Enterprise Architecture Strategy Modeling
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Abstract
One of the main concerns for Engineers is how to facilitate and automate the business activities by using technology. In this context, another concern arises, how to make sure that business people and IT people have the same business strategy in place. Through this project is intended to facilitate the communication of strategy to all people of an organization. One very known Strategic Management framework that will be used in this project is the Balanced Scorecard and it also will be used the Motivational Aspect Metamodel (MAM) which is very known in the Enterprise Architecture area and serve mainly to understand the motivations or intentions that explain why the enterprise architecture is made as it is. This project purpose is to extend the MAM in a way that strategy discussion between business people and IT people could be easier, by aligning it with the BSC. Some of the activities that will be done are the concepts mapping between MAM and BSC and the creation of a prototype that will have diagrams (views) of both where these views will have high-level of automated mapping between them using the Enterprise Architect software. In the end, the work will be evaluated by comparing time to finish and number of technical errors, creating the strategy the normal way and with the new metamodel and automation techniques, with real people.

1 Introduction

The main fields addressed in this paper will be Strategic Management and IT Strategy. Some of the main reasons why Strategy is so important is because it needs to deal with limited resources, internal environment, and external environment. Choosing a strategy which doesn’t consider any of these concerns could lead organizations to high costs or even bankruptcy. According to [Johnson02], Strategy is the direction and scope of an organization over the long-term, which achieves an advantage for the organization through its configuration of resources within a challenging environment, to meet the needs of markets and to fulfill stakeholder expectations. According to [Marshall00], to survive and have success in this dynamic environment, organizations should be prepared to rapidly respond to the changes, reorganizing their way of staying in the business when necessary. The elaboration of a coherent business strategy is increasingly becoming a basic necessity for the organizations [Marshall00] [Mintzberg96]. The strategy should exist in a way that can be related to the enterprise reality, guide the action and allow to monitoring of the enterprise [Kaplan96]. According to Kaplan, the explicitness of the business strategy of an organization contributes to the active improvement of the business [Kaplan96]. Related to the importance of the strategy explicitness of the business, Finkelstein says that adequate expressing of the business strategy to make all levels of the organization to understand the strategy is fundamental, but difficult [Finkelstein98].

The creation of models that allows the abstraction of the real complexity and focus on particular aspects of the business, is increasingly a necessity for whom manage and participates in an organization [Eriksson00]. [Mintzberg96] say that creating a common base for the understanding between the many players in the business related to the strategy to follow, are created conditions to exist a bigger focus of all the organization in the goals to obtain and in the way of obtaining them. In this context, is also considered the concern of IT alignment with the Strategy, which most of the today’s organizations already understand the importance. According to Patrick Lencioni, if you could get all the people in an organization rowing in the same direction, you could dominate any industry, in any market, against any competition, at any time. Most of the big organizations already have people that tries to do the bridge between the technology people and the business people, some of the positions for this are the IT managers, senior IT consultants, IT project managers, enterprise architects and even CIOs, all of them have more or less some responsibility to fill this gap, but many executives still complain about the lack of business understanding from the IT people.
1.1 Problem Definition

The problem which this paper wants to solve is how to conceive a collaborative business strategy tool that allows business people and IT management people see the same strategy through models that they learned and use, facilitating the discussion of the business strategy in both sides. This tool needs to automatically map concepts from Balanced Scorecard framework with concepts used in models as the Motivation Aspect Metamodel (MAM), by solving this problem, this paper can also serve as starting point to create a real world application that executive managers and enterprise architects could use and automatically decrease the time needed to model the strategy. When an executive manager has a mental model of the strategy, then he designs the strategy through a model, then the enterprise architect needs to look at that design and preferably get the same mental model. An example of a similar problem could happen between an architect and a civil engineer, where the architect has a mental model of how the house should be done and then design a house plan, and then the civil engineer needs to look at the same plan and preferably get the same mental model of the house. The Figure 1 helps understand this problem.

1.2 Goals and contributions

The goal of this dissertation is to address the identified problem in the previous section. Already exist strategic management frameworks and enterprise architecture frameworks capable of defining and modeling the business strategy, but it still doesn’t exist any tool capable of mapping concepts of both frameworks and automatically create an enterprise architecture strategy modeling based on the strategy defined using the strategic management framework or vice-versa. In this dissertation it is proposed to offer the following contributions in the search for the solution for the identified problem:

- Proposal of extensions (concepts) in the Motivation Aspect Metamodel to optimize the level of alignment with the Balanced Scorecard.
- Development of a table mapping concepts of Balanced Scorecard and the Motivation Aspect Metamodel.
- Development of a prototype of the proposed tool using the Enterprise Architect software and demonstration of an example.
2    Research Methodology

As discussed in this chapter, one of the factors which distinguish the scientific investigation from other works nonscientific is a methodology support and a set of methods and scientific procedures that ensure the scientific validation of the obtained results. The scientific methodology specification will ensure that the investigation can be made by others and provide tools to the investigator to approach the defined problems in a regulated and directed way.

2.1    Scientific Research Question

To formulate this question is considered the chapter 1, which have the problem to solve and chapter 3, which have the related work and helps understand the gaps that exist needed to solve the problem and which are the frameworks that the question should focus. After looking at these factors emerged the following target question in this investigation:

“How to enhance the automatic alignment between a strategy defined with Balanced Scorecard and a strategy defined with the Archimate language”

According to [Yin94], how we approach this issue is essential to define a set of hypotheses or propositions that will serve as a base and justification to the options taken in this investigation, hypotheses which are presented in next section.

2.2    Scientific Research Hypotheses

According to [Yin94] and mentioned by [Vasconcelos01], it should be defined a set of propositions (or hypotheses) that can lead the investigation at the correct way. These hypotheses can reflect a theoretical matter and also indicate where to look for relevant evidence and draw the solution that the investigator have in mind. The set of the presented hypotheses expresses the understanding that the investigator has about the approached issue. These hypotheses are the object of the developed tests along the investigation, with the intention of being individually evaluated. Like the scientific investigation question, the propositions that guide this dissertation were defined after the theme selection, the defined problem in chapter 1, the related work in chapter 3 and, obviously, the chosen scientific investigation question in the last section. The defined hypotheses are in the following table.

<table>
<thead>
<tr>
<th>Hypothesis 1</th>
<th>Is possible to identify and map all concepts of Balanced Scorecard with concepts of Archimate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 2</td>
<td>Is possible to extend Archimate language to increase the alignment with Balanced Scorecard.</td>
</tr>
<tr>
<td>Hypothesis 3</td>
<td>Is possible to create and modify an Archimate view automatically based on the definition of a strategy using Balanced Scorecard without any manual activity.</td>
</tr>
</tbody>
</table>

All these hypotheses will be individually analyzed and their veracity will be evaluated after this investigation. Considering this investigation issue and the defined hypotheses are convenient to make an investigation plan that identifies the select right investigation methodology.

2.3    Evaluation of the work

To validate the work done in this project, the hypotheses need to be evaluated. In this evaluation, it will be compared the number of concepts missing between the initial table of concepts mapping and the table 2 which is the test 1. Test 2 will be the action research method which consists in testing the prototype with real people and verify the value of some measures that can support the work done.

In test 1 will obtain Measure 1 and test 2 will obtain Measure 2 and 3. These measures can be seen in the following table:

<table>
<thead>
<tr>
<th>Measure 1</th>
<th>The decrease of concepts missing number.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure 2</td>
<td>The decrease of modification errors number.</td>
</tr>
</tbody>
</table>
Measure 3: The decrease of average time to complete 3 basic modifications in the views of BSC and Archimate views.

In measure 2, if the user change a specific element attribute and this attribute is different between views, is considered an error. Related to Measure 3, the user will execute 3 modifications in the views without the new metamodel and automatic concepts mapping implemented and then he will do the same to the same view, but with the respective changes. During this process, each modification will be clocked and then the average will be calculated to get the value of Measure 3. The modifications to be done in test 2 are the following:

<table>
<thead>
<tr>
<th>Modification 1</th>
<th>Change goal “Reduce context cost” to “Increase the efficiency of the public administration processes”.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modification 2</td>
<td>Change the work package (project) “Adoption of open software in IGAC” to “Adoption of free software in IGAC” and change the target “Reduction of 46%” to “Reduction of 30%”.</td>
</tr>
<tr>
<td>Modification 3</td>
<td>Related to goal “Reduce costs with the informatics function in Public Administration”, add the work package “Centralization of IT infrastructure between public entities”, add the Measure “Degree of cost reduction in IT infrastructure maintenance” and add the target ”Reduction of 25%”.</td>
</tr>
</tbody>
</table>

Each hypothesis defined should be evaluated by one or more measures. To relate them the following table was created:

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Proofs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 1</td>
<td>Measure 1, since no concepts missing, would mean the veracity of H1.</td>
</tr>
<tr>
<td>Hypothesis 2</td>
<td>Measure 1, since the more concepts mapped, the more easy is to extend and align. Measure 2, since more alignment means less human errors.</td>
</tr>
<tr>
<td>Hypothesis 3</td>
<td>Measure 2, since more automation decreases the number of errors. Measure 3, since more automation decreases the time to finish tasks.</td>
</tr>
</tbody>
</table>

3 State of the art

Since this project will involve 2 main fields as enterprise architecture (EA) and strategic management, this chapter gives an overview of the currently used frameworks and methods in both fields. Naturally, it cannot be exhaustive since the idea is not to explain all the framework and methods that exist in detail, but to have a good overview of the work done until now and then focus on what each one can give of relevant work to the purpose of this investigation. The examples provided in this section will be

3.1 Balanced Scorecard (BSC)

Balanced Scorecard (BSC) is a methodology used for measurement and management of performance, helping an enterprise to clarify and implement its vision and strategy, develop by Robert Kaplan and David Norton, two Harvard Business School teachers. According to [Kaplan94], traditionally, management focus has strongly been on financial aspects, but having financial measures alone are inadequate to guide the future development of an organization, and that they should have measure related to internal processes, customer satisfaction and ability to innovate. A better BSC view can be seen in the Appendix – Balanced Scorecard View, therefore suggests viewing an enterprise from the following four perspectives:

- **Customer perspective** of BSC translates the mission and strategy of the enterprise to specific goals focused in segments that can be communicated to all the organization. It also allows a clear identification and evaluation of value purposes directed to those segments. Allows the measures alignment of satisfaction, loyalty, retention, acquisition and profitability of the target audience and market segments.
- **Financial perspective**, also known as the shareholder perspective, start by defining the long-term financial goal and then connect them with the actions that need to be taken in the other perspectives. The elaboration of BSC should be a stimulus to each business unit of the enterprise, to define the financial goals and then these goals should be bound with the strategy. For almost all the organizations, the following themes are enough: recipe growth, improvement of cost and productivity ratio, improvement of assets utilization and risks reduction can provide enough connections to the four perspectives.

- **Internal business processes** perspective encourages the enterprises to identify which are the needed activities and processes to guarantee the satisfaction of the customer needs. The performance of any organization towards the customers is mainly determined by the processes, decisions, and actions developed in its interior. The internal indicators of BSC should focus on internal processes that will have more impact on the customer satisfaction. It should be indicators of activities in the value chain as planning, marketing, production, sales, etc.

- **Learning and growth perspective** helps identify how the enterprise is trying to innovate and grow, to gain competitive advantage. The pace which the world is changing is increasing faster each day mainly due to the technological disruptions, which the enterprises need to deal with. The enterprises that don’t innovate and learn to adapt to these changes will inevitably get in bankruptcy.

Other relevant concepts used in Balanced Scorecard are:

- **Vision** is a concise statement that defines the mid to long-term (three to ten years) goals of an organization. The vision should be external and market-oriented and should express, preferably in terms of how the organization wants to be perceived.

- **Strategic Objective** is a long-term organizational goal that helps convert a mission statement from a broad vision into more specific plans and projects. Can set the major benchmarks for success and is designed to be a measurable, specific and realistic translation of the mission statement that can be used by management to guide decision making.

- **The driver** is a force, internal or external that can influence the Strategy. External drivers include competition, markets, laws, taxes, customer needs and technological change. Internal drivers include profit goals, mission, and office politics.

- **The measure** is the observable parameters that will be used to measure progress toward reaching the objective, also known as key performance indicators.

- **Target** is the specific target values for the measures.

- **The initiative** is an action program or project to be initiated in order to meet the objective.

A simple example of the PGETIC Strategy defined using Balanced Scorecard would be the following.

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**Fig. 2.** - PGETIC Balanced Scorecard from [PGETIC15]
3.2 Motivation Aspect Metamodel

The Motivation Aspect Metamodel is part of the Archimate 2.1 Specification and consists of a group of motivational concepts and their relationships which are used to model the motivations or reasons that underlie the design or change of some enterprise architecture. The current metamodel of MAM is the following.

Viewpoints are a specification of the convention to build and use views. A simple example of the PGETIC Strategy, with only the customer perspective part, modeled using this metamodel is the following:

Please, note that with current metamodel is not possible to identify the difference between measure and the targets of this view. Is used data objects and in that case the concept used for measures and targets would be the same.

This section intention is to show the similarities and differences between BSC and MAM. Before mapping the concepts we should also consider that a perspective in BSC is the same as View in Archimate. View, according to IEEE 1471 / ISO 42010, is (part of) a system from the perspective of a number of concerns.
(derived from stakeholders). [Kaplan94] suggests viewing an enterprise from four perspectives: (1) customer, (2) financial, (3) internal business processes and (4) Learning and growth. Taking that into consideration we can consider the system as being the strategy and view as being the perspective. [Kaplan94] also suggests that each perspective focus in different aspects, just like the view focus in different concerns. That’s why in this paper is proposed to map the concepts of View to the concepts of Perspective, as an example, we could have a Customer View mapped with the Customer Perspective. The initial table of concepts mapping is the following:

<table>
<thead>
<tr>
<th>Balanced Scorecard concept</th>
<th>Balanced Scorecard concept description</th>
<th>Archimate concept description</th>
<th>Archimate notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
<td>Is a force, internal or external that can influence the Strategy. External drivers include competition, markets, laws, taxes, customer needs and technological change. Internal drivers include profit goals, mission, and office politics.</td>
<td>Is something that creates, motivates, and fuels the change in an organization.</td>
<td><img src="#" alt="Driver" /></td>
</tr>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>Is an outcome of some analysis of some driver. An assessment may reveal strengths, weaknesses, opportunities, or threats for some area of interest.</td>
<td><img src="#" alt="Assessment" /></td>
</tr>
<tr>
<td>Strategic Objective</td>
<td>Is a long-term organizational goal that helps to convert a mission statement from a broad vision into more specific plan and project. Goals set the major Benchmarks for success and are designed to be measurable, specific and realistic translations of the mission statement that can be used by management to guide decision-making.</td>
<td>Is an end state that a stakeholder intends to achieve. An end can represent anything a stakeholder may desire, such as a state of affairs, or produce value.</td>
<td><img src="#" alt="Goal" /></td>
</tr>
<tr>
<td>Vision</td>
<td>Is a concise statement that defines the mid to long-term (three to ten years) goals of an organization. The vision should be external and market-oriented and should express, preferably in terms of how the organization wants to be perceived.</td>
<td>Is an end state that a stakeholder intends to achieve. An end can represent anything a stakeholder may desire, such as a state of affairs, or produced value.</td>
<td><img src="#" alt="Goal" /></td>
</tr>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>Is a statement of need that must be realized by an element. Requirements model properties of these elements needed to achieve the ends (modeled by goals), representing the means to realize goals.</td>
<td><img src="#" alt="Requirement" /></td>
</tr>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>Is a restriction on the way in which a system is realized on the implementation of the system (e.g.: specific technology to be used) or on the imple-</td>
<td><img src="#" alt="Constraint" /></td>
</tr>
</tbody>
</table>
Table 1 – Initial Alignment between Balanced Scorecard and EAMS

<table>
<thead>
<tr>
<th>Balanced Scorecard</th>
<th>Balanced Scorecard concept description</th>
<th>Archimate concept description</th>
<th>Archimate notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>Is the specific target value for a measure.</td>
<td>Is the specific target value for a measure.</td>
<td><img src="https://via.placeholder.com/150" alt="Target" /></td>
</tr>
<tr>
<td>Measure</td>
<td>Is the observable parameters that will be used to measure progress toward reaching the objective, also known as key performance indicators.</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Initiative</td>
<td>Is an action program or project to be initiated in order to meet the objective.</td>
<td>A work package has a clearly defined beginning and end date, and a well-defined set of goals or results. The work package concept can be used to model projects, but also, e.g., sub-projects or tasks within a project, programs, or project portfolios.</td>
<td><img src="https://via.placeholder.com/150" alt="WorkPackage" /></td>
</tr>
</tbody>
</table>

Please note that the definition of concepts in Archimate is according to [OpenGroup]. In this table is possible to see the missing of concepts that can model the perspective of the Balanced Scorecard methodology and with that, we can conclude that the current metamodel doesn’t have all the concepts needed to be completely aligned with the BSC. This project doesn’t intend to create the concepts missing on the left side related to BSC but to create or identify the concepts missing on the right side related to MAM.

4 Proposed solution

In this chapter is intended to show the beginning of the solution for the defined problem in this paper, answering to how it will begin the work that must be done to accomplish the goal and contributions defined in section 1.1. To start is presented the newly developed concepts for MAM and why to use the m, then is presented the prototype which will be used and how it was done.

Considering the concept measure defined in Balanced Scorecard is proposed to add a concept called measure to the metamodel. Considering that in the Balanced Scorecard, the measure is always associated with one strategic goal, in this project, the new concept measure will be associated with a goal. Another new concept created in the metamodel is the target which intends to specify a specific value for the measure. Both could be create by using the concept business object, which according to [Vasconcelos01] already exists and consists of a passive element that has relevance from a business perspective and could be used to represent information assets that are relevant from a business point of view but is also abstract in a way that could be used to represent any type of information (e.g.: requirements, measures, targets, etc), being difficult to differentiate between the various types of information. The new concepts are the following:

<table>
<thead>
<tr>
<th>Balanced Scorecard</th>
<th>Balanced Scorecard concept description</th>
<th>Archimate concept description</th>
<th>Archimate notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>Is the specific target value for a measure.</td>
<td>Is the specific target value for a measure.</td>
<td><img src="https://via.placeholder.com/150" alt="Target" /></td>
</tr>
</tbody>
</table>
Measure | Is the observable parameters that will be used to measure progress toward reaching the objective, also known as key performance indicators. | Also known as Key performance Indicators is a type of performance measurement that evaluates the success of a goal.

| Measure | Measure |

Table 2 – Initial Alignment between Balanced Scorecard and EAMS

Please note that it still has some N/A (not available) concepts on the left side of the initial table related to the BSC concepts, but this project goal is not to change the BSC, despite that’s a chance of proposing some changes in the future. Taking into consideration the new concepts, the following metamodel is suggested.

Fig. 5 - New Metamodel

Is possible to see the customer perspective of PGETIC defined using BSC at Figure 3 in Section 3.1 and modeled with the current used metamodel in Figure 5 in section 3.2, but by viewing this last is not possible to identify to which perspective or which measures are used because the current metamodel doesn't have concepts that can symbolize those. But with the new metamodel is possible to define a complete model of the same strategy, which is the following.

Fig. 6 - PGETIC Strategy, customer perspective only, modeled with the new metamodel
5 Conclusion

In this project is demonstrated the feasibility of a tool creation that allows business people and IT management people see the same strategy through models that they learned and use, by using MAM and BSC, and fulfilling the missing gap between them. Some contributions already made is the new suggested concepts and metamodel and is intended to create the XML file that can be used by applications of both sides and allow the intended alignment. It also was mentioned that is intended to use the PGETIC Strategy as a use case, by defining the strategy using Balanced Scorecard and then, exporting to an XML file (based on the new metamodel) that can also be used by the EAMS. The evaluation can be done by comparing the number of missing concepts between BSC and MAM, and taking into consideration the main stakeholders opinion on the level of alignment that this tool allows.

References


[OpenGroup] OpenGroup, Immigration and Migration Concepts (Chapter 11.2)
http://pubs.opengroup.org/architecture/archimate2-doc/

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