Modelling Value with ArchiMate

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Abstract. This paper investigates the suitability of the ArchiMate modelling language for the purposes of modelling value and related concepts and approaches. Based on this we propose several improvement which can help enterprise architects come one step closer to being able to model all aspects of an organisation, from its strategy, to the value it should create and deliver, to the abilities which are needed to realise this value, and to the architecture which supports this value creation and delivery. This can aid with motivating the value of a project, making changes directly aimed at improving customer value, and visualising the value exchanges within the value network of the organisation.

Keywords: Value · Value network · e3value · Value exchange · Value stream · Enterprise architecture · ArchiMate

1 Introduction

The concept of value has been discussed since the days of Aristotle [1], and to this day it is still a point of debate for many scholars [2]. It is used in many different domains such as strategy, marketing, purchasing, supply chain management, etc. [3]. Therefore it is no surprise that value has a central role in debates about why an organisation exists. The creation and delivery of value is considered to be the core purpose of organisations [1]. The survivability and continued profitability of organisations are linked to their ability to fulfil their economic purpose, which is to create and distribute sufficient value to each primary stakeholder from their value network [4, 5].

In practice, the term of value is a common occurrence in discussions of business strategy [6]. A business strategy typically describes, at a high level, how an organisation intends to create and deliver value to its stakeholders. The execution of the strategy addresses the mobilisation and alignment of specific resources and capabilities [7]. Therefore, the change associated to strategy needs to realise a specific value.

Enterprise Architecture (EA) is a discipline which is focused on designing, planning and implementing of organisational change. A commonly used approach to illustrate the architecture of an organisation, in the context of EA, is the ArchiMate modelling language. This language supports the modelling of motivational elements (stakeholder, goal, assessment, driver, etc.), business elements (actor, value, business

process, business service, etc.), application elements (application service, application component, etc.), technology elements (network, device, node, etc.), and implementation and migration elements (plateau, work package, gap, etc.). Therefore it should be possible to use the ArchiMate language to model the strategy of the organisation, the value it should create and deliver, the abilities which are needed to realise this value, and the architecture which supports this value creation and delivery.

The main goal and contribution of this paper is an investigation into the suitability of the ArchiMate language for modelling value and value-related concepts and approaches. Based on a review of current literature we can provide a definition of value, identify the value-relating concepts, and determine relevant value-related approaches. We apply this knowledge to ArchiMate and assess if the current specification of the language is sufficiently developed for the purpose of value modelling. Based on this we suggest the adjustment of several definitions of ArchiMate concepts. Furthermore, we propose an extension to the current metamodel to support the modelling of these concepts and relationships. With the help of a case we demonstrate how value modelling can be done with ArchiMate.

Being able to model the relation between the architecture of an organisation and the value it intends to generate can have several benefits. First of all, it can become easier to motivate the value of specific projects that implement organisational change. By modelling the value that a goal is supposed to realise, we can reason that a project which realises that goal also contributes to realising the value. Second, by relating the value creation to elements of the architecture, an organisation can make changes to the value they create by making more precise adjustments to the specific elements of the architecture that help create the value. Last but not least, the exchanges that occur within the network of an organisation can be modelled by abstracting from how they are actually realised and focusing on the value that is being exchanged.

The research methodology we follow in this study is design science as proposed by [8]. The remainder of this paper has been structured according to the activities described in [8]. Hence, Sect. 2 includes a presentation of the current literature on value. Section 3 introduces the ArchiMate modelling language in its current specification. In Sect. 4 we assess the suitability of the ArchiMate modelling language and propose several adjustments together with a value centred metamodel. Section 5 contains a demonstration of our proposed metamodel with the help of a case study. The paper ends with some conclusions and pointers to future work (Sect. 6).

2   Value and Value-Related Concepts and Approaches

The purpose of this section is to present the current state of research relate the topic of value, the different types of approaches to value, and identify which concepts are used in relation to value. Based on this we propose a definition to value, identify relevant approaches and related concepts to be modelled with ArchiMate.

Many different definitions and meanings have been attributed to the concepts of value. The two most predominant views on value, which have been originally identified by Aristotle, are value-in-use and value-in-exchange.

Value-in-use represents the quality of something as perceived by users in relation to their needs [9]. This quality refers to how much that something is worth to someone. Value-in-use is created by integrating resources and applying competencies [1].

Value-in-exchange refers to the amount paid by the user to the seller for the value-in-use of something [9] which was created by the seller and distributed in the market [1]. This second view on value is related to the idea of bartering in which one party offers something to another party, which in return will offer something of equal value. The value (i.e., price of the exchange) is determined based on the supply and demand. By looking at value-in-exchange in this way it can be said that it represents the price the buyer is willing to pay in order to benefit from something produced by the seller.

The concept of value is used in many different domains such as strategy, marketing, purchasing, supply chain management, etc. [3]. Therefore it is no surprise that is has a central role in debates about why an organisation exists. Peter Drucker has defined the role of an organisation as a creator of value for the customer and society and not for the organisation and its shareholders [10, 11]. As a response to this view on value, a trend has emerged which states that organisations should create and maximize **value for all stakeholders** alike [12], whether they are shareholders, employees, customers, suppliers, community residents, natural environment [5]. By pursuing this approach to value generation, an organisation integrates short and long-term results and ties its operations to its financial needs and results [12].

2.1 Value Definition

Based on the different views presented on value, we formulate a basic and general definition of value. Simply said, *a value is the quality (worth) of something (tangible or intangible) as perceived by a stakeholder (in relation to their goals/needs).* This value can be realised by an actor and exchanged with other actors. This definition will be used as a basis for investigating the suitability of the current concept of value in ArchiMate.

2.2 Value-Related Concepts

Value within an organisation is not an isolated concept. By looking at the definition of value proposed in Sect. 2.1 of this paper, we can deduce that value is relative to a **stakeholder** and thus it does not exist independently of a stakeholder. Other interesting relationships to investigate are between value and strategic intent (strategy, goal, objective, etc.) and between value and capability (what an organisation can do to achieve a certain strategic intent).

As mentioned before, the generation of value for stakeholders is often used as an explanation for why an organisation should exist. By itself the pursuit of value generation does not give guidelines on how this value can be created or delivered, or which activities of an organisation generate the specific value [13]. The **strategy** of an organisation is typically used to describe how an organisation creates this value for its stakeholders [7]. The strategy can be further decomposed in long and short term goals/objectives which are

aimed at achieving stakeholder value. Therefore we can say that each strategy, goal, objective has a specific value for a stakeholder.

Current literature has proposed **capabilities** as the way to link business and IT [14, 15] because they are focused on business outcomes [16]. Typically business outcomes are quantitative in nature. Another approach to capabilities presents them as what is required to produce any type of value within an organisation. This implies that an organisation's value creation is highly related to its various capabilities [17].

2.3 Value-Related Approaches

Over the years several approaches have been developed to support value, within different disciplines. In business management, Porter has introduced the **value chain** as an approach for analysing the sources of competitive advantage by examining the activities of an organisation and their interactions [18]. In essence, a value chain describes the sequence of value adding activities to bring products and services to the market [19]. Although the value chain has proven very useful in the past decades, it has become an inappropriate tool to analyse many industries today and uncover sources of value, particularly in sectors such as banking, insurance, telecommunication, news, entertainment, some areas of the public sector, etc. [20]. There are several reasons for this: products and services have become more dematerialised, the value chain no longer has a physical dimension, industries are constantly changing and evolving which makes the traditional view on value chains incompatible, and there is a strong co-operative behaviour [20].

The modern version of the value chain is the **value network**. The main difference between the two approaches is that the focus is not on the organisation or the industry (value chain), but on the value-creating system itself, in which different actors co-produce value (value network) [20]. The value network creates value through complex dynamic exchanges between one or more actors [21]. The **value exchange** represents the total pattern of values received, created, generated, and distributed by an organisation in all of its ongoing relationships with other actors [22]. These value exchanges can take the form of (1) goods, services and revenue (including contracts, invoices, confirmations, payment, etc.), (2) knowledge (strategic information, planning knowledge, technical know-how, etc.), (3) intangible benefits (customer loyalty, image enhancement, etc.) [21]. The e3value ontology [23] is an economic value-based modelling approach which incorporates ideas of the value chain, value network with value exchanges. Besides describing value exchanges of the value network, this ontology also captures behavioural aspects of such networks by using value activities, start and end stimuli and dependency paths. Another modelling approach, coming from lean management, is **value stream** mapping. Traditionally, it is used as a visual representation of all the activities needed to bring a product from raw material, through manufacturing, to the customer [24]. An organisation can have multiple of these value streams, each corresponding to one product/service. This type of approach to value is used to link the value creating activities of an organisation to the customer. Even though this approach was developed with the manufacturing sector in mind, it is now also used in service driven other sectors which are focused on delivering services, such

as health care [25]. The activities of a value stream might differ, but the main principle of value stream mapping remains true: mapping of the activities that generate value for the customer. In the context of value networks and e3value, it can help with detailing, if so desired, of the activities/processes that create value for the customer. An organisation can use this information for improvements that are directly targeted at changing the value that is delivered to their customers.

3   ArchiMate

The core language distinguishes between three layers: business, application, and technology layer. Each of these layers contains structural, behavioural and informational aspects, and also defines relationships between and within the layers Fig. 1. A complete description of the ArchiMate language (core, motivation extension, implementation and migration extension) is offered by [26].
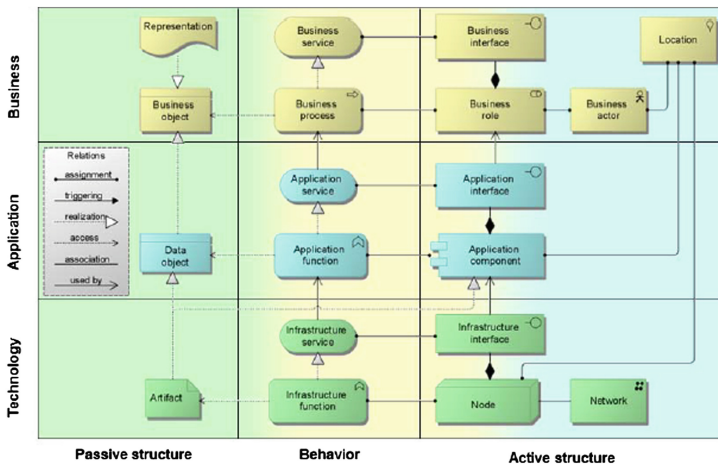

Fig. 1. ArchiMate core metamodel

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 (Fig. 2).

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. 3).

Iacob et al. [27] investigate if ArchiMate is suitable for modelling business strategy and value-related concepts. The conclusion of this research is that ArchiMate 2.1 Specification does not include all the necessary concepts, including the Capability concept. The authors also propose a metamodel for these new concepts, together with their relation to existing ArchiMate concepts (Fig. 4). In this metamodel we can see that the association relationship is used to model the relation between Value and other concepts.
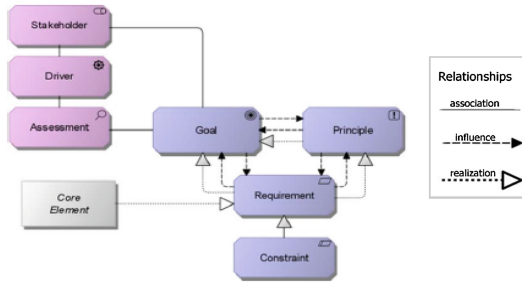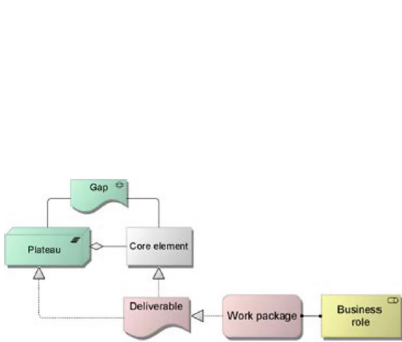
Fig. 2. Motivation extension metamodel

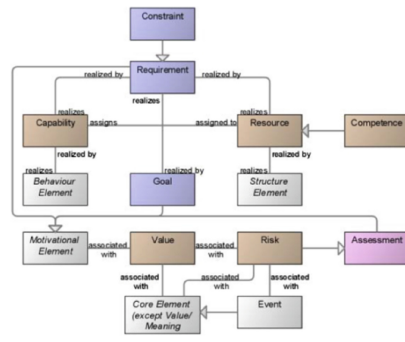**Fig. 3.** Implementation and migration metamodel

Fig. 4. The capability and resource metamodel as proposed by [27]

4   Modelling Value with ArchiMate

Several relevant concepts can be identified based on the literature review presented in Sect. 2. By using these concepts as a base, we can determine if the current specification of the ArchiMate modelling language [26] is sufficiently developed to model value, and the related approaches and concepts. Table 1 contains the assessment of current ArchiMate concepts and proposes several improvements to each of them, including the addition of the concept of Capability to the language.

From this we can conclude that the current specification of the ArchiMate language is not sufficient for modelling value, and value-related approaches and concepts. Therefore we propose the modification of the definition for Value and Stakeholder, the addition of the Capability concept as proposed by [27, 29] and the use of the realisation relationship to link Value to other ArchiMate concepts (goal, capability, core elements, work packages, plateaus).

Table 1. Assessment of ArchiMate 2.1 specification and suggested improvements

Concept/ Relationship	ArchiMate definition	Assessment	Improvement
Value	The relative worth, utility, or importance of a business service or product.	Definition is limited as it does not define value as being relative to a stakeholder. It does not reflect the relationship between the relative worth (value) and the needs and goals of stakeholders. It limits the value to being associated only with a business service or product.	**New definition**: the quality (worth) of something (tangible or intangible) as perceived by a stakeholder (in relation to their goals/needs).
Stakeholder	A person or a team that has interests or concerns regarding the outcome of the architecture.	Definition is limited by describing only the stakeholders that have an interested regarding the outcome of the architecture of an organisation. It considers only individuals and teams of individuals as possible stakeholders, and not organisations.	**New definition**: a person, a group of persons, or an organisation that has interests or concerns regarding the organisation, which is described by its architecture.
Business actor	An organisational entity that is capable of performing behaviour.	The business actor represents the actual entity that can have the role of Stakeholder.	No change
Goal	An end state that a stakeholder intends to achieve.	There is no distinction between the different strategic concepts such as Vision, Mission, Strategy, Objective.	Aldea et al. [28] have proposed using different profiled for Goal to model the different strategic concepts.
Capability	Does not exist in the current ArchiMate specification	It has already been proposed as an addition to the language by [27, 29]	**New concept definition**: the ability of an organization to employ resources to achieve some goal.

(*Continued*)

Table 1. (*Continued*)

Concept/ Relationship	ArchiMate definition	Assessment	Improvement
Association relationship	Models a relationship between objects that is not covered by another, more specific relationship.	This relationship is currently being used to link Value to other concepts of ArchiMate. We consider this relationship too weak for the purposes of modelling what creates value in an organisation.	We propose the use of a realisation relationship, in addition to the association relationship.
Realisation relationship	Links a logical entity with a more concrete entity that realises it.	The Value concept should be used to model what value is being created by an organisation. Thus not what value is being associated to a specific element, but what value is being realised by a specific element. By having this relationship to value it can become easier to determine where changes need to occur in order to influence that value that is being created.	**New relationship**: We consider this relationship to be more appropriate for modelling the relation between Value and other ArchiMate concepts. Use of this relationship does not exclude the use of the association relationship.
Flow relationship	Describes the exchange or transfer of information or value between processes, functions, interactions, and events.	The definition is limited because it does not include the possibility to model the value transfer between actors. Flow can be used to model value exchanges between the actors in a value network.	**New definition**: The exchange or transfer of information or value between actors, processes, functions, interactions, events.

Figure 5 shows how the concept of Value can be related to the proposed and current ArchiMate concepts. This metamodel includes all the required relationships for modelling all the value-related approaches presented in Sect. 2.

Even with the proposed extension there are still certain limitations to what can be modelled with ArchiMate, especially concerning value networks and e3value. The value exchanges between the actors of a network can be modelled in ArchiMate by using the flow relationship. Although this relationship expresses that there is a transfer of information, knowledge or value between two actors, it does not specify exactly what is being transferred.
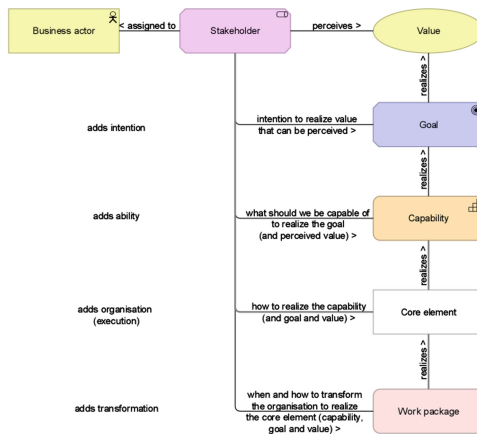

Fig. 5. Value and related concepts metamodel

We propose that in the case of flow relationships, the actual value that is being transferred should be associated to the flow relationship. Figure 6 illustrates our proposed idea of associating the value to the flow relationship.
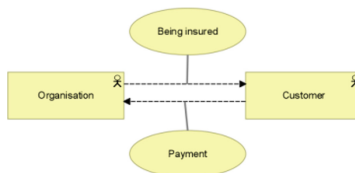

Fig. 6. Value associated to the flow relationship

Another limitation regarding value networks comes from the fact that the ArchiMate modelling language does not support at the moment a distinction between AND/OR junctions. Thus we cannot make the distinction between value exchanges that take place together in the same scenario (AND) or value exchanges that happen in alternative situations (OR).

5   Demonstration

Throughout this section we demonstrate how the value concept and its related concepts and approaches can be modelled. We take the example case study of the fictitious but realistic ArchiSurance organisation as described by [30]. This case study is published by the Open Group and is used to portray the use of the ArchiMate in the context of TOGAF. The following is a short summary of the case study.

The ArchiSurance organisation is the result of a merger between three independent insurance organisations. The main reason that leads to this merger is that the three independent organisations could not remain competitive without significant investments in IT. By combining into one organisation they would be able to control their costs, maintain customer satisfaction, invest in new technology and take advantage of the emerging high growth potential markets.
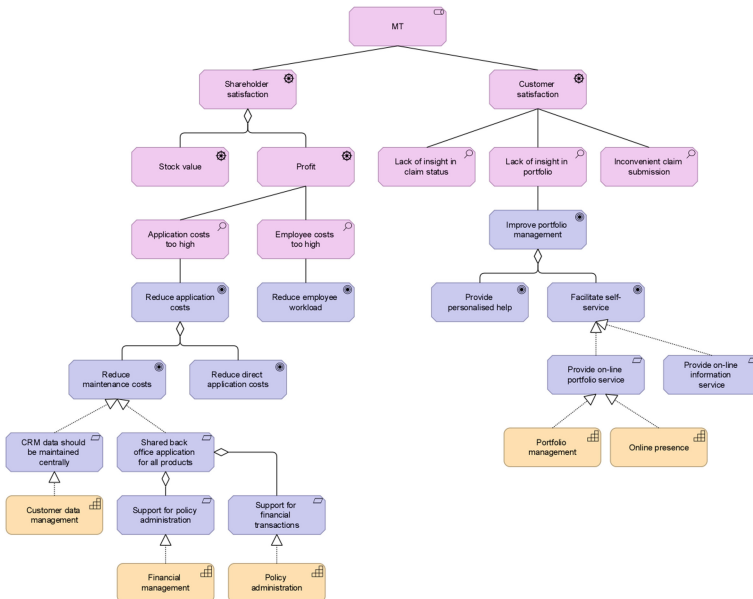

Fig. 7. Example shareholder and customer satisfaction strategy

The management team (MT) of the organisation has two main concerns: the satisfaction of the organisation's shareholders and customers. In terms of shareholders, the main concerns are the stock value and the profit. In terms of customers the main concerns are the customer complaints and leaving customers. An analysis of the profit concern reveals that application and employee costs are too high. An analysis of the customer complaints concern reveals that there is a lack of insight in claim status and insurance portfolio, and an inconvenient claim submission process. As a result of this assessment, the MT formulates several goals. For example, in order to deal with the high application costs the maintenance costs and the direct application costs need to be

reduced. Similarly, for the lack of insight into the insurance portfolio the goal formulated is to improve the portfolio management. For each of these goals there are several requirements formulated. These requirements are realised by several capabilities of the organisation. Figure 7 illustrates the example of the stakeholders, concerns, goals, requirements and corresponding capabilities of the ArchiSurance organisation.
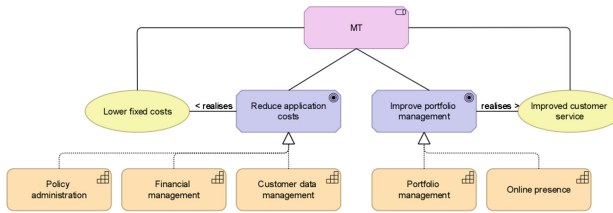

Fig. 8. Example goals that realise values, as perceived by the stakeholder

The MT expects a certain value to be realised by each goal. For example, the reduced application costs are supposed to realise the value of lower fixed costs. Similarly, the goal to improve portfolio management is supposed to realise the value of improved customer service. Figure 8 illustrates the relation between these goals and values as perceived by the MT. All the sub-goals, capabilities and projects that help realise these main goals are also realising the values or parts of the values.

The previous example shows how value can be perceived by an internal stakeholder of the organisation. It also shows how the organisation, at strategic level, intends to create value for their shareholders and customers. However the organisation does not realise this value alone, but it is part of a value network. The organisation has value exchanges with intermediaries and the customer. Figure 9 illustrates these value exchanges related to the main value creating processes, within the value network of the ArchiSurance organisation. In this the values exchanged between the actors of the value network are named on top of the flow relations.
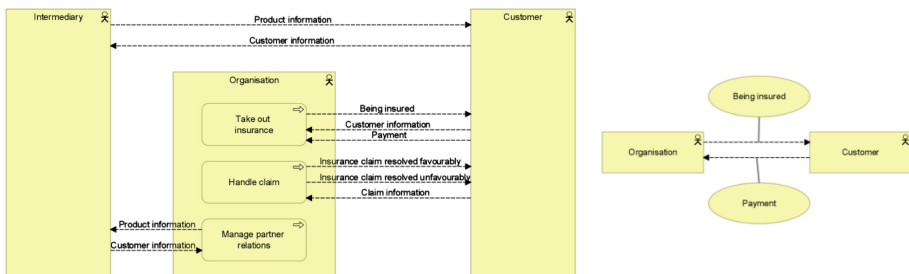

Fig. 9. Example value network with value exchanges and value creating activities

The ArchiSurance organisation wishes to improve the value it delivers to its customers. They can do this by having a closer look at its value streams. From the value network example presented above we can see that there are two main processes that

deliver value to the customer. Figure 10 illustrates the value streams for the two processes. In this figure we can see in detail the processes that realise the services that have a particular value for the customers. Any change that is aimed at improving the values delivered to the customer should be made within these processes.
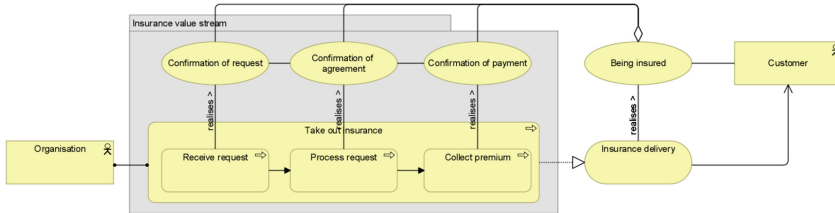

Fig. 10. Example value stream(s)

6 Conclusions, Limitations and Further Research

In this paper we have proposed an approach which will allow for Value and related concepts to be modelled with ArchiMate. Based on a literature review, we are able to put forward an improved definition of the Value and Stakeholder concepts of Archi-Mate. Furthermore, we determine which concepts can have a relationship with Value (Stakeholder, Actor, Goal, Capability, core elements, and implementation and migration elements), and also specify what kind of relationships are possible (realization and flow). The current AchiMate specification allows for the concept of Value to be related to all other concepts by using the association relationship. We consider this relationship to be too weak for expressing what actually creates value in an organisation. For the purpose of modelling a value network we propose the use of the flow relationship. This allows for modelling that there is a transfer between actors but does not specify what is actually being transferred. In order to be able to model the actual value that is being exchanged, we propose to use an association relationship to connect the value to the flow relationship. Another aspect that requires attention is the fact that no distinction can be made at the moment between flows that happen in the same situation and flows that happen in alternative situations. In order to deal with this limitation we propose an improvement to the junction concept.

There are several limitations to the research we have presented. We have determined that the ArchiMate language is not sufficiently developed at the moment to be use for modelling value and related concepts and approaches. Further research needs to be done in order to determine if the proposed changes to the language are sufficient. Furthermore, in this paper we have demonstrated how our proposed changes can be used with the help of a fictitious case study. Even though this is sufficient for illustration purposes, further research needs to be done in order to investigate the applicability and generalizability of our proposed extension in practice. Another point of interest for further research would be to determine if automated model transformations between e3value and ArchiMate are possible with the help of our proposed changes.

References

1. Vargo, S.L., Maglio, P.P., Akaka, M.A.: On value and value co-creation: a service systems and service logic perspective. Eur. Manage. J. **26**(3), 145–152 (2008)
2. O'Cass, A., Ngo, L.V.: Examining the firm's value creation process: a managerial perspective of the firm's value offering strategy and performance. Br. J. Manag. **22**(4), 646–671 (2001)
3. Lindgreen, A., Wynstra, F.: Value in business markets: what do we know? Where are we going? Ind. Mark. Manage. **34**(7), 732–748 (2005)
4. Clarkson, M.E.: A stakeholder framework for analyzing and evaluating corporate social performance. Acad. Manag. Rev. **20**(1), 92–117 (1995)
5. Hillman, A.J., Keim, G.D.: Shareholder value, stakeholder management, and social issues: what's the bottom line? Strateg. Manag. J. **22**(2), 125–139 (2001)
6. Brandenburger, A.M., Stuart, H.W.: Value-based business strategy. J. Econ. Manag. Strateg. **5**(1), 5–24 (1996)
7. Kaplan, R.S., Norton, D.P.: The strategy map: guide to aligning intangible assets. Strateg. Leadersh. **32**(5), 10–17 (2004)
8. Peffers, K., Tuunanen, T., Rothenberger, M.A., Chatterjee, S.: A design science research methodology for information systems research. JMIS **24**(3), 45–77 (2007)
9. Lepak, D.P., Smith, K.G., Taylor, M.S.: Value creation and value capture: a multilevel perspective. Acad. Manag. Rev. **32**(1), 180–194 (2007)
10. Drucker, P.F.: The Practice of Management. Harper and Row Publishers, New York (1954)
11. Martin, J.D., Petty, J.W., Wallace, J.S.: Value-based Management with Corporate Social Responsibility. Oxford University Press, New York (2009)
12. Drucker, P.F.: A Functioning Society: Selections from Sixty-five Years of Writing on Community, Society, and Polity. Transaction Publishers, New Brunswick (2003)
13. Jensen, M.C.: Value maximization, stakeholder theory, and the corporate objective function. J. Appl. Corp. Finance **14**(3), 8–21 (2001)
14. Danesh, M.H., Yu, E.: Modeling Enterprise capabilities with i*: reasoning on alternatives. In: Iliadis, L., Papazoglou, M., Pohl, K. (eds.) CAiSE Workshops 2014. LNBIP, vol. 178, pp. 112–123. Springer, Heidelberg (2014)
15. Stirna, J., Grabis, J., Henkel, M., Zdravkovic, J.: Capability driven development – an approach to support evolving organizations. In: Sandkuhl, K., Seigerroth, U., Stirna, J. (eds.) PoEM 2012. LNBIP, vol. 134, pp. 117–131. Springer, Heidelberg (2012)
16. Miklos, J.: A meta-model for the spatial capability architecture. J. Theor. Appl. Inf. Technol. **43**(2), 301–305 (2012)
17. Möller, K.K., Törrönen, P.: Business suppliers' value creation potential: a capability-based analysis. Ind. Mark. Manage. **32**(2), 109–118 (2003)
18. Porter, M.E.: Competitive Advantage: Creating and Sustaining Superior Performance. Free Press, New York (2008)
19. Sato, Y., Fujita, M.: Capability matrix: a framework for analyzing capabilities in value chains, IDE Discussion Paper 219, Institute of Developing Economies (2009)
20. Peppard, J., Rylander, A.: From value chain to value network: insights for mobile operators. Eur. Manag. J. **24**(2), 128–141 (2006)
21. Allee, V.: Reconfiguring the value network. J. Bus. Strateg. **21**(4), 36–39 (2000)
22. Miller, R.L., Lewis, W.F.: A stakeholder approach to marketing management using the value exchange models. Eur. J. Mark. **25**(8), 55–68 (1991)
23. Gordijn, J., Akkermans, J.: Value-based requirements engineering: exploring innovative e-commerce ideas. Requirements Eng. **8**(2), 114–134 (2003)

24. Gracanin, D., Buchmeister, B., Lalic, B.: Using cost-time profile for value stream optimization. Procedia Eng. **69**, 1225–1231 (2014)
25. Lummus, R.R., Vokurka, R.J., Rodeghiero, B.: Improving quality through value stream mapping: a case study of a physician's clinic. Total Qual. Manag. **17**(8), 1063–1075 (2006)
26. The Open Group: ArchiMate® 2.1 Specification. Van Haren Publishing, Zaltbommel (2013)
27. Iacob, M.E., Quartel, D., Jonkers, H.: Capturing business strategy and value in enterprise architecture to support portfolio valuation. In: 16th International Enterprise Distributed Object Computing Conference (EDOC 2012), pp. 11–20. IEEE, Bejing (2012)
28. Aldea, A., Iacob, M.E., van Hillegersberg, J., Quartel, D., Franken, H., Bodenstaff, L.: Modelling strategy with ArchiMate. In: Proceedings of the 30th ACM/SIGAPP Symposium on Applied Computing (SAC 2015), 13–17 April, Salamanca, Spain (2015, accepted)
29. Azevedo, C.L.B., Iacob, M.E., Almeida, J.P.A., van Sinderen, M., Pires, L.F., Guizzardi, G.: An ontology-based well-founded proposal for modeling resources and capabilities in ArchiMate. In: 17th International Enterprise Distributed Object Computing Conference (EDOC 2013), pp. 39–48 (2013)
30. Jonkers, H., Band, I., Quartel, D.: The ArchiSurance Case Study, White paper, The Open Group, Spring (2012)