Modeling Value Creation with Enterprise Architecture

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Abstract: Firms may not succeed in business if strategies are not properly implemented in practice. Every firm needs to know, represent and master its value creation logic, not only to stay in business but also to keep growing. This paper is about focusing on an important topic in the field of strategic management and economics: *value creation*. We develop a value creation framework and then use the ArchiMate enterprise architecture modeling standard to model value creation, using a four step method. The output of this method is a new model, the *value creation model*, which represents value creation by a firm. We demonstrate the use of the method with an example case. Potential uses of the value creation model, including traceability, sensitivity analysis and a networked enterprise architecture, are discussed in detail.

1 INTRODUCTION

The primary function of any firm is creating and maintaining *value* (O'Cass, et al., 2011) – only as long as a firm creates value in the eyes of the customer it can stay in business. The moment it stops offering this value, its existence is threatened. One would expect that the process of *value creation* is well understood by decision makers in general and by managers in particular. However, literature suggests that this not the case and there is "minimal theory explaining "-how-" managers/firms transform resources to create value" (Sirmon, et al., 2007). Moreover, there is little consensus on what value creation is or on how it can be achieved (Lepak, et al., 2007).

Amit & Zott (2001), while studying value creation in *e-business*, suggested that a business model should be used as a starting point for analysis of value creation. There exist different business modeling approaches, each with their own merits and focus (Al-Debei & Avison, 2010, Iacob et al., 2012).

A *business model* typically identifies agents, goals, resources and exchanges of resources between agents (Andersson, et al., 2006), and focuses on the *what* side of value creation. A *process model* is more detailed than a business model and focuses on the procedural and operational aspects, i.e., the *how* side of value creation. Apart from business and process models, we have *information systems models* which focus on the IT infrastructure of firms. The IT infrastructure components support the processes of the firm and therefore information system models can be considered as models that represent the *with what* side of value creation. A similar division of viewpoints on value creation was put forward by Gordijn & Akkermans (2003).

There exists a gap in the literature when it comes to representing *'how'* value is created and *'with what'* value is created. As firms get bigger in size and expand their business, the answers to these questions become increasingly complex. Managers frequently face problems while translating the value creation logic of the firm from strategy to implementation, i.e., how new products and services should be created and how the existing ones are to be improved. This is the case because there are no existing models or modeling approaches to specify the processes and technological resources used for creating a particular value proposition.

What is the correct way to model value creation at a low level of abstraction? To the best of our knowledge no satisfactory answer is found for this question in literature. We argue that the enterprise architecture of a firm provides an excellent base and starting point to model value creation at low level of

abstraction. An enterprise architecture (EA) model is the "organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirement of the company's operating model" (MIT, 2013). An EA model shows how a firm realizes the services it offers to its customers. (Janssen, et al., 2005). The EA modeling standard used for this research is ArchiMate® (The Open Group, 2012), which consists of different *elements* to model the business and IT processes of a firm, the supporting infrastructure and human resources. The main contribution of the paper is a method to derive a *value creation model* from an existing EA model. This value creation model will not only provide managers better insights into the existing value creation logic of the firm but will also aid in new value creation, thereby bridging the gap between strategy formulation and strategy implementation.

The structure of the paper is as follows. In Section 2 we present background information on value creation and the ArchiMate® EA modeling standard. In Section 3, 4 and 5 we create the necessary base for developing the method to derive the value creation model. The method itself is presented in Section 6. The use of the method to derive the value creation model is demonstrated with the help of an example in Section 7. The potential uses of the value creation model are discussed in Section 8. Finally, limitations of the research and potential areas of future research are given in Section 9.

2 BACKGROUND

2.1 Value Creation

We firstly clarify what we mean by the term *value creation*, since there is "-considerable disagreement and confusion-" among researchers about value creation. (Lepak, et al., 2007). O'Cass & Ngo (2011) identified two main streams of research in the field of value creation:

1. The first stream of research focuses on how value is created by the customer at the *point of exchange* and during use of the product/service, therefore is exogenously determined.
2. The second stream of research focuses on understanding how *value* is created by the firm at the *point of proposition*.

Exchange value is the amount paid by the customer to the firm for the product or service. The

transaction of product/service and the exchange value (between the firm and the customer), occurs at a point in time which is called the point *of exchange* (Bowman, et al., 2000). Point of proposition is the point in time at which a firm offers a product or service to the market. This product or service has some value in the eyes of the customer, and the firm expects that the customer is willing to buy that product or service. Our concept of *value creation* is aligned to the second stream of research and we aim to model the process of creating value by the firm. We define *value creation* as **the process or the mechanism via which firms build, combine and reconfigure resources (possessed or acquired) to produce a product or service for the customer.**

2.1.1 Elements of Value Creation

To model value creation, we have to answer three questions *a) what* is being created *b) what* activities are performed *c) what* resources are used. Correspondingly, we propose a three-step *value creation framework* for our research, shown in the Figure 1.
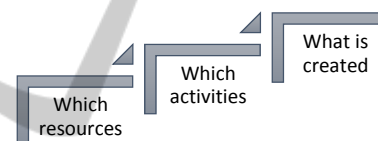

Figure 1: Three step value creation framework.

Various resources and activities come together to form a *value creation process,* whose output is a product or a service, which the firms offers to the customer, also called *the value proposition*. A value creation process has the following three constituents.

Value – is associated with the outcome of the value creation process. The outcome of the process has *value* to the customer (e.g., Flight ticket, Insurance Policy or Customer Support). It can be a part of the value proposition by the firm or the value proposition itself.

Resources – are the inputs for the value creation process. They can be inert inputs or human inputs. Human input is different from inert input as it is capable of creating new inert inputs (Bowman, et al., 2003). According to Osterwalder (2004), resources can be physical, human, intellectual or financial.

Activities – are performed on resources which incrementally change them to a product or service having value for the customer. Firms perform different kinds of activities for value creation (Bowman & Ambrosini, 2003). Activities acquired

by a firm from its business network are called *capabilities.*

2.2 ArchiMate

ArchiMate® is a widely popular EA modeling language, promoted by The Open Group®. It is a lightweight and scalable modeling language which provides an integrated architectural approach for describing and visualizing the different architectural domains, their underlying relations and dependencies in a firm. (The Open Group, 2012).

The ArchiMate metamodel consist of three types of elements, viz. active, passive and behavioral elements. They are related in the same way as parts of a sentence, i.e., subject (active structure element), object (passive structure element), and a verb (behavior element) (The Open Group, 2012). The active element performs an action (specified by the behavior element) on the passive element. Besides the above classification based on role, ArchiMate elements are also divided according to their specialization and scope into three layers, i.e., Business, Application, and Technology. The elements in the technology layer provide the necessary infrastructure to run applications, which in turn are used by business processes that realize the services and products offered to the customer. ArchiMate® also has a set of relationships to show how the different elements interact with one another. Many of these relationships (composition, aggregation, association, and specialization) have been inherited from UML, while others, like trigger, are from business process modeling languages. Relationships in ArchiMate® can also been ranked with respect to their "strength" (Buuren, et al., 2004).

At this point we ought to answer an important question, i.e., *why do we choose ArchiMate, to model value creation?* Firstly, ArchiMate has a layered structure spanning the whole enterprise. Thus it provides the required granularity to our approach to model value creation at a low abstraction level. Secondly, the supporting infrastructure for performing the processes, i.e., human, IT resources, etc. is incorporated in ArchiMate®. Thirdly, the resource and activity components of the value creation framework aligns well with the concept of structural and behavioral elements in ArchiMate® metamodel, respectively. Lastly, ArchiMate® is adopted by the Open group and is widely used by academics and practitioners in the field of enterprise architecture (Iacob, et al., 2012)

2.3 e-3 Value Model

It should be kept in mind that firms may acquire resources and activities for *creating value* from partners in their business network. e-3 value (Gordijn & Akkermans, 2003) is a simple technique to model value creation by firms from a network perspective. A e-3 value model shows how firms create value in a network by exchanging objects having economic value among them. Originally proposed to gauge the feasibility of new e-commerce ideas and ventures, e-3 value models have been successfully applied to many diverse industries, like healthcare and banks (Kinderen, Gaaloul, & Proper, 2012). Key concepts used in an e-3 value model are Actor, Value exchange and Value Object.

3 CLASSIFICATION OF ARCHIMATE ELEMENTS

In this section we classify ArchiMate elements based on value creation framework presented above and our definition of *value creation* as resources, activities and value.

Value is Business service, Application Service, Infrastructure Service and Business Product. It is through these concepts, that the firm exposes its value offerings to the environment.

Resources are mostly the structural components in ArchiMate i.e. Business Object, Data Object, Application Component, Artifact, System Software, Device, Network, Role, Business Collaboration, Application Collaboration, Communication Path and Node.

Activities are behavioral elements in ArchiMate, i.e., Business Interaction, Application Function, Business Function, Application Service, Infrastructure Service, Infrastructure Function, Application Interaction, Business Process, Business Service.

The remaining ArchiMate elements do not fall into any of categories above. Such elements are Meaning, Contract, Application Interface, etc.

4 RELATING VALUE TO RESOURCE AND ACTIVITY

For relating a particular service/product to resources and activities, which realize it, we have developed an algorithm which traverses an ArchiMate model as

a *directed graph,* while treating ArchiMate elements as *nodes* and the relationships between them as *edges*. Our starting point is a given EA model (modeled in ArchiMate) and a certain service (or product) for which one wants to understand the value creation process. The selected service/product to be analyzed is the *starting element* of the algorithm. The result of applying the algorithm to an ArchiMate model, is a smaller model, called, the *value model* which specifies how value is created at the process level, and in which the selected service/product is the root node. To derive the value model, the algorithm starts with a chosen service/product and includes all architecture elements on which this service/product is *dependent*. It does this recursively. To define *dependency*, we have used the meaning associated to each relationship shown in Table 1.

Table 1: ArchiMate relationships and their weights.

Relationship	Meaning	Weight
Composition	Is Composed of	7
Aggregation	Is an aggregation of	6
Assignment	Is performed by	5
Realization	Is realized by	4
Use	Uses	3
Access	Accesses	2
Trigger	Is triggered by	1
Flow	Inflow	0

All entries in the column "Meaning" form the set **E** of all unidirectional relationships expressing dependency between two architecture elements. The weights of the relationship have been motivated from Buuren, Jonkers, Iacob, & Strating (2004). Thus, we define the following sets:

- *N = {all ArchiMate elements which are classified as either Value, Resources or Activity}.*
- *E = {all unidirectional dependency relationships}.*

The algorithm makes the following assumptions.

- There exist a stack **S**, with unlimited storage.
- Each element of the given EA model has 5 fields, i.e., Name, Type, Parent, Relationship and State. At initiation, the Parent and Relationship fields of all elements in the EA model is NULL. Also, the State field is equal to "not checked".

Below we provide the pseudo-code specification of the proposed traversing algorithm.

Step 1: Push the starting element into S. Create S in the new model

Step 2: Till S is not empty.

Step 3: Pop one element from S. Call it E_0. If E_0:state is not equal to "is checked" proceed further, else go to Step 2.

Step 4: For every X attached to E_0 through Y

Condition 1: IF (X: type$\in$N) AND (Y$\in$E) THEN

a) {Create a model E_0:parent$\rightarrow$X via Y_{real}} where Y_{real} is the lowest weighted relationship between Y and E_0: relationship.
b) {Push X in S if state of X is not equal to "is checked"}
c) {X: parent = NULL, X: relationship=NULL}

Condition 2: IF (X: type$\notin$ N) and (Y$\in$E) THEN

a) {Push X in S if state of X is not equal to "is checked"}
b) IF {E_0: parent = NULL} THEN {X: parent = E_0 } ELSE {X : parent = E_0 : parent}
c) IF {E_0 : relationship = NULL} THEN {X: relationship = Y} ELSE {X : relationship = Y_{real} } where Y_{real} is the lowest
d) weighted relationship between Y and E_0: relationship}

Condition 3: IF (Y$\notin$E) THEN

a) Do Nothing

Step 5: Mark E_0 "is checked". Go to step 2.

Stop

This algorithm has been successfully implemented in EA modeling tool *BiZZdesign Architect* ® for testing purposes.

5 VALUE CREATION AND VALUE NETWORKS

"In today's global economy, firms rarely create value in isolation. Instead, firms co-operate to create products and services" (Cavusoglu, et al., 2011). They create value together with suppliers, customers, and sometimes even with competitors. The discussion of value creation by a firm would be incomplete without the inclusion of its business network because the success of a firm largely depends on how well it is able to manage and exploit its network to create greater value for the customer and thus greater profit for itself. (Normann &

Ramirez, 1993). A firm acquires resources, capabilities from other firms in its network and employs them in its value creation process (Bowman, et al., 2000). Without the inclusion of these acquired resources and capabilities, our value creation model would be incomplete. We call these resources and capabilities, *use-values*. To model use-values and include them in a given EA model of a firm we follow a 4 step, Create, Select, Model and Make (CSMM) procedure, described below.

1. **Create** an *e-3 value model*, showing the acquired *use-values* and the network entities from which they are acquired.
2. **Select** those *use-values* which are used in realizing the product (or service) under analysis.
3. **Model** and add these acquired *use-values* as services (business, application or infrastructure) or product in the given EA model. Another way of adding these *use-values* is by using the collaboration element in ArchiMate i.e. *business collaborations* (when two *Roles* are collaborating to perform a specific function) or *application collaboration* (when two Application Components are collaborating to perform a specific function).
4. **Make** a relationship between these new additional elements (made in step 3) and an existing element in the EA model which uses them.

6 A METHOD TO MODEL VALUE CREATION

In this section we present a step by step method for creating the *value creation model* using a given EA model. The concepts used in the method, are e^3-value model, value creation framework, and the algorithm developed as a part of this research, all of which have been discussed in the previous sections. The only pre-requisite for applying this method is that there exists an EA model of the firm.

Step 1. Choose the business product or service from the given EA model for which analysis has to be done. This product or service would be the root of the *value creation model.*

Step 2. Create an *e-3 value* model, select, model and add the *use-values* acquired from the network to the EA model, by following the CSMM procedure mentioned in section 5, sequentially. After **Step 2** the EA model with which we stared, would have some addition in the form of new external services, products or collaborations.

Step 3. Run the algorithm with the product or service chosen in **Step 1** as the starting element. As a result a smaller value model is created. This step is automated by using the EA modeling tool, *BiZZdesign Architect®.*

Step 4. Select the key activities from the value model and make two tables for each of these activities, i.e. *Internal Value table* and *External Value table*. In these *value tables*, those resources/capabilities are enumerated which are difficult to be modeled using ArchiMate concepts, e.g. skills, funds, revenue, consultancy etc. Resources/Capabilities which are possessed by the firm are entered in the Internal Value Table and those which are acquired from the network are entered in the External Value Table. Each of these resources/capabilities are then added to the value model and related to an existing element.

The final model resulting after these 4 steps is the *value creation model* for a given service/product. It includes the network perspective of value creation and also those resources which are difficult to model using the standard ArchiMate concepts.

7 ILLUSTRATION OF THE METHOD

We illustrate our method presented in Section 6 with the help of an example case which has is an adaption of the case used by Schuster & Motal, 2009.

Case Description: A Newspaper Publisher, wants a sustained increase in its *coverage* by retaining its current customers and also by increasing its customer base. To accomplish this, the Newspaper Publisher has started providing a monthly gift to all its current readers and to every new reader, so that they continue their subscription with the Newspaper and do not start a subscription from a different newspaper. Since the publisher does not produce gift items (and neither does it want to do that), it acquires them from a Gift Vendor. The gifts are sent by the Gift Vendor to the Newspaper's office, from where they are sent to the customers. The Vendor gets paid by the publisher for every gift which is delivered to its warehouse. New customer acquisition is an important function of the Newspaper, which is performed by the Marketing Department. This is done in two ways. 1) *By Online Marketing* on the Internet and 2) *By Cold Calling.* Customer Acquisition via cold calling is outsourced to a Call Center. The call center transfers the details of customers interested in a subscription to the

Newspaper. For this, the call center is paid a fixed amount per month by the newspaper. The value network of the Newspaper Publisher (Figure 2) consists of the *Call Center, Gift Vendor, Reader* (current customers) and *Test Reader* (new customers). The EA model of the Newspaper Publisher is given in Figure 4. A middle level product manager of the Newspaper Publisher wants to know how the value proposition, Advertising Gift, is realized or created. We apply our method to the above case.

Step 1. The business service (in the EA model of the newspaper) which has to be analyzed is the service *"Provide Advt. Gift to customer".* This service will be the root of the value creation model.

Step 2: In the second step of the method we have to follow CSMM procedure as described in Section 5.
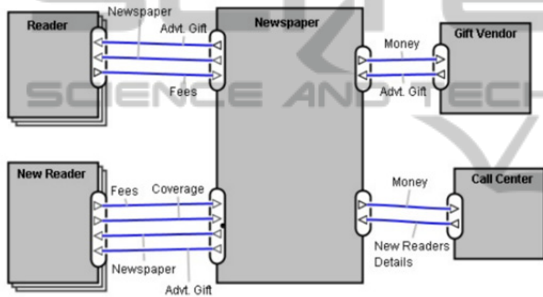

Figure 2: A simple e-3 value model of the example case.

Create: An e-3 value model has been created based on the case description. It has five network actors namely, Newspaper, Gift Vendor, Call Center, Reader and New Reader. The use value which the Newspaper acquires from the network are, Advt. Gift from the Gift Vendor, New Customer Details from the Call Center, Fees and Coverage from the Readers.

Select: In this step we choose those use-values which are used for realizing the business service, *Provide Advt. Gift to Customer.* For providing Advt. gift to customer only one use value is required, i.e. the Advt. Gift itself from the Gift Vendor.

Model: We model *Advt. Gift* as a business product.

Make: We now connect business product *Advt. Gift* and the business process *Store Gift* by the used-by relationship as shown in Figure 3.

Step 3. In this step the algorithm is run on the EA model of the newspaper with the business service, *Provide Advt. Gift to Customer* as the starting element. The resulting value model is shown in

Figure. 5 (left).

Step 4. From the above *value model* the key activities of are to be filtered. Due to space restriction only one entry for internal value table and one entry for external value table is shown for the business process *Store Gift*.

We now add each of these values to the value model and relate them to the appropriate element.
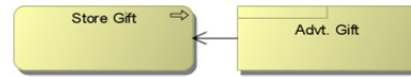

Figure 3: Make a relationship.

The final model after mapping these values is shown in Figure 5 (right). The final model is called the ***value creation model*** for providing the advertising gift to the customer.

Table 2: An entry for the Internal Value Table.

Store Gift	Value	Element	Description
	Comp-uter Skills	Store Manager	The store managers should have the computer skills to enter the data in the logistic software

Table 3: An entry for the External Value Table.

Store Gift	Value	Element	Description
	Ware-house Space	Store Gift	The newspaper rents the warehouse space to store the gifts sent by the gift vendor

8 APPLICATION OF THE VALUE CREATION MODEL

In this section we discuss ways in which the value creation model can be used in practice to support analysts and decision-makers in firms.

8.1 Extract a Relevant Subset of a Model

In its basic form, the method extracts a subset from a complete EA model that is relevant from the perspective of a certain type of value that is delivered to the customer. This enables product or process managers to focus on the elements in the architecture needed to deliver a specific product or service to the customer. The value creation model is
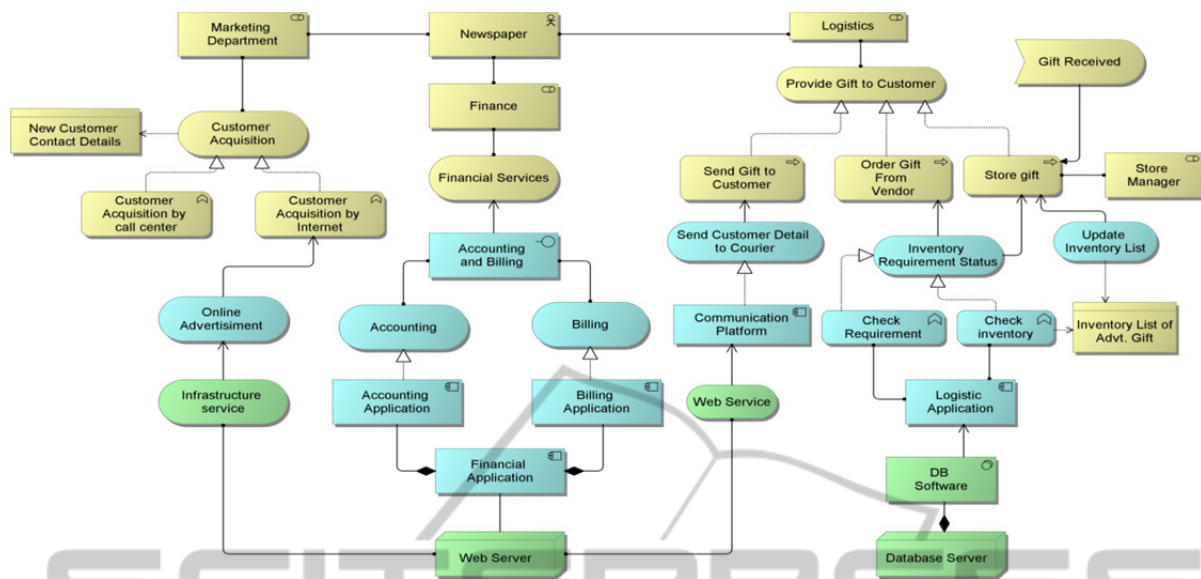
Figure 4: The EA model of the Newspaper Publisher.

a good starting point to improve Business-IT alignment, as it highlights how IT facilities are involved in providing customer value.

8.2 Linking EA to Value Networks

In the second step of the method we suggested a way to model values acquired from the network. These values can be modeled as services, products or collaborations. If the EA models of all the firms participating in value network are known, then the value creation model provides a way of linking the EA models of the firms in a network, resulting in a networked EA model. Previously, several researchers Publisher have tried to integrate *e-3 value* and ArchiMate by attempting a mapping between them. Janssen, Buuren, & Gordijn (2005) concluded that there is much similarity between these two modeling techniques. The first step of our method uses an *e-3 value model* to model the services acquired from the network and thus shows a possible way of mapping these two approaches. Also the value creation model can help in mapping the value activity concept of e3 value model to an EA model.

8.3 Analysis

The value creation model is a good starting point for various types of qualitative and quantitative (financial) analysis of an EA model. It has been previously shown that ArchiMate can be used for portfolio analysis, cost benefit analysis and also business case modelling (Janssen, Buuren, & Gordijn, 2005). The value creation model can provide a basis for calculating the costs incurred for realizing a product or service, and thus aid the above-mentioned types of analysis. Since the value creation model includes the use-values acquired from the network (Step 2), as well as the resources and activities which are difficult to model as ArchiMate elements (Step 4), it is a more comprehensive way of doing cost-benefit analysis. A second type of analysis is traceability analysis. Our method can be used to trace a value proposition to the resources and activities that realize it, thereby helping product or process managers to decide whether changing or stopping a particular activity or resources would affect a given value proposition. Traceability is not only confined to a single firm, but could span a complete network. From the example of the Newspaper Publisher and the Vendor, the value proposition of Advertising Gift can be traced back to resources, such as the Shipping Component application of the Gift Vendor. A third type of analysis that we want to highlight is sensitivity analysis, to determine *how critical* certain resources or activities are to a given value proposition. For this purpose, a number of metrics can be defined, such as the *weight* and *importance* of elements in the architecture. The result of the analysis is a *sensitivity factor*, which indicates how much a product or service will be affected if a certain resource or activity is changed or removed. A detailed research
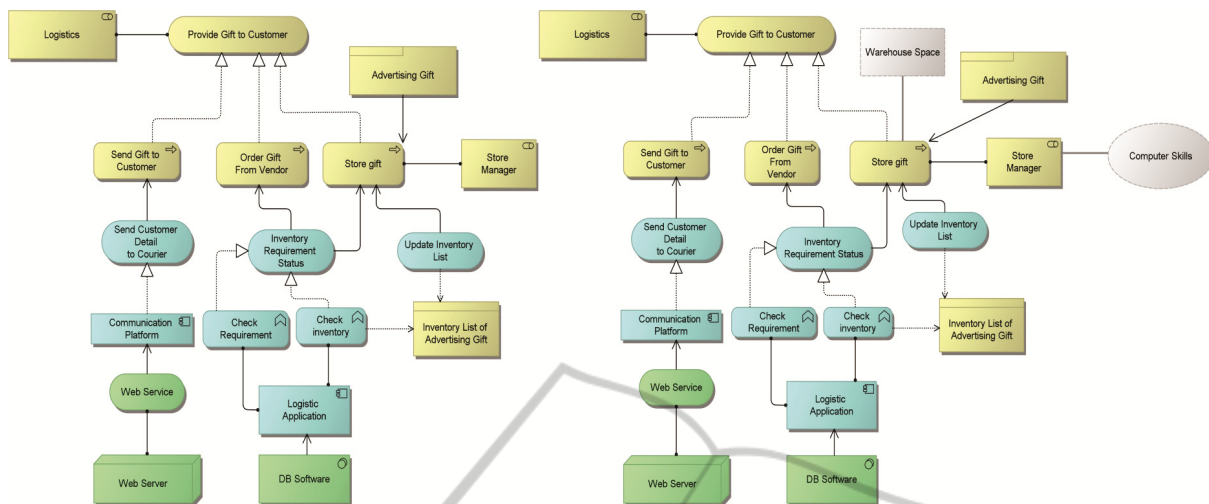
Figure 5: The Value Model (Left) and the Value Creation Model (right).

paper, dedicated to the quantitative applications of the value creation model is under preparation.

8.4 Composition of New Services

The value creation model may also aid process and product managers in designing or composing new services. The model is used to identify the resources and activities that are used to realize an existing service, and which may be reused or replicated to compose similar services.

9 CONCLUSIONS

In this research paper we have shown a step-by-step method to model value creation using ArchiMate. We argue that our method and the value creation model will help managers to better implement, analyze, evaluate and reconfigure strategies. A detailed evaluation of the method was conducted through an online survey and personal interviews of researchers and practitioners. The results of the evaluation show that the method in general and the value creation model in particular have important practical and theoretical implications in real life problem solving and decision making. Further extension of the method and its application to different cases are in progress. Below we enumerate some of the limitations of our research.

Firstly, the method has not been tested on a real case. Secondly, we have chosen not to use the association relationship as *an edge* while creating the value model. This might lead to some omissions from the original ArchiMate model. Thirdly, in the

case of a large organization, having a complex EA, the value model itself can be large and difficult to analyze. Lastly, since some elements are excluded from the original EA model, the algorithm can result in some relationships between two elements which are inconsistent with the ArchiMate meta-model.

This research opens some promising future areas of research. The value creation model should be used in real cases to ascertain its contribution. The metrics proposed in this research, have to be further formalized before they can be used in real cases. More possible uses of the value creation model have to be explored.

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