

# Modelling strategy with ArchiMate

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## ABSTRACT

This paper investigates whether the ArchiMate modelling language can be used to model the most commonly used strategy models and concepts. This can be considered as an important step into closing the gap between Business and IT. By having a better understanding of what is needed to model strategy, we can analyse if the current version of the ArchiMate modelling language is sufficient or what additions need to be made. Also by knowing how the strategic concepts are used in the context of business we hope to improve the way they are modelled with ArchiMate. In order to do this, we start by taking a look at the strategic planning process and identify its main concepts. It starts by presenting the strategic planning process and its corresponding concepts and strategy models. This is followed by an analysis of the suitability of ArchiMate in which we argue that resource and capability concepts are concepts that should be included in the next versions of the language. Lastly, we demonstrate how strategy can be modelled with the help of a case study.

## Categories and Subject Descriptors:

Applied computing - Enterprise architecture

## Keywords

Strategic planning process; business strategy; ArchiMate; enterprise engineering; modelling strategy.

## 1. INTRODUCTION

In recent years it has become more and more clear that in order for businesses to have a good performance they need to master both strategy design and strategy implementation. This means that an organisation needs to equally master the business and IT domains and find an alignment between the two. Business scholars have been trying to adapt the existing strategy models and methods to accommodate for the needs of the IT domain. An example of this is the Balanced Scorecard which has been adapted to use IT measurements [1], [2].

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There has also been an increase in interest among enterprise architecture scholars to model strategy. This has manifested itself in the form of the Motivation extension being added to ArchiMate [3], mapping of the Business Model Canvas with ArchiMate [4], [5], and propositions for further extension of the ArchiMate language with the concepts of Resource and Capability [6].

Although there is interest on both sides to bridge the gap between disciplines, the current models, methods, methodologies, frameworks are not mature or complete enough to improve the alignment between business and IT. In this paper we are investigating one side of the discussion that looks at the suitability of the ArchiMate language for modelling strategy. It is worth mentioning that in the development of the Motivation extension of ArchiMate several existing standards for goal modelling such as the Business Motivation Model [26] have been considered [27]. Our intent is to determine if, after these additions, ArchiMate is mature enough to support strategy modelling.

The recent developments provide us with tools to model strategy with the help of enterprise architecture, but they do not show us how to model it. This is needed in order to show how elements in the architecture of an organisation contribute to the strategy, or how changes to it may contribute to implementing the strategy. Also, by knowing how to model strategy we can determine how strategy impacts the enterprise architecture. This can be used to run impact analyses and determine which course of action is best aligned with the strategic intent (scale, money, time).

The goal of this paper is to investigate if and how ArchiMate can be used to model strategy. This is done by determining if the language supports all of the most commonly used strategy concepts and, if necessary, how the current concepts can be specialized to express more specific strategy concepts directly. The ArchiMate modelling language was chosen as a basis for this work because it already contains a series of strategy concepts through the Motivation extension, and it is also one of the most used languages for enterprise architecture.

The main theoretical contribution of this paper is an assessment of the current ArchiMate language and its suitability to modelling strategy. We also suggest several improvements that can be made in order to increase the expressiveness and ease of use of language in the context of strategy. The main practical contribution is a demonstration of how enterprise architects can use the ArchiMate language, with our proposed recommendations, to model strategy.

The main benefit of this approach is that the high level strategies and goals of an organisation can be directly linked to its detailed architecture. Thus the impact of organisational change resulting

from new strategies can be easier and more accurately determined than by using a business model. For example, the Business Model Canvas, which presents a high level view on an organisation, is limited in the amount of information that can be used for analysis and decision making. Thus an analysis of the architecture of an organisation, with the help of ArchiMate, would yield a deeper understanding of how its resources and capabilities would contribute to developing or implementing a specific strategy.

The research methodology we follow in this study is the design science research methodology proposed in [7]. The research activities suggested by [7] have also shaped the structure of the paper, as described below. The introduction presents the problem addressed in this paper and presents the general idea underlying the core contribution. Section 2 includes a review of the strategic planning process and its core concepts. Section 3 provides a description of the ArchiMate core modelling language and its extensions. In Section 4 we assess the suitability of the language from a strategy perspective. Section 5 provides a demonstration of how the ArchiMate modelling language can be used to model strategy. The paper concludes with a discussion of the proposed approach, conclusions and pointers to future work (Section 6).

## 2. STRATEGIC PLANNING PROCESS AND CONCEPTS

The strategic planning process is a topic that has been thoroughly discussed and analysed over the years. Even though this is a very competitive field of research and opinions may vary from scholar to scholar, there is still a common understanding of what the main steps of the strategic planning process are: strategy analysis, strategy formulation and strategy implementation. [8], [9], [10] state that an important addition to these steps is the visioning process, which should serve as a starting point for the strategic planning process. To all of these steps several strategy models and concepts can be assigned [25]. In the following paragraphs we will present the most common concepts that are associated with the different steps of the strategic planning process (Fig. 1). Aldea et al. [25] propose a method which integrates all the steps of strategic planning process and ArchiMate.

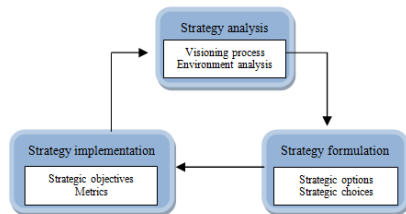


Figure 1 - Strategic planning process

### 2.1 Strategy analysis

The visioning process can be described as the process of clarifying values, focusing on a mission and stretching the horizon with a vision [10]. The main concepts that can be derived from this step are the mission and vision.

The mission should indicate the activities of an organisation and what it does or intends to do on a daily basis [11]. It should be generic enough to cover all the strategies of an organisation and it should make the vision operative. This means that a mission should indicate the activities of an organisation that are meant to make the vision a reality.

The vision is usually considered to describe a desired ideal future of an organisation. It can be as vague as a dream, or as precise as a goal or a mission statement [12]. In most cases the vision of an organisation needs to be measurable and achievable, thus it resembles more a goal than a vague dream.

The concept that plays a central role in the following steps of the strategic planning process is the strategy. This seemingly simple concept is surrounded by quite some debates in the world of strategic management. The most common definition of strategy considers it as being a plan for the future and/or a pattern of behaviour [13]. In layman's terms, strategy refers to what an organisation intends to do and how it intends to do it in order to fulfil its vision in the long run. It also helps support the mission.

The mission and vision of an organisation serve also another purpose. They are used by organisations to communicate, at a high level, to their environment and stakeholders what their activities are and what they intend to achieve in the future. This can also be considered to be a main differentiator to strategy, which is usually only communicated internally, since it is seen as an organisation's source of competitive advantage.

Before making any decisions regarding what strategy an organisation should use in order to improve itself or its position in the market, there is the question of knowing their environment, both internal and external. This entails analysing the environment and determining which factors are influencing the organisation. The most commonly used categorization for factors is strengths, weaknesses, opportunities and threats. According to [14], [15], the most relevant strengths and weaknesses of an organisation come from an analysis of their resources and capabilities. The most relevant opportunities and threats can come from the macro-environment of organisation [16], [17].

### 2.2 Strategy formulation

Once the analysis of the environment is complete, the most influential factors are selected, and these will become the driving forces behind new strategy development [18]. The combination of these strengths, weaknesses, opportunities and threats can help create a series of alternative strategies which are meant to take advantage of the strengths and/or opportunities of an organisation and/or combat their weaknesses and/or threats.

### 2.3 Strategy implementation

In order for a strategy to be implementable in an organisation, it needs to be translated into specific measurable objectives [Kaplan & Norton, Measures that drive performance]. These objectives are statements of specific outcomes that are to be achieved [19] and are usually accompanied by performance measures, specific targets they need to achieve, and also initiatives that can be implemented to achieve them [20].

As a conclusion of this section, the most important concepts that can be identified from the strategic planning process are: mission, vision, strategy, analysis, resources, capabilities, factors, objectives, measures, targets, and initiatives.

## 3. ARCHIMATE

As mentioned before, the Motivation extension of ArchiMate was introduced to model the motivation (goals, requirements, etc.) behind an enterprise architecture. An enterprise architecture

should implement the organization's strategy. In that sense, it is (part of) the motivation for the architecture. Therefore we want to investigate if ArchiMate, and the Motivation extension in particular, is suited for modelling strategy. Before presenting how this modelling can be done, we first take a look at the ArchiMate core and at its two extensions: the Motivation extension and the Implementation and Migration extension.

### 3.1 ArchiMate core

The core language distinguishes between three layers: the business layer, the application layer, and the technology layer. Each of these layers contains structural, behavioural and informational aspects, and also defines relationships between and within the layers (Fig. 2). A complete description of the ArchiMate language is offered by [21].

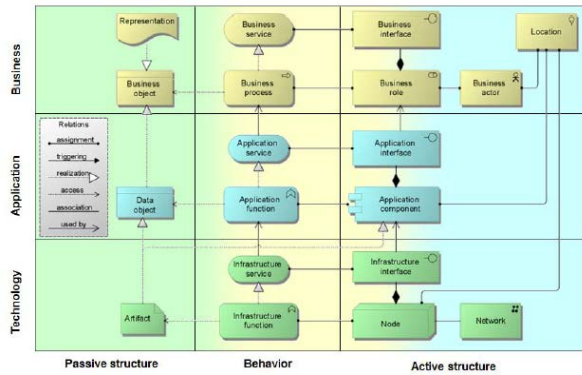


Figure 2 - ArchiMate core metamodel

### 3.2 Motivation extension

The role of the motivation extension is to allow for the modelling of motivations or reasons that underlie the design or change of some enterprise architecture [21]. For this reason, the motivation extension is the main focus of this paper (Fig. 3). Within this extension the following concepts are defined [21]:

- Stakeholder describes a person or a team that has interests or concerns regarding the outcome of the architecture;
- Driver represents an internal or external force that triggers and motivates change in an organisation;
- Assessment is used to describe the outcome of a specific analysis on a driver;
- Goal is used to describe an intended result that a stakeholder wants to achieve;
- Requirement is used to describe what is needed to be able to achieve a specific goal;
- Constraint represents restrictions to the way a goal can be achieved;
- Principle is used to design the means to realize a goal.

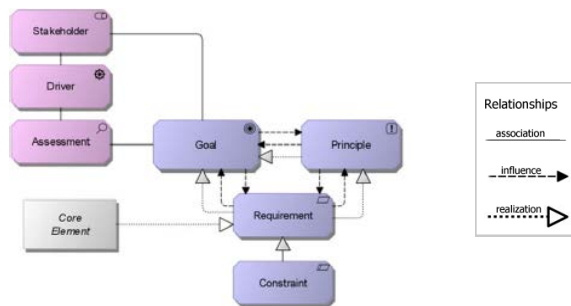


Figure 3 - Motivation extension metamodel

### 3.3 Implementation and migration extension

The implementation and migration extension describes concepts that support the modelling of the architectural change process and provides insight into these changes and into portfolio and project management decisions (Fig. 4). The extension introduces the following concepts [21]:

- Work package is the central behavioural concept which defines a series of actions designed to accomplish a goal within a specific time. It can be used to model projects, subprojects, programs, or project portfolios;
- Deliverable is used to model the precise outcome of a work package;
- Plateau is used to model the state of the architecture that exists for a limited period in time. Can be used to model baseline, transitional, and target architectures;
- Gap is used to model the differences between two plateaus.

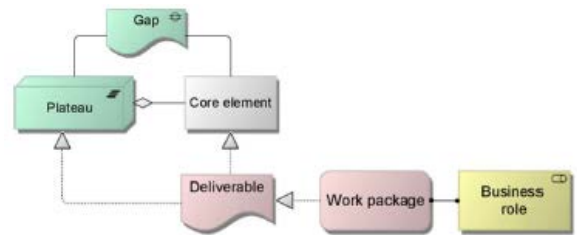


Figure 4 - Implementation and migration metamodel

Figure 5 shows how the Resource and Capability concepts can be related to the Implementation and Migration extension concepts.

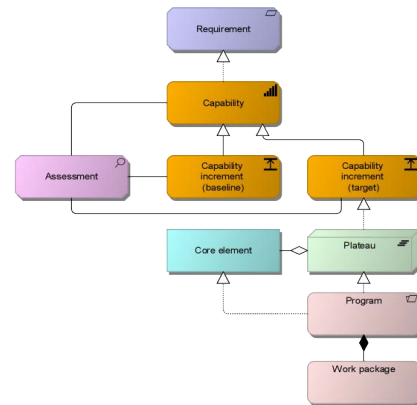


Figure 5 - Resource and Capability to Implementation and Migration metamodel

## 4. MODELLING STRATEGY WITH ARCHIMATE

Several strategic concepts have been identified in section II. Within this section we revisit these concepts and determine to what extent they can be represented by using the motivation extension of ArchiMate. We will look at the expressiveness of these concepts (if it includes all the necessary concepts and relations) and ease of use (if the ArchiMate concepts are intuitive enough and can be used to model strategy concepts directly).

- Mission. This concept is mostly used to determine what organisations are doing or intending to do on a daily basis. It could be considered as a more specific goal for the behaviour

of the organisation on a more day-to-day basis. Thus it could be modelled with the Goal concept.

- Vision. From the definition [12] of this concept we can conclude that it could be considered as a more high-level goal. Thus the vision concept could be modelled using the Goal concept.
- Strategy. This concept is used to describe a plan for the future and/or a pattern of behaviour, and could be considered as a goal that needs to be accomplished in order to achieve the vision of an organisation. Thus the strategy can be modelled with the Goal concept of ArchiMate.
- Analysis. This concept is already defined in the motivation extension as Assessment of internal and external drivers.
- Resource and Capability are two concepts that do not have a direct equivalent in ArchiMate. These concepts are also considered by [6] and are suggested to be added as an extension to the language.
- Factor. This concept is already defined in the motivation extension as Driver that represents the internal and external factors that can influence an organisation.
- Objective. Since the objective is a statement of specific outcomes that are to be achieved, this is considered to be in line with the definition of the Goal concept of ArchiMate.
- Measure and Target. Since these two concepts are properties that can be associated with objectives, we propose to define them as attributes of Goal.
- Initiative. This concept represents what will need to be done in order to achieve objectives. Since the requirement concept from ArchiMate is used to model what is needed to be able to achieve a specific goal, we propose that initiative can be modelled with the Requirement concept.

From this we can see that the Motivation extension of ArchiMate can be used to model the majority of the strategy concepts, with the exception of the resource and capability concepts. [22] propose the following metamodel to support the addition of these concepts (Fig. 6):

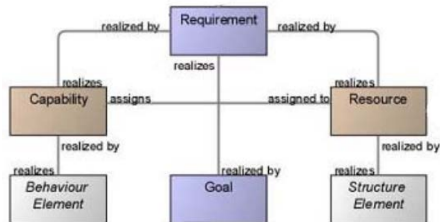


Figure 6 - Resource and Capability metamodel

In order to facilitate the modelling of strategy with ArchiMate we also propose the way these concepts relate to each other by using standard ArchiMate relationships. The conceptual model can be seen in Fig. 7 and the explanation of the relationships can be seen in Table 1 (Proposed relationships for the conceptual model). According to [28], if we consider the transitivity of relationships possible in ArchiMate, we can make abstractions like, a certain Capability or Resource is associated to a strategy. Several of these abstractions can be made in order to facilitate stakeholder-specific visualisations.

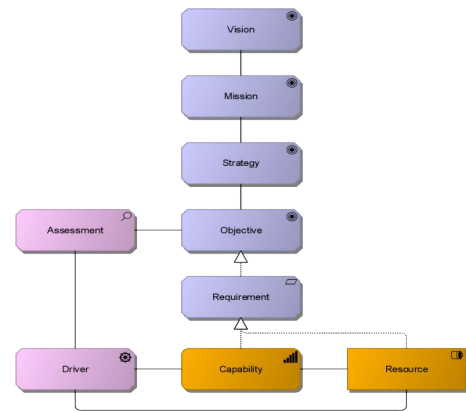


Figure 7 - Modelling strategy with ArchiMate

So far we have analysed if the identified strategy concepts can be represented by existing ArchiMate concepts. Now we will look at how intuitive these concepts are when modelling strategy. One main problem can be immediately identified when looking at how many strategy concepts need to be modelled with the Goal concept. In theory the mission, vision, strategy, and objective are all different levels of goals. But when using the same concept to model all of them, they lose their distinctive purpose. We propose that in order to keep the identity of these concepts, we do not add more concepts to ArchiMate, but to create an ‘add-on’ for strategy modelling using the standard extension mechanism of ArchiMate. This mechanism allows one to introduce specializations of an existing ArchiMate concept, thereby inheriting the relationships of this concept with other ArchiMate concepts. In this case, specializations of the Goal concepts can be introduced to model the vision, mission, strategy, and objectives of an organization explicitly. With the specialized concepts, dedicated and intuitive notations can be introduced for ease-of-use and clarity. Fig. 8 depicts the specializations of the Goal concept.

## 5. VALIDATION

In this section we present the application of the proposed modelling of the strategy concepts with the Motivation extension of ArchiMate. For this purpose we use the anonymized case of a healthcare organisation.

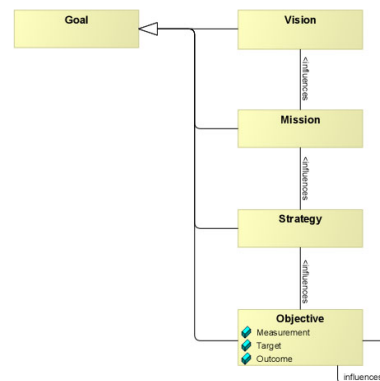


Figure 8 - Metamodel of the specialization of the Goal concept

**Table 1 - Proposed relationships for the conceptual model**

Concept 1	Concept 2	ArchiMate relationship	Meaning and motivation
Mission	Vision	Influence	According to the [12] the mission should operationalize the vision of an organisation. In other words, the mission can be used as a basis to achieve the vision, thus it influences the vision.
Strategy	Mission	Influence	According to the [12], a strategy can be considered as a part of the plan to implement the mission. Thus it can be said that the strategy implements the mission.
Assessment	Driver	Association	As mentioned before, the drivers are analysed with the help of an assessment.
	Goal	Association	The outcome of the assessment of a driver can either dictate the need for new goals, the adaptation of current goals, or that the current goals are in line with the driver. Thus the goal addresses the assessment.
Resource	Driver	Association	According to [14], the most influential internal drivers come from the resources of the organisation.
	Capability	Used by	According to [22], capabilities are defined as the ability to employ resources to achieve some goal. This can be translated to capabilities use resources to achieve a goal.
Capability	Driver	Association	According to [15], organisational (dynamic) capabilities can be considered to be sources of competitive advantage for an organisation. Thus any weak capabilities can become concerns for organisations.
Driver	Stakeholder	Association	The internal and external drivers can be seen as concerns that stakeholders have and that influence their decisions and behaviour.
	Goal	Association	Since the drivers influence the stakeholders and the stakeholders have goals, it can be said that the drivers influence the goals as well.
Objective	Strategy	Influence	The organisational strategy is decomposed in multiple types of organisational objectives. Thus it could be said that a strategy influences the objectives [24].
	Objective	Influence	The objectives of a strategy can be elaborated in layers that are supposed to have an influence on each other. Thus it could be said that an objective influences another objective [24].
	Attributes		Each of the objectives of an organisation need to have the following aspects determined: measurements, targets, and outcomes after completion of the projects [24].
Initiative	Objective	Realization	The initiatives that are determined are meant to help achieve the objectives. Thus it could be said that the initiatives are meant to implement the objectives of an organisation.
Stakeholder	Goal	Association	Every stakeholder in an organisation has a certain stake, thus has certain goals that he/she would like to be achieved
	Role	Specialization	As mentioned in the definition, the stakeholder is a role that an actor can have in an organisation.

**5.1 Strategy analysis**

The current mission statement of PRO-fit is: We offer the most innovative healthcare services with a quick and reliable solution.

Their current vision is: In the next 5 years we strive to become the leading provider of healthcare services in the country.

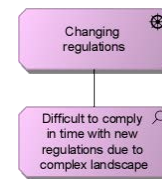
Fig. 9 illustrates how the mission and vision can be modelled by using the Goal concept.



**Figure 9 - Mission and Vision**

In order to determine what the best course of action for the organisation would be we need to analyse and model the factors

that might influence it from the internal and external environments. For example, if we consider that the changes in the tension of industry rivalry would affect the organisation, according to [18] we would look at the following five aspects: political, economic, socio-cultural, technological, legal, ethical factors. Fig. 10 illustrates an analysis of the changing regulations factor (legal).



**Figure 10 - Analysis of industry drivers**

According to [14] and [15], the most influential internal drivers come from the resources and capabilities of an organisation. Fig. 11 shows how the analysis of the customer process handling capability can be modelled.

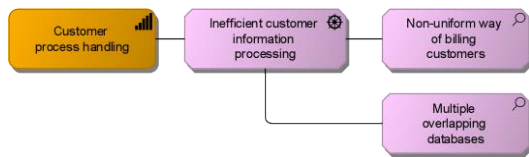


Figure 11 - Analysis of a capability

By analysing the capabilities of the organisation we can see that they have a capability for regulatory compliance. This capability can be linked to the analysis of the external factor for changing regulations. The concern for rules changing can have a direct link to the regulatory compliance capability. Fig. 12 shows how this can be modelled.



Figure 12 - Link between capabilities and external factors

## 5.2 Strategy formulation

When formulating new strategies, an organisation needs to consider which concerns from its internal and external environment it wants to address, and how it wants to do that. For example, in order to deal with the changing regulations and the inefficient customer information processing we can determine that a course of action could be to centralize the underlying IS. Fig. 13 illustrates how this strategy can be modelled.

## 5.3 Strategy implementation

Based on the formulated strategy we can go in more detail in order to prepare it for implementation. According to [24] we need to divide this strategy into objectives, determine measures, targets, and initiatives. Let's take for example the Centralize IS strategy. Based on the assessment of the driver we consider the objectives of eliminating local variance, facilitating resource sharing, and improving information sharing. This can be implemented by consolidating applications, harmonizing processes, and centralizing information. Fig. 14 illustrates how these objectives can be modelled.

Now that all the steps of the strategic planning process have been completed, we can see how all of this can be modelled together (Fig. 15).

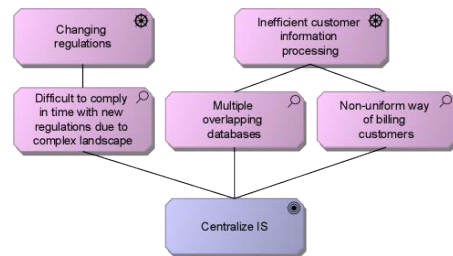


Figure 13 - Formulation of a strategy based on drivers and assessments

We can express all of the relevant information from the strategic planning process, and by suggesting a hierarchy with the way the goals are modelled, we can determine which are the higher level goals (mission, vision), the middle level goals (strategy), and the low level goals (objectives).

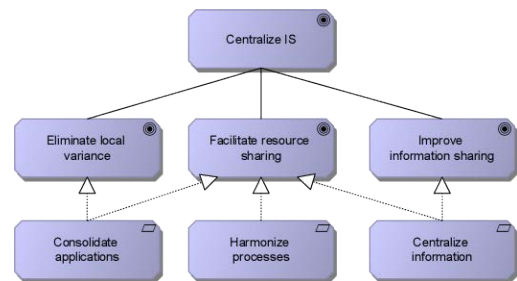


Figure 14 - Implementation of a strategy

Another aspect to be shown is how changes in strategy can impact architecture. We continue with the same example as we had previously. According to the requirements that have been formulated for the Centralize IS strategy, we can model the corresponding capability increments, the plateaus, and corresponding programs (Fig. 16). The next step to the process would be to model the corresponding work package/projects that need to be implemented in order to realize the Centralize IS strategy.

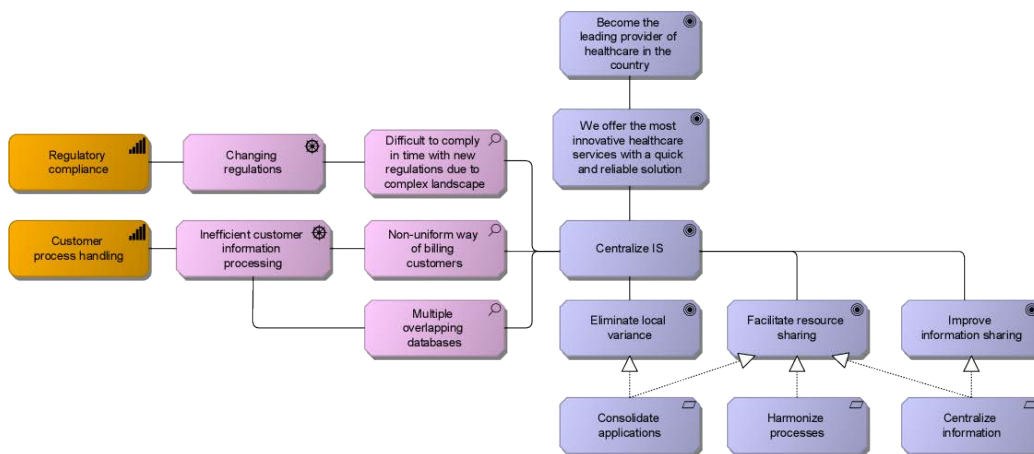
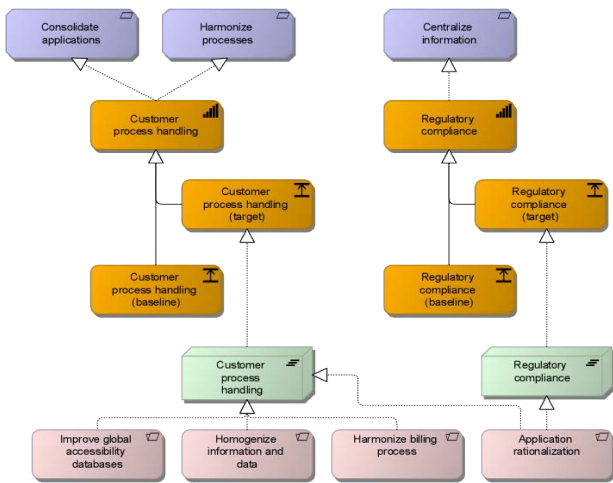


Figure 15 - Modelling the strategic planning process with ArchiMate

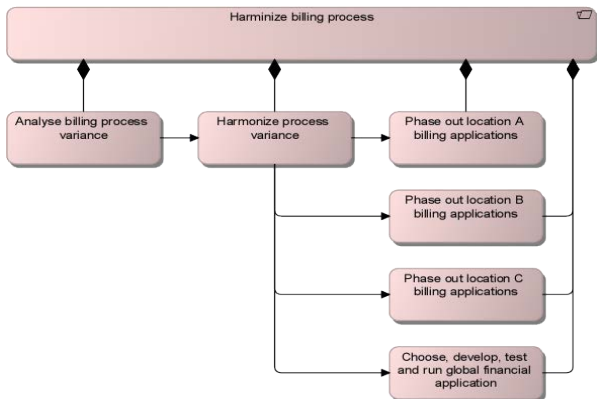


**Figure 16 - Capability increments, plateaus and programs**

We take the example of the Harmonize billing process program and model the corresponding projects (Fig. 17).

### 5.4 Benefits of modelling strategy with ArchiMate

Modelling strategy with ArchiMate can open the door to new possibilities for linking strategy to portfolio management, capability-based planning, and the architecture of an organisation. Several benefits can be result from these relationships. For portfolio management we identify three benefits:



**Figure 17 - Programs and projects**

- Clarify the contribution of projects to strategy by having a relationship between projects and the strategy they help implement. Projects can be grouped and prioritized per strategy by assigning values to them. As portfolio management develops within ArchiMate, more advanced analyses can be performed to determine how much each project contributes to a strategy and to the overall direction that an organisation wishes to pursue. For example for the case we presented earlier, we can see that the “Phase out location A billing application” has a direct contribution to the Centralize IS strategy facilitates the definition of business cases for projects by knowing which concerns they are addressing and how these concerns are related to a strategy. This information can help determine the expected benefits of

projects. Also during strategic planning several metrics are determined which can be used for portfolio management.

- Support investment decisions by knowing exactly which projects contribute to which strategy. By using the relationships between projects and strategies combined additional information regarding costs, benefits, contribution (% or #) we can create detailed models and viewpoints of project portfolios and help make decisions.

For capability-based planning we identify two main benefits:

- Make strategic decisions based on organisational capabilities that need to be improved. By doing this an organisation can make decisions and create new strategies that are targeted at improving its weaknesses. Like in the example in our case, the Centralize IS strategy was formed based on the two capabilities that represent concerns to the organisation.
- Use organisational capabilities to further develop an organisation. By using fully developed capabilities (strengths), an organisation can plan for future growth with new capabilities, functions, etc.

For the general architecture we can determine two main benefits:

- Determine the impact of new strategies on the architecture of an organisation. By having a link between a strategy and architecture we are able to make models to visualize how a strategy with new goals, objectives, requirements and projects will influence the organisation.
- Determine how changes in the architecture can affect a strategy. If an element of an architecture is changed or removed it could have an impact on a strategy if it was associated to that strategy. For example if a core application that is used by strategy is removed, then that specific strategy can no longer be realized, unless the application is replaced by an equivalent one.

## 6. DISCUSSION AND CONCLUSIONS

In this paper we provide insight into how strategy can be modelled with ArchiMate. In order to do this, we look at the suitability of the language. We assess it in terms of expressiveness (if it includes all the necessary concepts and relations) and ease of use (if the ArchiMate concepts are intuitive enough and can be used to model strategy concepts directly). We show that the language does not include all the necessary concepts to model strategy. With the addition of the resource and capability concepts as an extension to the language, modelling of strategy is possible. We also propose that the concept of goal should be specialized to model the mission, vision, strategy and objectives of an organization directly. This improves ease of use and clarity.

With the case study we validate the proposed metamodel by showing how strategy can be modelled. By relating strategy to architecture we open the door to new possibilities such as making impact analyses of strategy on architecture and of changes in architecture on strategy. Further uses of this relation could be of supporting investment decisions, facilitating the definition of business cases for projects, clarifying the contribution of projects to strategy (portfolio management), etc. We suggest that further research should be done to investigate these possibilities and into improving the expressiveness and ease of use of.

## 7. LIMITATIONS AND FUTURE WORK

There are several limitations to our work so far. We have determined that the ArchiMate language is not very easy to use when trying to model multiple strategy concepts with the Goal concept. We have proposed introducing specialisations of the Goal concept, but we done only preliminary research into what visualisations these specialisations should use. The final results of this research will be included in future work.

We have discussed the benefits of modelling strategy with ArchiMate for portfolio management and capability-based planning. These benefits are the results of preliminary experiments with the case study presented. Further research needs to be done in order to refine and further validate them. We have also looked into several analyses that can be used to complement these benefits, the results of which will be subject to future work.

Another limitation comes from the Resource and Capability extension, which is still not finished. The concept of capability increment is at the moment a concept, but further research needs to be done to determine if it is appropriate considering that there the concept of plateau exists but there is no concept of time.

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