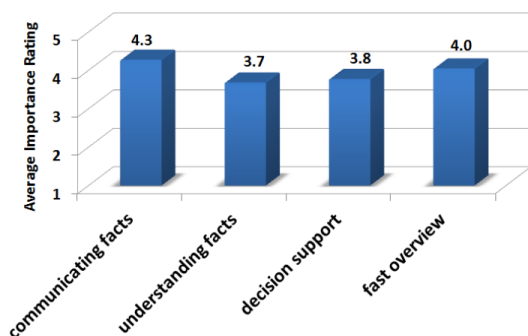


Figure 3.18: What are the goals in using metrics?

Besides the goals of using metrics, we examined the scenarios, in which metrics are used. Par-

ticipants of the survey could rate four different usage scenarios on a five point scale (1 not important – 5 very important). The scenarios were: *understanding problems*, *predict effects of actions*, *setting goals and check their achievement*, and *show status quo and possibilities for improvement*.

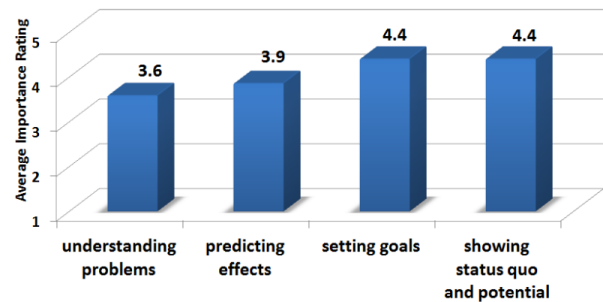


Figure 3.19: What are the usage scenarios of metrics utilization?

The results in Figure 3.19 show that the two usage scenarios *setting goals* and *showing status quo and potential* are of most importance with *understanding problems* being the least important scenario.

Besides the usage scenarios analyzed in the aforementioned question, two different application areas have to be considered: Business and IT aspects.

The business value has to be measured, not only IT efficiency or costs. This demands the business to be part of EA management.

An Enterprise Architect from the Finance Industry

Only if a combination of business and IT related metrics is used in an EA management approach, an integration and collaboration of both stakeholder groups can be achieved.

As a conclusion, metrics can be regarded an important aspect in EA management. In contrast

to this, the interviews showed that only a minor part of the surveyed companies are really using metrics on EA level on a regular basis. Nevertheless, the field of metrics for EA management is a young and promising one, worth future research.

A reason for this difference may be that participants of the online survey were not identical to the participants of the interviews.

The following quotation gives a good indication of how most of the participants in the interviews perceive application landscape metrics.

Basically an interesting subject, but the field is still immature.

The Head of IT Architecture from the
Public Utility Industry

I have seen many different documentations in various styles, ranging from "take the file folder in the shelf behind Anja" to formal descriptions.

A Project Manager from the Financial Industry

The anecdote exemplifies that there are many different approaches to do EA management, which range from very informal ones over typical EA management frameworks to those based on more formal techniques.

In order to find a compromise between these different approaches, we have developed the concept of *EAM Patterns*. These patterns complement existing EA management frameworks, providing a holistic and generic view on the problem of EA management, and provide additional detail and guidance needed to systematically establish EA management in a step-wise fashion within an enterprise.

The EAM Patterns are part of the EAM Pattern Catalog, which identifies the dependencies between

- individual management concerns (Which goal is to be achieved for which stakeholders?),
- management methodologies (Which activities are required to address a given concern?),
- supporting viewpoints (Which diagrams, figures, tables, listings, etc. help stakeholders to collaboratively perform these activities?), and
- information models (Which information is required to create a particular viewpoint?).

Methodologies, viewpoints, and information model fragments are thereby called EAM patterns. An EAM Pattern is a proven practice-based, general, and reusable solution to a common problem in EA management, for a given context, identifying driving forces, denoting known usages, and consequences. They can and may have to be adapted to a specific enterprise context. Four different kinds of EAM patterns are included in the EAM Pattern Catalog: methodology patterns (M-Patterns), viewpoint patterns (V-Patterns), information model patterns (I-Patterns), and Anti-Patterns.

The EAM Pattern Catalog, as a collection of observed proven-practices in EA management supports different usage scenarios for companies in the context of EA management:

- Establishing an organization-specific EA management through EAM Pattern integration
- Inspiring and assessing an already implemented EA management approach
- Specifying requirements and goals for EA management

To support the future development and refinement of EAM patterns and the documentation of additional ones, these patterns are documented in the EAM Pattern Catalog Wiki. This wiki also provides case studies, articles, and latest news on EAM Patterns. It is available online at

<http://eampc-wiki.systemcartography.info>.

Bibliography

- [Bu07] Buckl, S. et al.: *Generating Visualizations of Enterprise Architectures using Model Transformation (extended version)*. *Enterprise Modelling and Information Systems Architectures – An International Journal*. 2(2). 2007.
- [DD04] Department of Defense: *DoD Architecture Framework (DODAF) Version 1.0: Volume I: Definitions and Guidelines*. 2004.
- [In05] IT Governance Institute: *Cobit 4.0*. Rolling Meadows, IL, USA, 2005.
- [JZ92] J.F., S.; Zachman, J.: *Extending and Formalizing the Framework for Information Systems Architecture*. *IBM Systems Journal*. 31(3). 1992.
- [La08] Lankes, J.: *Metrics for Application Landscapes – Status Quo, Development, and a Case Study*. PhD thesis. Technische Universität München, Fakultät für Informatik. Munich, Germany. 2008.
- [Ma08] Matthes, F. et al.: *Enterprise Architecture Management Tool Survey 2008*. TU München, Chair for Informatics 19 (sebis). Germany. 2008.
- [MW05] Macharzina, K.; Wolf, J.: *Unternehmensführung*. GablerVerlag. Wiesbaden. 5 edition. 2005.
- [Ob04] Object Management Group (OMG): *UML 2.0 Superstructure Specification (formal/05-07-04)*. 2005.
- [OM05] Object Management Group (OMG): *UML 2.0 Infrastructure Specification (formal/05-07-05)*. 2005.
- [Th07] The Open Group: *The Open Group Architecture Framework (TOGAF) "Enterprise Edition" Version 8.1.1*. 2007.
- [Th09] The Open Group: *The Open Group Architecture Framework (TOGAF) "Enterprise Edition" Version 9*. 2009.
- [WR04] Weill, P.; Ross, J.: *IT Governance – How Top Performers Manage IT Decision Rights for Superior Result*. Harvard Business School Press. Boston, Massachusetts. 2004.
- [Za87] Zachman, J.: *A Framework for Information Systems Architecture*. *IBM Systems Journal*. 26(3):277–293. 1987.