Business IT Alignment between Business Model and Enterprise Architecture with a Strategic Perspective

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ABSTRACT

In this paper, we put forward a visualization that can support the transition between a business model and an IT infrastructure. It is based on a combination of existing models: enterprise architecture and the Business Model Canvas. We show how the proposed visualization, which has a strong focus on a business model strategy, can help IT alignment. It can do so at both the business model level and at the IT infrastructure level, thanks to a correspondence between both paradigms in the intermediary model. The presentation of the intermediary model is followed by an example of a use case.

Keywords: Business Model, IT Alignment, Enterprise Architecture, ArchiMate, Business Model Canvas

INTRODUCTION

Information technology (IT) is becoming more and more ubiquitous, changing the way we exchange information and extending the realm of possibilities. This is true not only for information technology itself, but also for all domains that interact with it. Faster computation, together with increased storage and bandwidth, make it possible for new services to be introduced; in turn, this offers the potential for new business models, lower barriers of entry, more competition, and new innovation. Whether dealing with an existing business or a start-up, the key is to design and iterate around their business models. Furthermore, new services, such as cloud computing, offer an opportunity to experiment with new business models without having to make huge investments in IT infrastructure. Nonetheless, a business model strategy still needs to be aligned with its processes and any supporting IT applications, regardless of whether IT infrastructure is virtual or physical.

As stated by Van Burren et al. (van Buuren, Gordijn, & Janssen, 2005, p. 2):

Enterprise architecture and business modeling methodologies meet in service offering and realization. In general, business models focus on the service value generated by a business, whereas enterprise architecture models show how a business realizes these services. Linking these approaches results in a powerful modeling tool that couples the value exchange between businesses and the costs that are required to realize these services

As well as having the potential for linking costs, we sought to provide a way to identify key activities and resources that support business models, as well as highlight under-utilized assets. In turn, this helps in our awareness of new business model opportunities. The identification of key components can be helped by matching the business model and infrastructure to patterns of known combinations of components.

The objective of this paper is to propose a model construct that assists the transition between a business model and an enterprise architecture model. This should allow for a better alignment of the business model's value proposition with the IT infrastructure necessary to make such a transition. Therefore our research question can be formulated as:

Is there an intermediary model that can facilitate the alignment between a business model and enterprise architecture, using a formalism that is accessible to users of both paradigms?

This paper is structured according to the guidelines of a design science research article by Gregor and Jones (2007). In the following section we will describe related studies on the topics of the modelling of business models and enterprise architecture, and the relationships between them. We then describe how our research fits into design science methodology. In the fourth section, we propose a new business visualization for an enterprise architecture that is based on a combination of different models. These models are described in terms of existing literature. We then proceed to illustrate the model through an example of a use case. We show how it can be useful to identify alignment across business, application and infrastructure layers. We conclude with a discussion about the implications of the proposed model in practice and how it could be extended.

RELATED WORK

In this section, we describe the frameworks and models that individually address part of the solution. In the fourth section, these are combined into one model. The considered models and starting points are enterprise architecture frameworks and business models. For both categories we also take into consideration studies that use them as a starting point for transformation. This represents a bottom-up, respectively a top-down approach to handling IT alignment between strategic business models and more of a process-level view of the activities. In a third part, we also include frameworks that help to classify parts of the discussed components, such as application portfolio and IT services.

Enterprise Architecture

Enterprise architecture describes the components of an enterprise across its domains and how communication helps them to interact with each other. Frameworks that support enterprise architecture include The Zachman Framework (Zachman, 1987), The Open Group Architecture Framework (VHP, 2009) and ArchiMate (Lankhorst, 2004). The latter separates the domains into three layers: business, application, and technology. Each layer has sub-layers that split the internal representation from the external by exposing its services to the upper layer as interfaces. The topmost business layer exposes the enterprise services to an additional layer containing external roles and actors.

As can be seen in figure 1, ArchiMate is particularly attractive because it focuses on a visual representation. In particular, it encourages the use of visual cues, such as colours, to highlight the different modelling layers (Lankhorst, 2005). Moreover, ArchiMate opts for a unique language (UML) to model every layer of the architecture, thus supporting communication when teams responsible for the different layers need to collaborate.

Even though ArchiMate does go above the business processes layer to expose external business services, there are still some limitations to being able to carry out a strategic analysis of the business model using only this framework. Furthermore, it is relevant to note that ArchiMate is a focused infrastructure with a bottom-up construction. The Business Model Ontology can complement this shortfall in business model strategy; it is presented together with the Business Model Canvas (BMC) in the next section.

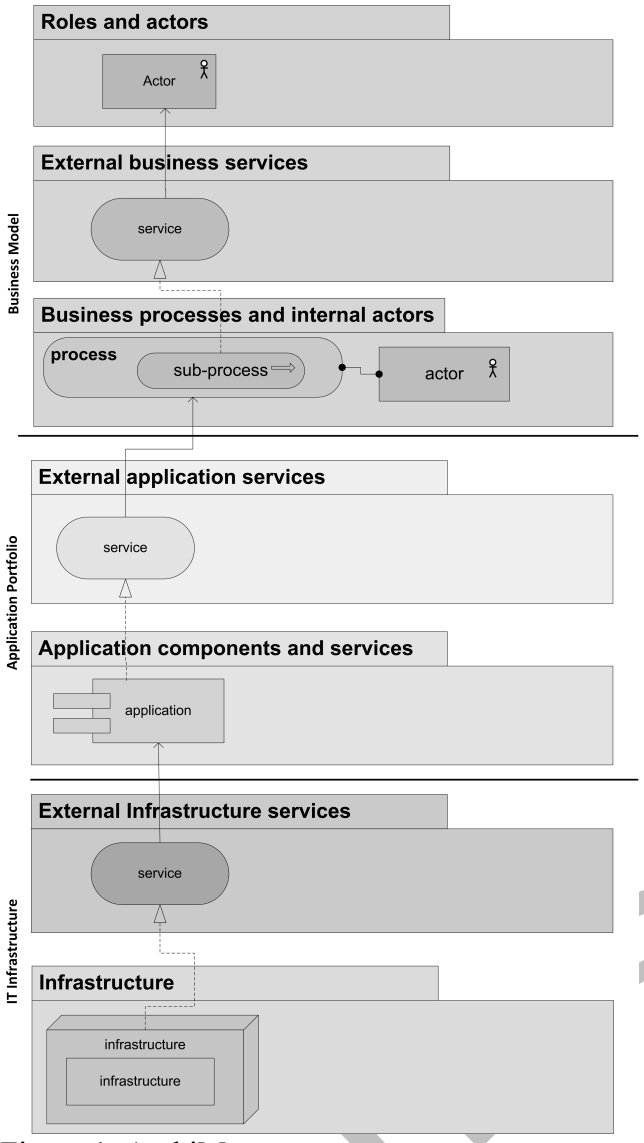

Figure 1: ArchiMate

Different approaches have been chosen for introducing a strategic aspect to enterprise architecture: adding new components to the meta-model of existing enterprise architecture frameworks, defining a direct correspondence between enterprise architecture components and elements of a business model, or using a transition model that helps connect both models.

In their study of enterprise architecture as strategy (Ross, Weill, & Robertson, 2006) presented a way of modelling strategy with a high level abstraction of EA components focused on business process, data, technology and customer types. While resembling a business model, the focus of their strategy is still largely on how value is provided to the customer rather than why. Additionally, having a different layout for each example makes it more difficult to compare the different types of diagrams.

One explorative study (Yu, Strohmaier, & Deng, 2006) added an intentional dimension of motivations, rationales, and goals into enterprise architecture. This was done using the i* model. In a similar approach, goals and requirements were added as components of enterprise architecture to introduce ARMOR as an extension to ArchiMate (Quartel, Engelsman, Jonkers, & Van Sinderen, 2009). In this study, "*Goals are refined into (alternative sets of) sub-goals, via goal trees. Low-level goals (requirements) are related to the services, processes and applications that implement the requirements.*"

Using goals helps to relate the reason for a service (why) to its implementation (how). This linkage opens the way for an iterative process, as highlighted when moving from an as-is architecture to a to-be architecture (Yu et al., 2006). In their process, iteration between the reason for a process and its execution is carried out inside the enterprise architecture model until an adequate 'to-be' solution is found. Alignment with the starting business vision, which defined the initial reasons for the change, is an area for future study.

Chen (2008) used a Service Oriented Architecture (SAO) perspective to present BITAM-SOA, a framework that has the same layers and interface between layers as ArchiMate (infrastructure, applications, process), whilst directly adding business model elements, customers, value proposition and cost into the architecture. In our opinion, this direct connection to the service process works in specific cases for SOA services; however, the business elements are more or less requirements and potential consumers of a given service offering, rather than a global business model strategy.

In their study, Iacob, Meertens and Jonkers (2011) offered a direct correspondence between elements of ArchiMate and the BMC, without using an intermediary model. Nonetheless, they did use an augmented model of ArchiMate, which contains additional quantitative cost information. Their process aggregates components of ArchiMate into all elements of BMC to reason on the business model strategy supported by the architecture. After modifying the architecture to fulfil new opportunities, and having regenerated a corresponding business model view, a second step allows for a comparison between the business models supported by both an as-is and a to-be architecture. This example provides a good argument for the value of connecting enterprise architecture to a more complete business model visualization in order to rethink architectural changes.

Business Model

Many definitions and visualizations of business models are available. We chose to use the Business Model Ontology (Osterwalder & Pigneur, 2002), and its more popular visualization template, the BMC.

The Business Model Canvas (BMC) is a representation of an enterprise's business model through nine building blocks. These elements were derived from an in-depth literature review of many previous conceptualizations of business models (Osterwalder & Pigneur, 2002). In this depiction, the business model of a company is a simplified representation of its business logic, viewed from a strategic standpoint (i.e., on top of Business Process Modeling), as shown in figure 2.

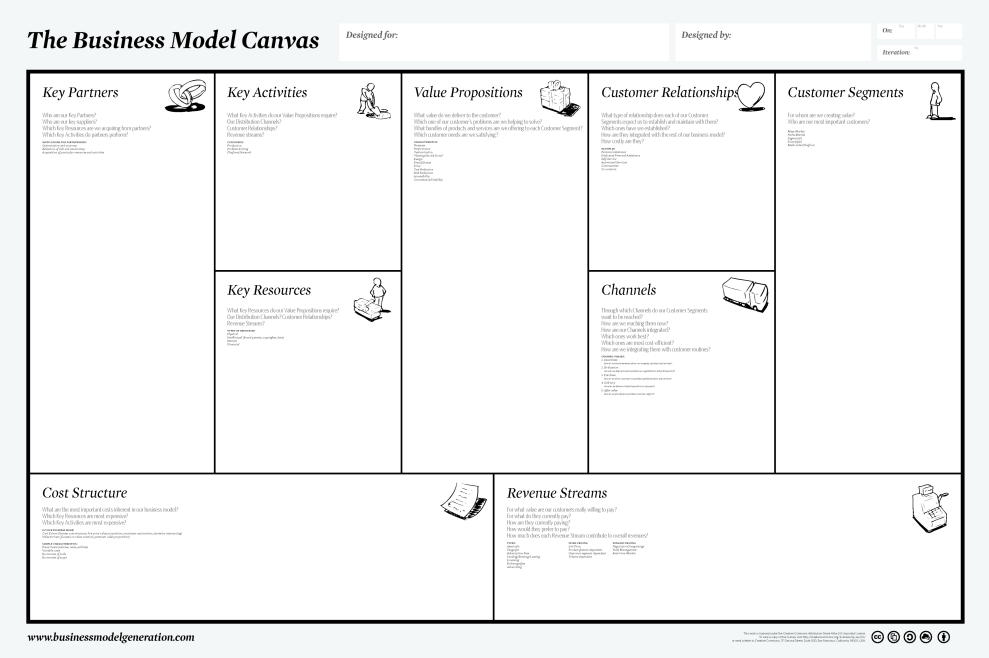

Figure 2: Business Model Canvas (businessmodelgeneration.com Creative Commons Attribution-Share Alike 3.0)

Value Proposition is at the centre; it describes which customers' problems are solved and why the offer is more valuable than similar ones from competitors (product, service). The customers themselves are analysed in *Customer Segment*. They are separated into groups to help identify their needs, desires and ambitions (single people, families). *Distribution Channel* illustrates how the customer wants to be reached and by whom he is addressed (Internet, store).

In addition, *Customer Relationships* specifies the type of relationship expected by the customer and how it is established and maintained (promotion, support, individual or mass). In order to be able to deliver the value proposition the business has to have *Resources* (staff, machines, secret knowledge). These resources are transformed through *Key Activities* into the final product or service (development, production, secret process). Most of the time a business also depends on an external *Partner Network* (logistics, financial), either for resources or for activities. This can provide better quality components or a lower price on those that are nonessential. Since any business model would not be complete without financial information, the final two building blocks focus on cost and revenue. The *Cost Structure* should be aligned to the core ideas of the business model (key resources, key activities), and *Revenue Streams* must mirror the value assigned by customers in terms of how much they are willing to pay, and how they will perform the transaction (one-off fee, subscription).

There are also other business model representations, such as e3value, which have been used in several papers as a starting point for adopting a process model. For example, Andersson et al. (2006) described a method to go from an e3value model to a process model by augmenting the e3value model with additional information. In a second step, they made use of a pattern library at the process level to construct the resulting processes. A similar transformation has been illustrated (Pijpers & Gordijn, 2007) that augments e3value, but then goes on to focus on creating a transition model called e3-transition, which forgoes the need to look up a process in a pattern library.

Another study (Andersson et al., 2007) sought to extend the syntax of e3value in the form of annotations to capture the relationship between goal models and business models. The

authors highlighted an open question that arose from their experiment: the difficulty to find a compromise between keeping the clutter introduced by additional information at an acceptable level, and still having the right amount of information. From this perspective, another approach to transforming an e3value model directly into a coordination model (Fatemi, Sinderen, & Wieringa, 2010) argued that there is a need for a less complicated method; one that does not introduce additional concepts, such as ownership rights, custody or physical delivery, or make it hard for others to use them in practice.

IT Services

When moving from the abstract to the specific or when grouping specific elements into a more generic element, it is useful to have some sort of classification system. In the context of IT alignment, one approach is to classify a portfolio of IT applications and categorize IT resources. Approaching IT services from a more managerial top-down view, Weill et al. (P Weill & Broadbent, 1998; P. Weill & Vitale, 2002) defined two such classifications.

First, from a management perspective, they defined four objectives for an IT application portfolio: infrastructure, transactional, informational and strategic. Infrastructure is the base component that is used by all the other categories. Transactional applications are basic systems that focus on cutting cost and increasing throughput. They can be used by informational or strategic applications. Informational applications provide ways to increase control, have access to better information and improve quality. Strategic applications should provide innovative services and help generate a competitive advantage.

Weill et al. (P. Weill & Vitale, 2002) went on to better describe and compare IT resources by providing a classification of IT capabilities: application infrastructure, communication, data Management, IT management, security, architecture and standards, channel management, IT research and development, and IT education. This list is based on a comprehensive survey they carried out and each item has a set of sub-items to help assess the importance of the capability.

Identified gap

Based on a literature review, it is clear that there are still opportunities to provide a visual and high level intermediary model between the business model and enterprise architecture. In our opinion, there are three stages: high level business model strategy, business goals and activities, and finally the process that makes up the activities. While most solutions address the two lower stages, we feel there is still a gap for a model which is simple and helps in the transition between the very high level strategic vision of a business model and its implementation parts.

After presenting our research methodology in the next section, we will go on to describe how these models can be combined to provide a strategic business visualization of an enterprise architecture.

RESEARCH METHODOLOGY

We chose to perform our research under the Design Science Research paradigm, focusing on an artefact that is at the centre of a three-cycle framework (Hevner, March, Park, & Ram, 2004). These cycles are relevance, rigor and design. *The Relevance Cycle bridges the contextual environment of the research project with the design science activities. The Rigor Cycle connects the design science activities with the knowledge base of scientific foundations, experience, and expertise that informs the research project. The central Design Cycle iterates between the core activities of building and evaluating the design artifacts and processes of*

the research. [...] These three cycles must be present and clearly identifiable in a design science research project. (Hevner, 2007, p.88)

We used a design cycle for the development, iterating through different versions of our visualization and adapting it after each evaluation. The models used to build our visualization are from widely accepted publications. Therefore, the grounding of our artifact in the common knowledge base respects the rigor cycle. The relevance of our work can be supported by two arguments. Firstly, there still is a need for better solutions to help with the alignment between business models and IT. This is even more relevant in the light of new opportunities offered by cloud computing. Secondly, our choice of models seems to be justified by the adoption rate of the BMC, as well as by software developers such as Software AG who have since started to include the BMC on top of their enterprise architecture modelling stack (ARIS). To complete the relevance cycle, the artifact should also be evaluated in the real environment; we addressed this topic in the evaluation section.

We also paid attention to cover the necessary components for a design theory in information systems as proposed by Gregor and Jones (2007). The purpose and scope of our paper has been stated in the introduction section. Our constructs came from the description of frameworks and model on which we composed our new visualization of the enterprise architecture. We present our artificat (form and function) in the following section and also describe the principles of implementation. This is followed by a case study to illustrate the artifact through an expository instantiation. The model's mutability, and its eventual extension beyond that presented, is discussed in the conclusion. The final component, testable propositions, is covered in the evaluation section.

CORRESPONDENCE BETWEEN MODELS

As stated in the introduction to this paper, our goal is to propose a model construct that helps to bridge business models and enterprise architecture models. In most methods described in the relevant literature, the end result is a process diagram. In contrast, our intention is not to provide a method for transforming a business model into a process model. Rather, we think that focusing on such a transformation goes beyond high level enterprise architecture and is not relevant for a global strategy overview. Nonetheless, transformation can be helpful when translating a specific detailed business goal into an actionable process, if this is the intention. Our objective is to focus on the strategy through having a better grounding of the activities and IT resources required, without going into too many details. This should be achieved while still keeping a connection with some lower level elements in order to be able to take alignment into consideration. Therefore, it is important to be able to identify key components for alignment in relation to the strategy, but not every step of its execution. Furthermore, compared to the methods used in a goal-based approach, we prefer to be even more general, not just linking a specific goal to be implemented, but linking it to the global business vision.

According to Fatemi et al. (2010), the approach should be as simple as possible; thus, a model should not be augmented with complicated additions if it aims to be useful in practice. Whilst we agree with this, we would argue that an intermediary model is still necessary. It seems extremely unlikely that high level elements can be mapped directly to detailed process level elements, and business model and enterprise architecture with different languages and abstraction levels.

Moreover, we strongly believe that it is crucial to reduce complexity by using a standardized layout. This leads to quicker identification of the elements in the model. It should also facilitate comparisons between different alternatives, since the same kind of elements will be at the same spatial position. Having set this requirement, we opted for the BMC as our business model representation, with ArchiMate for the enterprise architecture

model reference. The fact that the BMC is mostly focused on the internals of the company does not limit our model since, for IT alignment, we are looking at the internals. Thus, this is not necessarily a value networked situation in which e3value could have been considered.

A correspondence between the chosen models and framework can be seen in figure 3. The main objective is to have visualization using a similar structure to the enterprise architecture framework ArchiMate. The aim was also to provide additional business model considerations. The matching of elements has been done at a high level using the general definition given to them in each of the theories.

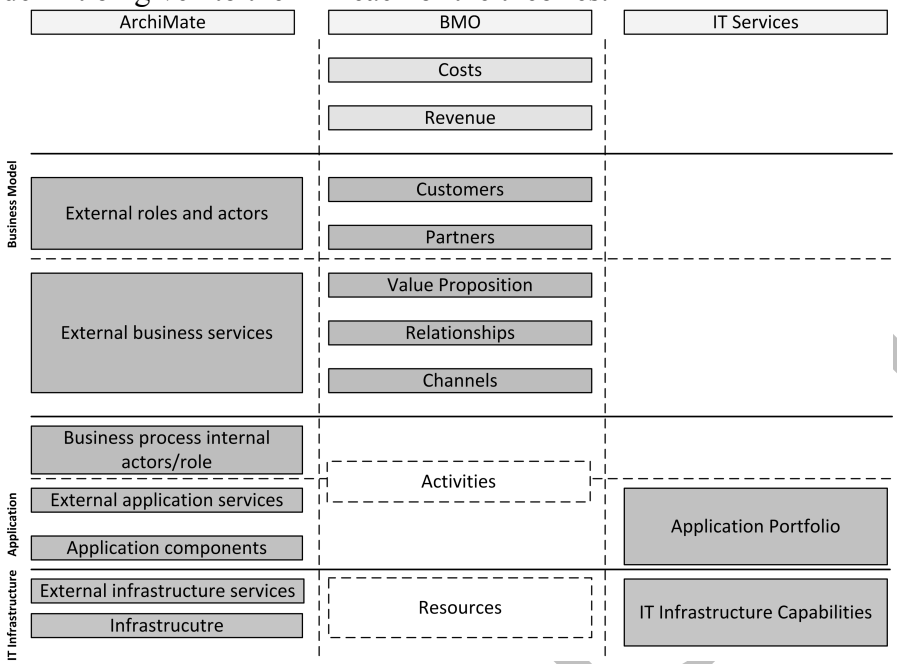

Figure 3: Correspondence between models' elements

Correspondence between BMC and ArchiMate

In ArchiMate, the topmost layers' concern is with external actors, which in the case of the BMC are its customers' segments and partners. ArchiMate does not have a distinct layer for financial considerations such as cost and revenue. Evidently, since the BMC describes business models, most of its elements can be compared to ArchiMate's business layer. The activity element can be considered similar to the external application services which the application layer exposes to the business layer; however, it does not go into detail at all on how the activities are produced. Some of the key resources of ArchiMate's technical layer might emerge in the BMC's resource element, but in general it is at too high a level to really identify technical components.

It is important to underline the fact that the correspondence is only a loose one, meaning that, for the most part, elements cannot be directly mapped between the two models. The BMC is only meant to show the key elements, which are necessary to explain the business strategy. Therefore, key activities and key resources do not contain all the activities necessary to generate a value proposition, just the ones that are most important for the strategy. Important activities, which are necessary to create the service itself but are considered of an operational value, might not show up. This is the case even if they are considered essential when looking at value creation from an enterprise architecture point of view. Furthermore, the BMC also considers resources to be those elements that are not necessarily physical in nature, such as brands, patents, and know-how. As such, they are not necessarily visible in the infrastructure part of an enterprise architecture perspective. Therefore, a direct mapping

of all elements is not possible since there will always be some filtering or aggregation depending on the perspective.

The building blocks of the BMC can also be grouped into three more general perspectives: a *financial perspective,* including cost and revenue, which cannot be found in the basic ArchiMate; a *customer perspective,* including value proposition, channels, relationship and customers, which can be compared to the higher sub-layers of ArchiMate's business layer; and an *activity perspective,* including partners, resources and activities, which is close to the business process layer.

ArchiMate also includes the notion of actors. Actors are present in an early version of the Business Model Onthology, but were not included in its later version as a Business Model Canvas (BMC). This is a simplification, due to the fact that the behaviour of the actor is captured in the affected element associated with that actor. Whilst this suffices at the strategy level, it may be necessary at the architecture level to know who has the right to affect which component. This can also be applied to ArchiMate's classification of infrastructure, information and behaviour. Infrastructure can loosely be related to a resource, while information can be a resource, or a combination of resource and activity. Behaviours, as is the case with actors, are not directly captured; only their impact on an activity.

To complement the weak matching of the BMC's activities and resources with the application and IT infrastructure layers, we chose to include the IT services model in our construction.

Adding IT Services

Instead of associating IT applications directly with their activities, it is better to classify them by the process type they support. One such classification is carried out in the internal perspective of a strategy map (Kaplan & Norton, 1996; Kaplan & Norton, 2004). A strategy map is an evolution of the Balanced Scorecard created by Kaplan and Norton. It provides an alternate, but very similar view to the BMC's description of a business model. The four processes are: operations management, customer management, innovation, and regulatory and social. This classification should help to group the BMC's activities more easily and connect them to ArchiMate's business processes.

In addition to offering an improved classification of the IT infrastructure, instead of addressing it as a common resource of the BMC, a more detailed classification can be used. This is presented in the IT services framework.

VISUALIZATION OF THE INTERMEDIARY MODEL

We decided to structure the visualization using the same layers found in enterprise architecture models. Furthermore, in order to facilitate visual comparison, we chose to have a fixed layout, with each element having its own position. Being an intermediary model, it includes elements of both the BMC and ArchiMate, adding more details to some elements of the former and aggregating information from the latter. In our opinion, it is important to be able to transition between the two models and the intermediary model. Thus, it allows a transition to the strategic vision, as well as the enterprise architecture, which in turn might be linked to a low level process implementation. Furthermore, enterprise architecture modelling should offer the ability to leverage the knowledge of transformation and alignment that has already been developed in this field.

Unfortunately, this transition is not automatic. Thus, it requires some design thinking on the part of the user. Nonetheless, we feel that our proposed intermediary model helps to structure the transition, which allows freer movement between models.

Based on the described correspondence, figure 4 shows the proposed visualization for integrating all the components mentioned. To further help connect the components, the IT services classification are grouped into an application portfolio at the application level.

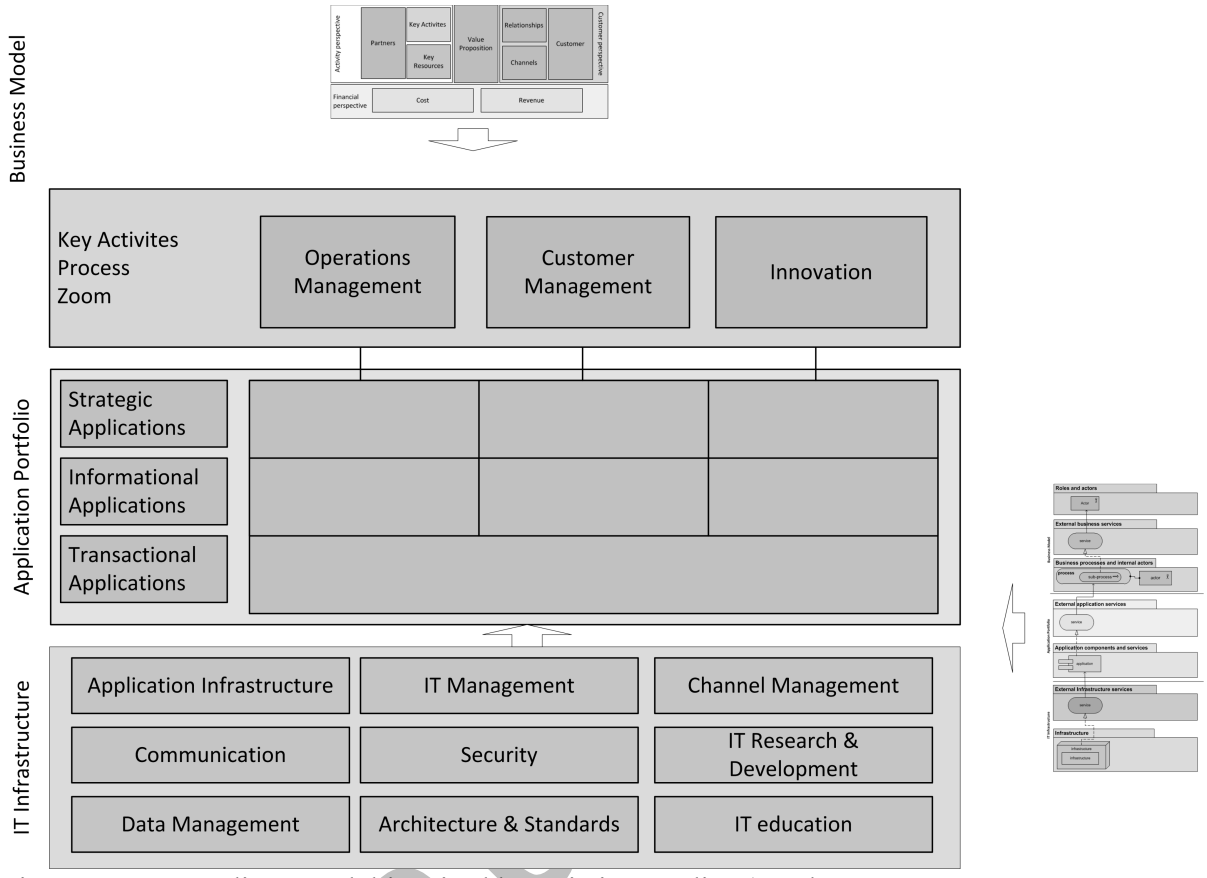

Figure 4: Intermediary model inspired by existing studies (Kaplan & Norton, 1996; Lankhorst, 2004; Osterwalder & Pigneur, 2002; P. Weill & Vitale, 2002)

On the technology layer at the bottom, the IT infrastructure is decomposed into the nine IT capabilities identified by Weill et al. (Weill & Vitale, 2002). The combining of these services enables different applications to be used. To simplify the visualization and avoid duplication of elements, we considered that the IT infrastructure service as a resource provides the same information as the IT infrastructure application layer of the application portfolio. We therefore did not include the latter, preferring to choose the more detailed classification of the former.

The applications found on the application layer make up the enterprise's application portfolio. The remaining three classifications can be organized into a three by three matrix: the rows of the portfolio distinguish between transactional, informational and strategic applications; and the columns are given by the processes the application supports in the business layer, namely operations management, customer management or innovation. The transactional applications are mostly combined to form informational or strategic applications before being used by an activity; thus, it is not necessary to classify them into these three categories. It is not always the case that a strategic or informational application requires a transactional one, since these applications can also directly depend on one or more IT infrastructure services. Additionally, with the emergence of a cloud computing infrastructure

or even application, they can be replaced by external services such as Platform as a Service or Software as a Service.

The business layer uses the same layout as the BMC in order to benefit from the known layout of its components. In order to better link the activities, a zoomed view has been added under the BMC, which represents a more detailed decomposition of the key activities into processes. These processes are categorized into three types: operations management, customer management, and innovation. Since this is only a zoomed view, all the links within the BMC are still valid, and an activity can be connected to the partners and value propositions it supports. In turn, a value proposition is linked to customer segments through the channels by which they are reached and maintain a customer relationship.

As described in the correspondence section, key resources can also include the physical IT infrastructure and applications. Whilst not all the resources involved in all the activities will be listed, it should at least highlight the resources that are strategic to the realization of the main value proposition. Such a list should be aligned with the links established between infrastructure, application and activities in the lower part of the visualization.

Partners might be involved or directly provide activities. In this case, a partner is connected through activity in the BMC and then to the lower parts. It might also be the case that a partner, a relationship or channel has a direct connection with an application or infrastructure component. Most of the time, this should go through an activity, at least when a zoomed view of the activities is available. If this is not the case, it may indicate a missing process or some misalignment.

Finally, the financial layer takes into account the cost and revenue of the business model by basing itself on the functions used for each value proposition. Which get their costs from the process they involve, which in turn can base their costs on the applications they involve, which themselves are based on IT services.

Using the Visualization

The proposed visualization can be helpful in different situations, whether as a top-down, bottom-up or mixed approach.

A top-down approach can be useful when planning for a new business model without assigning any existing resources. Visualization can help in evaluating the feasibility of the business model by specifying the applications and resources needed to realize it. In addition to there being variants of the business model, there will also be variations in the way that it is implemented. This can be explored with this construct, without having to directly build a complicated enterprise architecture model, and whilst still being able to think about IT resources. Moreover, having a strong link to the business model is useful, since thinking about some implementation points may generate new ideas for new business models. Taking advantage of some sort of pattern or best practice library can be helpful in differentiating between the multiple ways that a given activity can be implemented.

When choosing to extract the business model from an existing architecture, as in a bottom-up approach, it helps to have a proposed visualization that has classifications for the different layers. Such classifications perform the grouping and abstraction that is necessary to arrive at high level activities, which are then linked to the other components to form a business model representation. Some elements will have to be added from outside the architecture, but the model should provide the right conditions inside to be able to ask the right questions about the missing elements. Additionally, if some of the existing elements match a business model pattern, this can give further insight into which components are key in such a strategy. For example, if there is clearly a central platform component and a specific customer segment using it, it can be worthwhile to check whether there is a second set of customers which the

platform can or does connect to. This would then match the double-sided business model pattern.

In most cases, there is no clear top-down or bottom-up approach; instead, there are some parts of a business model and some kind of architecture model. Bringing both together will be an iterative process of changing business model components, as well as adding missing applications and IT resources to the visualization. During the process, a new objective, unused components, and a strategic component will emerge, all of which are undervalued. This process of modelling an as-is situation will help to reveal opportunities and threats, which will be a starting point for model variants of a to-be model. Further analysis can then be performed more thoroughly in an enterprise architecture model. It should also be noted that alignment is not a final step: it should not discourage the seeking out of new opportunities, even if it will require some non-alignment to reach it.

To highlight different aspects it is possible to create multiple versions that focus on specific elements. There is also the possibility of drawing links between elements to underline an alignment story, as illustrated in the example given in the next section.

INSTANTIATION CASE: SWITCHER SA

The proposed visualization was applied to a company called Switcher SA in order to highlight the alignment between their Business Model and enterprise architecture. Figure 5 shows the business model and the intermediary model visualization combined as one. We first describe Switcher SA's business model before going on to describe the intermediary visualization and the transition to the enterprise architecture.

Business Model

Switcher SA is a small private Swiss company engaged in the manufacture and distribution of garments. The company places a particular focus on social responsibility throughout the whole value chain, from resource production to the distribution of its products. Their products are garments that are simple, colourful and good quality. The company sells them at an affordable price, whilst still being able to guarantee a sustainable and traceable product to their customers. Their customers are not limited to buyers who are aware of sustainability issues. Through their high quality and competitive pricing Switcher also has a wide customer base that includes families. Other customers include clubs, enterprises or events who use coloured T-shirts as a base for custom-printed promotional articles. Therefore, there are three types of channels to reach customers: the stores, the printer who carries out customization work, and an online store. The company's relationship with its customers is enhanced through a loyalty program called Switcher Friends, which offers special discounts. The brand is also promoted through event sponsorships. At the business model level, the key resource is their brand (well known in Switzerland) and their contacts with partners. Partners who constitute the backbone of their product include: the raw material producer (cotton, dye), garment manufacturer, and the logistics companies (transport, storage). Key activities are the management of the value chain, which allows them to guarantee supply to their wholesalers, and point of sale management for their stores.

Intermediary Model

With regard to IT infrastructure and applications, there is a standard set of IT support for employees, as well as Enterprise Resource Planning (ERP) software for supply chain and financial management. In addition, there are the necessary resources for maintaining a point of sale system and an online store. It is worth mentioning that the special strategic application known as the *Switcher Colour System* supports the operational part by guaranteeing that all

garments have the right colour dye across all the suppliers. It therefore plays an important role in guaranteeing product consistency and quality.

The proposed visualization is particularly helpful in analysing such a connection. By way of illustration, we focus on the implication of the value proposition of traceability for the lower levels. Going from top to bottom in figure 5, it is possible to see how the value proposition of a responsibly produced garment (ethics, traceability) is delivered through the ability to trace each step of the production process. Traceability is made possible only by an innovative traceability management process, which depends heavily on a custom ERP application (Kookaburra Software) at the application portfolio level. To offer this application, there is a need for a custom ERP at the IT infrastructure level; this has to be developed in-house (IT research and development). Furthermore, the channel which allows the customers to consult tracking information is made possible by a special website (respect-code.org). Based on this analysis, we can identify the custom ERP (Kookaburra Software) as a key resource in the business model, since without it one of the main value propositions could not be realised. Moreover, a custom ERP requires an activity of IT development. We can therefore justify the need for development in relation to the value proposition. Previously, the IT development might have been considered as an unnecessary cost at a strategic level.

Enterprise Architecture

In order to demonstrate the link with ArchiMate we put forward an extract of the enterprise architecture for Switcher SA that was focused around a traceability service, as can be seen in figure 6. This is a first step to a more zoomed-in view, which could then be further drilled down to reach a detailed process description. Whilst most of the business model components disappear, the business processes gets more detailed and links are drawn between elements. It can also be observed that Archimate provides a distinction between internal and external services, which are connected by interfaces. This is a distinction that our intermediary model does not provide in order to be more abstract.

In our focus on traceability, we chose to consider the client side. Thus, we highlighted components from which the client can retrieve information. Another focus could have been on how the information is retrieved from the partner and put into the system for later retrieval. The corresponding elements to those mentioned in the intermediary model are given in bold type. We shall go through them from top to bottom and comment on the new distinctions introduced by this more detailed view.

It can be seen that partners and customers are at the top of the diagram and are grouped into one layer. The customer is directly connected to the external business service which provides the value proposition and not the general properties of the value proposition itself. The traceability management process can be seen to be composed of sub processes of the control and reporting of Corporate Social Responsibility (CSR). In addition to the more detailed description offered by the sub-processes, there is also information on actors' responsibilities in a process. We illustrate this here by adding the CSR Officer. At the application layer, we can observe the distinction between external and internal services. With regard to this ArchiMate model, it is possible to observe that the required applications and IT infrastructure, which were highlighted, have a lot more dependencies into other components, without which the service in question would simply not be feasible. For example, the custom ERP (Kookaburra) depends on other applications which feed it the needed information. Also, the more detailed low level IT infrastructure is added to this model.

In a second more detailed ArchiMate model, information which is still missing in our version would be added, such as the differentiation between structure, information and behaviour.

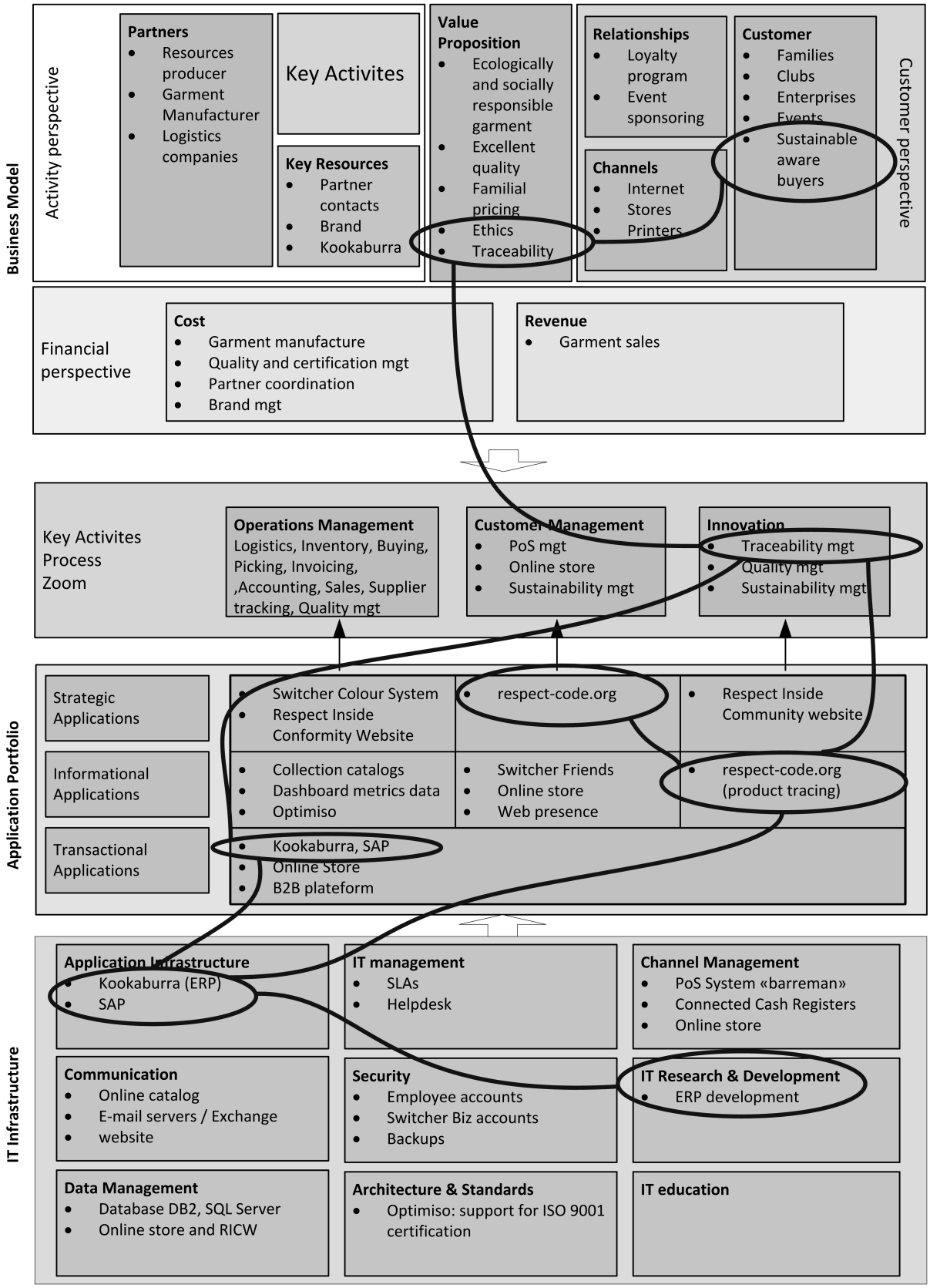

Figure 5: Switcher SA Business Model Enterprise Architecture

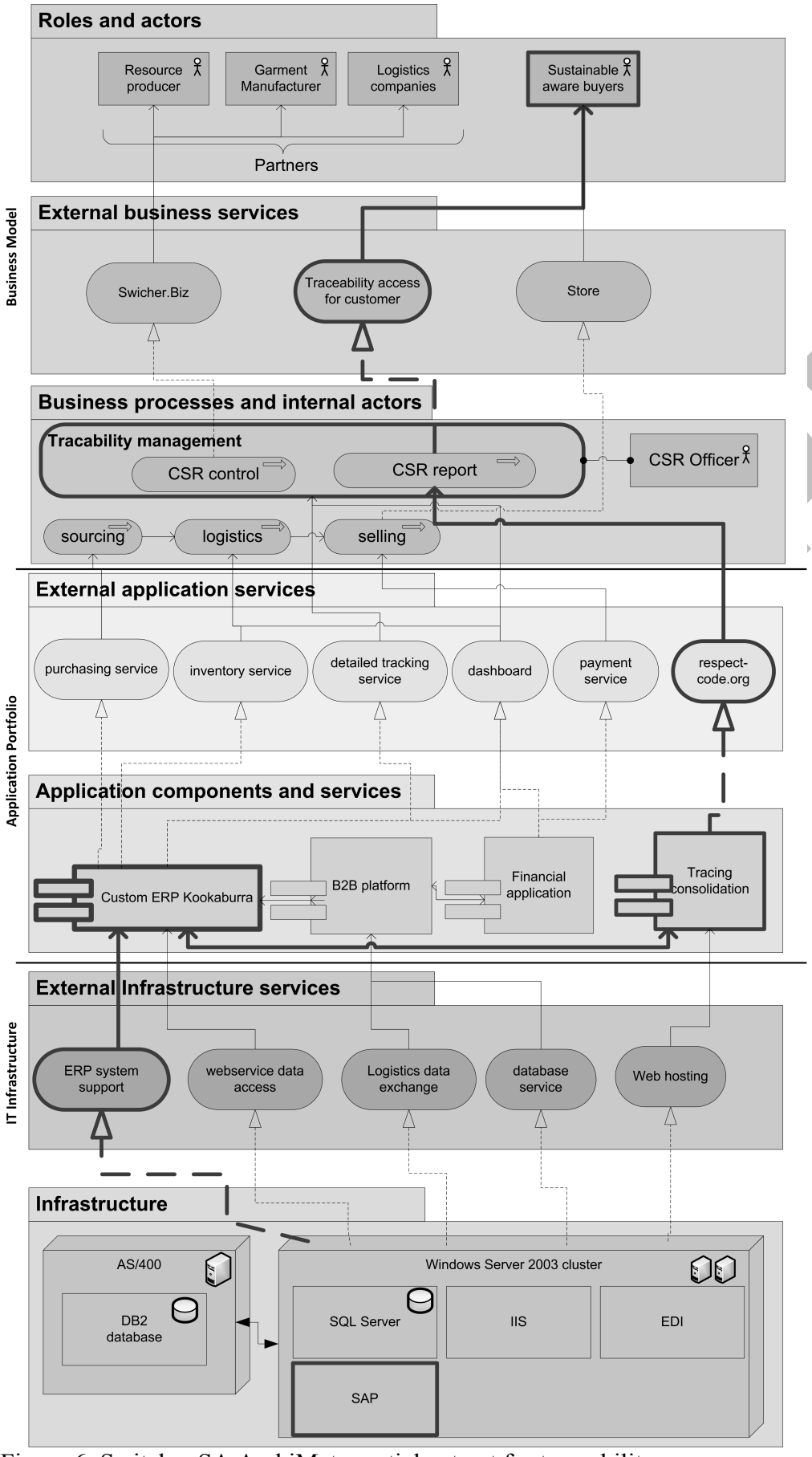

Figure 6: Switcher SA ArchiMate partial extract for traceability

EVALUATION

There are two types of evaluation to be considered in design science research: evaluation which allows for new iterations of the artifact and the field test; and the real world problem the artifact tries to solve. Preliminary testing was carried out throughout the design process by creating versions of the visualization for use cases. In addition, testing was carried out using master's degree students. They used the intermediary visualization as part of a report in which they had to analyze different aspects of a company, including business model and architecture. The results showed that the groups which had to provide the intermediary visualization had their enterprise architecture models match their business model more closely. The next step is to perform an evaluation on more in-depth cases as well as take into account feedback from the professional community using enterprise architecture and business models.

Based on the Switcher SA case we gained a set of insights about the intermediary model. Attempting the exercise without using the intermediary model led to a business model with activities and resources that were not key to the strategic vision. Furthermore, they produced labels using technical terms that were not familiar to business people. Similarly, in the ArchiMate model there was trouble connecting an abstract external business service to a concrete implementation process.

Creating the intermediary model forced us to have a more consistent wording of the elements acceptable to business and technical people. Reaching the right compromise for the wording also helped to improve the classification used in the layers and choose the right abstraction level for each element. This helped the correspondence between the intermediary model and the ArchiMate model. Unnecessary technical detail was not added to the business model; on the contrary, such key assets as Kookaburra Software were highlighted. The importance of IT development staff was also identified, a fact that might have been missed if there had been no classification grid.

This led us to note the following comments and test propositions:

For the top-down approach, it will be interesting to evaluate the range of variation that can be generated using an identical starting business model. In terms of control, testing will also allow us to examine whether using a pattern library to guide the addition helps or hinders in the search for an architecture that can efficiently support the overarching business model.

Testing for the bottom-up approach will be more difficult. As yet, there is no formal process for identifying which elements should be considered for filtering or aggregation before adding them to the intermediary model. Additionally, for an architecture that supports multiple business model focuses, several versions will have to be produced and then merged together or split according to different business considerations. This evaluation will, therefore, require several iterations if we are to gain an insight into how to approach the problem in a more formal way. The potential for better identification of key resources or discovering new business opportunities based on existing resources should justify the time required for such an evaluation.

In terms of evaluating a dynamic approach to mixed-mode iteration, it is difficult to envisage a test if the above two evaluations have not been undertaken. Moreover, an iterating approach touches on the topic of comparing different versions of a model and determining its evolution, which we consider to be outside the scope of this paper and thus the subject of future study.

DISCUSSION AND CONCLUSIONS

Comparing IT services and a business model and seeing how they are connected, helps in their alignment; it also helps to highlight any interactions between them. This opens the road

to assigning a cost to each offered value proposition. It could also allow help prioritize the importance of assets to allow for strategic outsourcing of non-core services or providing new value propositions that involve underutilized services.

We set out to look for an intermediary model which can facilitate the alignment between a business model and enterprise architecture using a formalism that is accessible to users of both paradigms. As a solution, we put forward an intermediary model, which takes components of both paradigms in order to have a common ground. Through a use case we showed how this model can connect to the business model vision, as well as to the enterprise architecture. Having constructed our model using formalism from both domains, the intermediary model provides a basis of discussion for both paradigms. This enables both a top-down and a bottom-up view of the enterprise architecture, as well as a business-focused and an IT-focused view, thereby helping the alignment of business strategy and technical IT infrastructure.

ArchiMate provides a more IT-centric view, with technical details that have to be abstracted in order to transform it into business visualization. In addition, the business visualization elements have to be extended with additional information in order to use them to build an ArchiMate model. Therefore, an intermediary model could result in the creation of multiple variants of the related ArchiMate model or business model. This is not necessarily a problem; indeed, it could lead to the development of new opportunities, as well as help to identify areas that require more attention when considering alignment.

Further use cases have to be tested to see how the method can help in identifying misalignments. It might also be possible to define a more systematic way to transition between models, although such a method would have to handle the variability of these multiple models.

By choosing to use a fixed layout for the visualization, we have made it possible to compare different models and thus start addressing the need for more "*formalized means of representations as well as procedure model to allow a structured and comparable visualization of business models*" (Burkhart, Krumeich, Werth, & Loos, 2011, p.15). Our proposed visualization and its technique of zoom/pivot focus on IT applications and activities should be applied to other components of the business model canvas in a formalized and visual way.

Applying Patterns

Beyond making it possible to visualize the business model on a one-page canvas, the BMC also allows us to highlight and compare business model patterns and BMC (Osterwalder & Pigneur, 2010). A business model pattern describes some components of a business model and their relationships in a way that can be applied to other similar situations. As with patterns in other fields, it is then possible to identify missing components once a certain situation is recognized (freemium, double-sided, unbundling, long tail).

In addition, Weill et al. (P. Weill & Vitale, 2002) used the notion of pattern to classify the importance of the IT capabilities they defined for each situation. Therefore, it may be possible to compare the implication of patterns at the IT infrastructure level as well as the strategic business model level to further help with alignment.

For example, Switcher SA acts as a value net integrator, which according to the IT capabilities pattern requires important channel management systems. This is indeed the case for Switcher SA. The company has an important investment in a point of sale system, which aligns to the business model strategy of owning stores to reach niche customers interested in responsibly produced garments.

External Factors

In its current form, the proposed model focuses on enterprises' internal factors. With the need for more collaboration and the growing importance of external factors such as social and regulatory constraints, the model should be augmented.

At the business layer, the environment map described for the BMC (Osterwalder & Pigneur, 2010) could help in identifying external influences using its four components: key trends, market forces, industry forces, and macro-economic forces. This in turn, as with the internal components, could be aligned to the fourth unused process category of the strategy map: regulatory and social processes. Alignment with the lower layers might be more difficult because these concerns seem to impact on every component of the schema and cannot be resolved by just adding one more column.

Nonetheless, the proposed model already provides a good insight into a large part of internal considerations and should be further tested in use cases and tried in practice.

Computer Assisted Tool

We argue that one way to handle the multiple models problem, introduced by the focus on a specific feature of the business model, or the need to compare different implementation possibilities, is to use a computer assisted tool. It would help make sense of the different versions by providing visual hints such as changing the size or colour of the different components. In a digital version, it would also be possible to only display elements which are directly linked together. In a further step, such a tool could, thanks to additional information such as cost data on elements, compute totals on a business model level. This could enable a rough estimation of a business model's viability based on part of its implementation.

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