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ENTERPRISE ARCHITECTURE MANAGEMENT VALUE CREATION MECHANISMS

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ABSTRACT

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Enterprise Architecture Management (EAM) is claimed to create value to organizations. Understanding this value is important for EAM expectations management, investment analysis, and EAM research. In addition to understanding '*what*' value can be associated with EAM, it is beneficial to understand '*how*' that value is created. Pursuing such research is a novel endeavor. The 'what' and 'how' of EAM value were researched through literature review, a survey exploring the experiences of EAM stakeholders, and data analysis on the obtained survey results to identify relationships. Previous research suggests EAM value to fall into the categories of strategic and political, knowledge management related, communicational, transformational, inter-organizational, integration and interoperability related, flexibility and agility related, economic, and others. According to the results, higher solutions integration, better communication and information sharing, improved transparency of dependencies, and better decision making were EAM values most experienced by the professionals. Enterprise Architecture (EA) product and service quality, culture and attitude towards EA[M], and EA product and service use were all concluded to impact EAM value creation. Involving architects in development projects, ensuring the use of EA descriptions, and having the possibility to ask the architects' assistance were seen important aspects in EAM value creation. The results have implications for both academics and industry.

Keywords: enterprise architecture, enterprise architecture management, value creation, value creation mechanisms

TIIVISTELMÄ

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Kokonaisarkkitehtuurin (KA) hallinnan väitetään luovan arvoa organisaatioille. Tämän arvon ymmärtäminen on tärkeää kokonaisarkkitehtuurityöhön liittyvien odotusten hallinnalle, investointianalyyseille ja kokonaisarkkitehtuurin tutkimukselle. Mahdollisen arvon lisäksi on hyödyllistä ymmärtää, 'miten' tämä arvo muodostuu. Tällaisella tutkimuksella on huomattavaa uutuusarvoa alalla. Kokonaisarkkitehtuurityöhön liitettävän arvon 'mitä' ja 'miten' kysymyksiä tutkittiin tässä työssä kirjallisuuskatsauksen, KA:n sidosryhmien kokemuksia tutkivan kyselyn ja kyselytutkimuksen tulosten analyysin avulla mahdollisten suhteiden tunnistamiseksi. Aiemman tutkimuksen perusteella KA-työhön liitetty arvo voidaan jaotella strategiseen ja poliittiseen, tiedonhallintaan liittyvään, kommunikaatioon liittyvään, muutoskykyyn liittyvään, organisaatiosuhteisiin liittyvään, integraatioon ja yhteentoimivuuteen liittyvään, joustavuuteen ja ketteryyteen liittyvään, taloudelliseen ja muuhun. Tämän tutkimuksen tulosten perusteella ammattilaiset kokivat KA-työstä ratkaisuiden parempaa yhteentoimivuutta, laadukkaampaa viestintää ja tiedonjakamista, parannettua riippuvuuksien läpinäkyvyyttä ja laadukkaampaa päätöksentekoa. KA-työn tuotosten ja palveluiden laadun, kulttuurin ja asenteen KA-työtä kohtaan sekä KA-tuotosten ja -palveluiden käytön todettiin kaikkien vaikuttavan KA-työhön liitetyn arvon kokemiseen merkittävästi. Tärkeänä KA-työn arvon kannalta havaittiin arkkitehtien osallistuminen kehitysprojekteihin, KA-kuvausten hyödyntämisen varmistaminen ja mahdollisuus kysyä arkkitehtien apua. Saaduilla tuloksilla on mahdollisia vaikutuksia sekä tutkimukselle että liike-elämälle.

Avainsanat: kokonaisarkkitehtuuri, kokonaisarkkitehtuurin hallinta, arvonluonti, arvonluontimenetelmät

FIGURES

TABLES

EQUATIONS

TABLE OF CONTENTS

1 INTRODUCTION

"To a big extent, managing the enterprise means managing the enterprise architecture (Goethals *et al.*, 2006)." The modern enterprise has grown complex and is on a constant hunt for improved operations. Change is vital, and happening faster than ever before (Paton and McCalman, 2008; Miller and Proctor, 2016). However, it is easier to change when you understand where you are and where you should be going. Managing the Enterprise Architecture (EA), i.e., managing the building blocks and interrelations of the enterprise, can help enterprises achieve vital qualities – enhanced agility, alignment, and integration. (Goethals *et al.*, 2006) EA management helps organizations manage complexity (Alwadain *et al.*, 2016), create competitive advantages (Vargas *et al.*, 2013), and enables IT landscape management as a whole (Närman *et al.*, 2012). It increases information security (Burmeister, Drews and Schirmer, 2019), lowers costs (Tamm *et al.*, 2011), and even creates possibilities for better strategic management (Simon, Fischbach and Schoder, 2014). Claims of Enterprise Architecture Management (EAM) benefits and value are listed in various books, studies, and professional literature. They make EAM seem like the silver bullet. However, it seems like many studies miss to explain the mechanisms of how that value is created.

To allow better understanding of EAM value creation mechanisms, this study seeks to answer the following questions:

1. What EAM value is perceived by EAM stakeholders?
2. What kind of EAM value creation mechanisms can be found in practice?

2 PREVIOUS LITERATURE

This chapter presents and synthesizes previous literature on value creation in the context of EAM. First, we discuss the different definitions of Enterprise Architecture and Enterprise Architecture Management. Following, we explore the concept of value in EAM efforts – what does it mean and what value is EAM claimed to create. Finally, we investigate previous research on *how* EAM creates value. The value creation mechanisms suggested in prior literature are synthesized in the end of this chapter.

2.1 Defining Enterprise Architecture (EA) and Enterprise Architecture Management (EAM)

There are numerous studies and articles on EA. The concept has been studied from various perspectives – operational, strategic, and managerial. Nevertheless, there is no single used definition for EA. Many previous studies mention the definition of EA by the IEEE (2022), defining EA as "the fundamental organization of a system embodied in its components, their relationships to each other and to the environment and the principles guiding its design and evolution". The ISO 15704:2019 (2019) standard defines [Enterprise] Architecture as:

> the conceptualization of the form, function, and fitness-for-purpose of an enterprise in its environment, as embodied in the elements of the enterprise, the relationships between those elements, the relationship of the enterprise to its environment and the principles guiding the design and evolution of the enterprise (ISO, 2019).

Following the core idea of the previously presented two popular definitions, several EA studies describe EA as the fundamental organization of an enterprise defined and represented through its components (e.g., information technology (IT) systems and business processes) and their interrelationships (Stelzer, 2010; Tamm *et al.*, 2011; Simon, Fischbach and Schoder, 2014). These characteristics are central in all identified EA definitions. Additionally, in a similar manner to ISO 15704:2019 (2019) and the IEEE (2022), some studies mention EA to encompass the architectural principles directing the design and evolution of the architecture (Stelzer, 2010). For Enterprise Architecture, we adopt the popular definition by the IEEE (2022).

Many definitions distinguish between Enterprise Architecture, as the product or actual structure, and Enterprise Architecture Management (EAM), as the activity of aiming to manage that structure. In these definitions, EA is presented as the collection of descriptions representing the business and IT structures in different states – past, current, and future (Niemann, 2006). These products are the documented representation of the organization's EA (Lange, Mendling and Recker, 2016) – models, standards, principles, and other descriptions produced by the EAM processes (Tamm et al., 2011). EAM is defined as the establishment

and purposeful development of the EA, guiding business change from an architectural perspective (Aier, Gleichauf and Winter, 2011). In other words, EAM processes are the activities of designing, managing, and transforming the EA to support the overall strategy of the enterprise. The EAM processes include inception of the EA, developing and managing standards and metamodels, managing the IT landscape, managing the business architecture, developing solution architectures, (Simon, Fischbach and Schoder, 2013) and developing and managing documentation (Tamm et al., 2011).

In practice, EA frameworks (EAF) are used as a guide to navigate and organize EAM work and EA documentation. Commonly presented as the founding father of the concept of EA, John Zachman proposed the first structured EAF in 1987. His framework proposes elements for answering the *what, how*, and *where* questions regarding the addressed system from the different perspectives of the core stakeholders – the system owner, the system designer, and the system builder. (Zachman, 1999) The Zachman framework has since gone through many iterations to reach its modern form as represented in FIGURE 1. Somewhat recent general, i.e. not domain/industry-specific, frameworks include the Integrated Architecture Framework (IAF), by Capgemini, and The Open Group Architecture Framework (TOGAF), by The Open Group (The Open Group, 2018). Modern EAFs are comprehensive methodologies for EAM – toolkits for planning, developing, maintaining, and deriving value from EA (Gong and Janssen, 2019).

Creating fuzziness around the distinction between EA and EAM, a few studies approach the concept of EA through the *management* of the Enterprise Architecture (Goethals *et al.*, 2006; Gong and Janssen, 2019), describing EA as encompassing both EA operations, e.g., EA management and definition activities, and EA's role as representations, or products of these operations (Niemi and Pekkola, 2016). This paper follows the distinction between EA as the product or actual structure and EAM as its management activities.

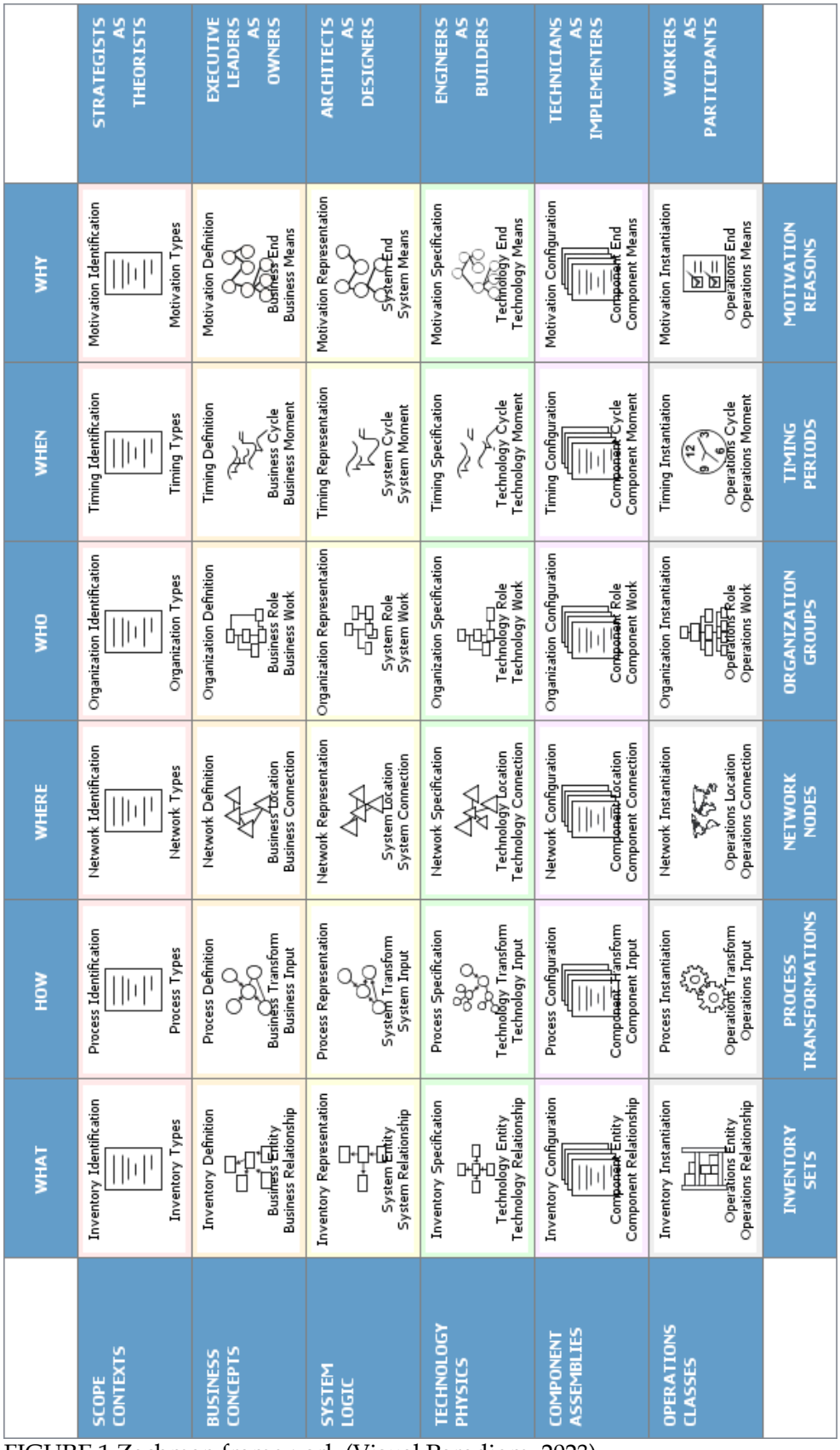

FIGURE 1 Zachman framework (Visual Paradigm, 2023)

2.2 Value in EAM

Studies have argued EAM to result in value (Tamm *et al.*, 2011; Foorthuis *et al.*, 2016). In practice, a clear understanding of EAM value is essential for setting realistic expectations, determining the risk and return of EAM investments, and ensuring necessary commitment to EAM (Rodrigues, L. S. and Amaral, L., 2010; Bernus *et al.*, 2016; Gong and Janssen, 2019). In the context of this study, understanding EAM value is essential for comprehending the perceived value by EAM stakeholders and exploring the EAM value creation mechanisms. Fortunately, previous literature on EAM value and benefits is abundant.

Fundamentally, the word "value" means to 'be worth' (The Open Group, 2018). Traditionally, it is often associated with the monetary worth and financial benefit of something (Merriam-Webster, 2022). An enterprise exists to create value to its stakeholders. However, rather than as a purely financial concept, value may also be understood as the usefulness, advantage, benefit, or desirability of something (The Open Group, 2018). Empirical evidence suggests value from EAM to fall into the following categories:

- strategic and political,
- transformational,
- communicational,
- economic,
- flexibility and agility related,
- integration and interoperability related,
- inter-organizational,
- knowledge management related, and
- others (Gong and Janssen, 2019).

Value can be potential, perceived, or realized. Potential value is the inherent value of EAM that can *potentially* become realized. (Kluge, Dietzsch and Rosemann, 2006) An example of potential value from EAM includes increased quality of development projects (Foorthuis *et al.*, 2010). Perceived value is value that is *experienced* by EAM users and stakeholders (Kluge, Dietzsch and Rosemann, 2006) – e.g., from a project team's perspective, EA descriptions may improve the transparency of dependencies (Niemi and Pekkola, 2016). Finally, realized value is the net benefit, the net positive impact (Kluge, Dietzsch and Rosemann, 2006). An example of realized value from EAM could be an improved systems environment (Tamm *et al.*, 2011).

EAM delivers value for both projects and entire organizations (Tamm *et al.*, 2011; Foorthuis *et al.*, 2016). It facilitates better availability of information on the enterprise's current architecture (Niemi and Pekkola, 2016), as well as its target state (Foorthuis *et al.*, 2010), and supports projects, enabling alignment with overall enterprise strategy (Goethals *et al.*, 2006; Kluge, Dietzsch and Rosemann, 2006). As Gong and Janssen (2019) sum up, EAM acts as an enabler for successful transformational projects in organizations. Additionally, on the organizational level,

EAM is claimed to increase an organization's ability to respond to changing customer and market needs (Tamm *et al.*, 2011), improve operational excellence (Kaisler, Armour and Valivullah, 2005), and lower operational costs (Bradley *et al.*, 2011).

In exploring the notion of value from EAM, one can feel a need to distinguish between value resulting directly from EAM, its direct value, and value resulting from the impact of EAM to intermediators, its indirect value (Tamm *et al.*, 2011; Gong and Janssen, 2019). Direct value from EAM is typically associated with increased knowledge of the enterprise and its goals, enabling e.g., more informed decision making (Tamm *et al.*, 2011). However, most of EAM value is indirect, realizing through the consumption of EAM offering – EA descriptions and EAM services – in organizational activities (Tamm *et al.*, 2011; Niemi and Pekkola, 2016; Gong and Janssen, 2019). In other words, using EA descriptions as an example, an enterprise's EA documentation – as a collection of descriptions – does not result in value if none of these descriptions are used in some value adding practice (Persson and Stirna, 2001). According to previous literature, indirect EAM value can realize through e.g., increased project quality (Foorthuis *et al.*, 2010), faster time-to-market (Cardwell, 2008), or improved organizational capability to change (Boucharas *et al.*, 2010).

Saleem and Fakieh (2020) discuss a further distinction by grouping financial benefits with the concept of tangibility and non-financial benefits with the concept of intangibility. An example of proposed tangible value from EAM is [IT] cost savings (Tamm *et al.*, 2011; Kappelman and Zachman, 2013; Niemi and Pekkola, 2016). Due to its typically quantifiable nature, tangible value is relatively easy to measure. However, Tamm et al. (2011) claim direct value from EAM to typically be intangible. Moreover, looking at an example of intangible value, e.g., the dissolution of information silos, this type of value may require more creativity to quantify and measure (Tamm *et al.*, 2011). Some authors overall doubt the direct measurability of EAM value, at least with traditional methods (Kluge, Dietzsch and Rosemann, 2006).

Finally, EAM value can be immediate or realize long-term (Niemi and Pekkola, 2016). On one hand, improved transparency of dependencies, for example, may realize as soon as these dependencies are documented and the documentation is used (Niemi and Pekkola, 2016). Similarly, easier scoping of development projects may be experienced valuable in a relatively short amount of time (Foorthuis *et al.*, 2010). On the other hand, increased business/IT alignment (Goethals *et al.*, 2006; Bradley *et al.*, 2011), lower IT resource heterogeneity (Boh and Yellin, 2006; Aier, Gleichauf and Winter, 2011), and improved operational excellence (Kaisler, Armour and Valivullah, 2005) may take considerably longer to realize.

To summarize and provide a conclusion on the characteristics of EAM value as argued by the explored previous literature in this chapter, EAM value:

- Can be potential, perceived, or realized,
- May realize on project and/or whole enterprise level,
- May realize immediately and/or longer term,
- May be difficult to measure directly,
- Is often indirect,
- Can be direct, however then is typically intangible.

As was seen in this chapter, EAM is claimed to create several kinds of value. The following table synthesizes the presented EAM value proposed by previous literature. The values are grouped according to the EAM value categories after Gong and Janssen (2019).

TABLE 1 EAM value proposed in literature by categories after Gong and Janssen (2019)

EAM Value Category	**EAM value**	**Source**
Strategic and political	Increased business/IT alignment	(Goethals *et al.*, 2006; Bradley *et al.*, 2011; Tamm *et al.*, 2011; Foorthuis *et al.*, 2016; Niemi and Pekkola, 2016)
	Better decision making	(Goethals *et al.*, 2006; Tamm *et al.*, 2011; Lange, Mendling and Recker, 2012b; Niemi and Pekkola, 2016)
	Increased control on organizational complexity	(Foorthuis *et al.*, 2016)
	Improved operational excellence	(Kaisler, Armour and Valivullah, 2005; Tamm *et al.*, 2011)
	Better compliance with regulations, standards, and quality requirements	(Boucharas *et al.*, 2010)
	Improved business continuity	(Boucharas *et al.*, 2010)
	Improved risk management / less risky operations	(Boucharas *et al.*, 2010; Tamm *et al.*, 2011; Foorthuis *et al.*, 2016)
	Better resource management	(Boh and Yellin, 2006; Tamm *et al.*, 2011)

	Increased business stability	(Tamm *et al.*, 2011)
	Create competitive advantage	(Vargas *et al.*, 2013)
Knowledge Management Related	Increased organizational learning	(de Vries and van Rensburg, 2008; Lange, Mendling and Recker, 2012b)
	Clear overview of organization	(Niemi and Pekkola, 2016)
	Improved transparency of dependencies	(Niemi and Pekkola, 2016)
	Dissolution of information silos	(Aier, Gleichauf and Winter, 2011)
	Better understanding of organization's vision	(Foorthuis *et al.*, 2010; Lange, Mendling and Recker, 2012b)
Communicational	Better communication and information sharing	(Cardwell, 2008)
	Availability of information on EA	(Niemi and Pekkola, 2016)
	Common vocabulary	(Niemi and Pekkola, 2016)
Transformational	Better project efforts alignment with overall corporate strategy	(Goethals *et al.*, 2006; Kluge, Dietzsch and Rosemann, 2006)
	Increased project quality	(Foorthuis *et al.*, 2010, 2016)
	Better management of complexity in projects	(Boh and Yellin, 2006; Foorthuis *et al.*, 2010, 2016)
	Improved organizational capability to change	(Boucharas *et al.*, 2010)
	Faster project initialization	(Foorthuis *et al.*, 2016; Niemi and Pekkola, 2016)
	Timely completion of projects	(Foorthuis *et al.*, 2016)
	Clear requirements and restrictions	(Niemi and Pekkola, 2016)

Inter-organizational	Better management of external relationships	(Bradley *et al.*, 2011)
	Increased customer intimacy	(Tamm *et al.*, 2011)
	Increased external collaboration	(Foorthuis *et al.*, 2016)
Integration and interoperability related	Higher solutions integration	(Boh and Yellin, 2006; Niemi and Pekkola, 2016)
	Increased organization-wide standardization, integration, and deduplication of assets	(Foorthuis *et al.*, 2016)
	Better data integration	(Boh and Yellin, 2006)
	Improved/harmonized business processes	(Kaisler, Armour and Valivullah, 2005; Foorthuis *et al.*, 2010; Tamm *et al.*, 2011)
	Increased reusability of IT assets	(Boucharas *et al.*, 2010; Aier, Gleichauf and Winter, 2011)
	Increased process synergies	(de Vries and van Rensburg, 2008)
	Less inconsistency and redundancy in IT	(Foorthuis *et al.*, 2010; Aier, Gleichauf and Winter, 2011; Niemi and Pekkola, 2016)
	Lower IT resource heterogeneity	(Boh and Yellin, 2006; Aier, Gleichauf and Winter, 2011)
Flexibility and agility related	Increased ability to respond to customer and market needs	(Tamm *et al.*, 2011)
	Increased strategic agility	(Bradley *et al.*, 2011; Tamm *et al.*, 2011)
Economic	Lower operational costs	(Bradley *et al.*, 2011)
	Lower IT costs	(Tamm *et al.*, 2011; Kappelman and Zachman, 2013; Niemi and Pekkola, 2016)
	Lower project costs	(Foorthuis *et al.*, 2016)

Others	Increased upfront detection of development problems	(Goethals *et al.*, 2006)
	Increased adoption of modern technologies	(Aier, Gleichauf and Winter, 2011)
	Faster time-to-market and delivery	(Cardwell, 2008)
	Easier scoping of development projects	(Foorthuis *et al.*, 2010)
	Improved innovation capabilities	(Lange, Mendling and Recker, 2012b)

2.3 Value Creation and Value Creation Mechanisms

For value to be perceived or realized, it must be somehow created (Priem, Butler and Li, 2013). According to the value-based theory of strategy, value is created in operations when the consumer is willing to invest more on a product or service than the opportunity cost for supplying this product or service is for the party supplying it (EQUATION 1). Here, willingness to pay is the maximum amount of money or other valuable possession the consumer of the product or service is ready to give up in order to consume the product or service. Meaning, receiving the product or service for the 'price' of the transaction is deemed beneficial for the consumer over *not* receiving the product or service. Similarly, 'opportunity cost' here means the aggregated cost of supplying the product or service. A positive result for the equation signifies an operation that created value. (Brandenburger and Stuart Jr., 1996)

EQUATION 1 Traditional formula for value creation (Brandenburger and Stuart Jr., 1996)

Value created = willingness to pay – opportunity cost

However, modern value creation must consider the heterogeneity of the consumers and suppliers. Whether it is an organization or an individual, what one needs or wants depends greatly on the situation, context, and even moment. Different consumers ultimately have different needs, impacting the value created for those consumers. This does not mean the previously presented equation does not give correct results. The equation is still as valid. However, created value is not stable nor constant, rather it fluctuates from moment to moment and individual to individual. The dynamism of this phenomenon makes reliably determining created value a complex endeavor. (Priem, Butler and Li, 2013)

Like on the consumer side, supplier organizations and their offering are also typically heterogenous. Supplier organizations must have a competitive advantage, something that makes the customer choose their product or service over

other such products or services available (Brandenburger and Stuart Jr., 1996). In other words, the value created to the consumer must be greater than in the case of the other available options on the market.

A value creation mechanism means the function of employing resources and capabilities to a set of actions to translate certain preconditions into value (FIGURE 2). Identifying such mechanisms means describing how valuable effects are produced. That said, value creation mechanisms are not and are not intended to be a guarantee for value, they do not always work. Moreover, value creation mechanisms provide insight on potentially valuable operations. They facilitate understanding of how value is created in practice. The mechanisms require certain preconditions, and may have identified boundary conditions that must be met to achieve value. (Shollo *et al.*, 2022) The general idea of a value creation mechanism is visualized in FIGURE 2.

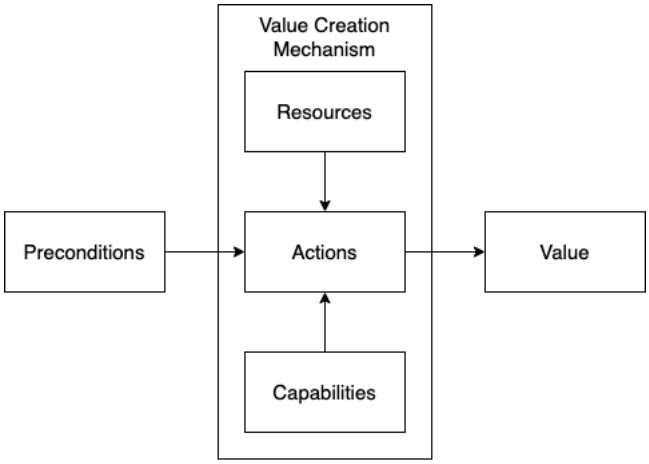

FIGURE 2 Visualization of the concept of a Value Creation Mechanism according to Shollo *et al.* (2022)

The modern enterprise commonly utilizes different information systems to support or carry out business activities. In the field of Information Systems, value creation models typically highlight resources, assets, capabilities, and applications. These components experience or realize transformations in which value is created. (Shollo *et al.*, 2022)

Resource-based theory, dynamic capabilities, and resource orchestration theory all seek to shed light to value creation in organizations. Looking at the first of the mentioned, resource-based theory, as the name suggests, claims resources to be the basis for value creation. According to the theory, an organization should take advantage of resource heterogeneity among competing firms. Acquiring necessary competencies, assets, and capabilities an enterprise can gain competitive advantages to its peers. (Barney, 1991) However, solely possessing such resources has been determined not to automatically mean increased performance (Sirmon, Gove and Hitt, 2008). You may employ the best developer to ever live, however, if all your developer does is stare at a wall (an example of an activity typically not leading to any added value), the added value your superior resource brings this arrangement can be rather nonexistent.

The orchestration of resources is seen as a major operator in value creation (Sirmon, Gove and Hitt, 2008). Dynamic capabilities emphasizes an enterprise's

ability to reconfigure its competences to address the needs of quickly changing operating environments. (Teece, Pisano and Shuen, 1997; Pavlou and El Sawy, 2011) If the mentioned world-class developer is employed in developing a new software to answer a soaring internal or market need, the created value of the configuration may be significantly positive.

Finally, resource orchestration theory suggests strategically important resources to be built rather than acquired, again emphasizing the necessity of suitable orchestration. (Chadwick, Super and Kwon, 2015) In order to create value, an organization must be able to structure the different resources to value-adding capabilities. By leveraging these capabilities in its operations, the organization realizes true competitive advantage. (Sirmon, Hitt and Ireland, 2009)

Finally, this chapter will conclude what was described of value creation mechanisms in general. Value creation can traditionally be calculated with a rather simple equation of the amount the consumer is willing to invest to receive the product or service subtracted by the opportunity cost to supply the product or service over something else. However, modern understanding of value creation seizes the concept of dynamism and heterogeneity in both suppliers and consumers. The amount of value created may fluctuate from consumer to consumer, supplier to supplier, and moment to moment. Though, this dynamism was also seen as one aspect of potential competitive advantage, and thus may be considered a significant possibility for the modern enterprise. Value creation mechanisms are formed by a set of resources, actions, and capabilities to translate certain preconditions to valuable outcomes. According to resource-based theory, obtaining quality resources is crucial in seeking competitive advantage. However, dynamic capabilities and resource orchestration theories illustrate solely possessing quality resources is not enough, but these resources should also be put into use in value-adding ways.

2.4 Value Creation Mechanisms in EAM

Proceeding from the '*what*' to the '*how*' in EAM, previous literature suggests different views on how EAM is found to create value (Niemi and Pekkola, 2016). The subject is significantly less studied than the concept of EAM value in general. The causal mechanisms for EAM value creation are complex and not fully understood (Foorthuis *et al.*, 2016). Next, we explore three generic models explaining EAM value creation mechanisms. The models are those of Niemi and Pekkola (2016), Foorthuis et al. (2016), and Lange, Mendling and Recker (2012a). Being generic models, in this context, means the models focus on EAM as a whole rather than on a specific EAM context or division, e.g., EA standards use (Niemi and Pekkola, 2016). In addition to the in-depth exploration of these three models, the chapter will provide broader insight on how several other of the models presented in the literature position themselves related to these selected few models. All the models proposed by the pool of literature used in this study are synthesized in the end of this chapter.

2.4.1 Model by Niemi and Pekkola (2016)

According to Niemi and Pekkola (2016), EAM value creation requires a chain of interconnected constructs: *EA Social Environment, EA Process Quality, EA Product Quality, EA Service Quality, EA Results Use, and EA Benefits* (FIGURE 3). These constructs are high-level causal factors taking part in EAM value creation. Some of the constructs can be associated directly with EAM value, while others create EAM value through intermediating constructs. (Niemi and Pekkola, 2016) Next, we will investigate the constructs and their causal relationships to explore the model deeper.

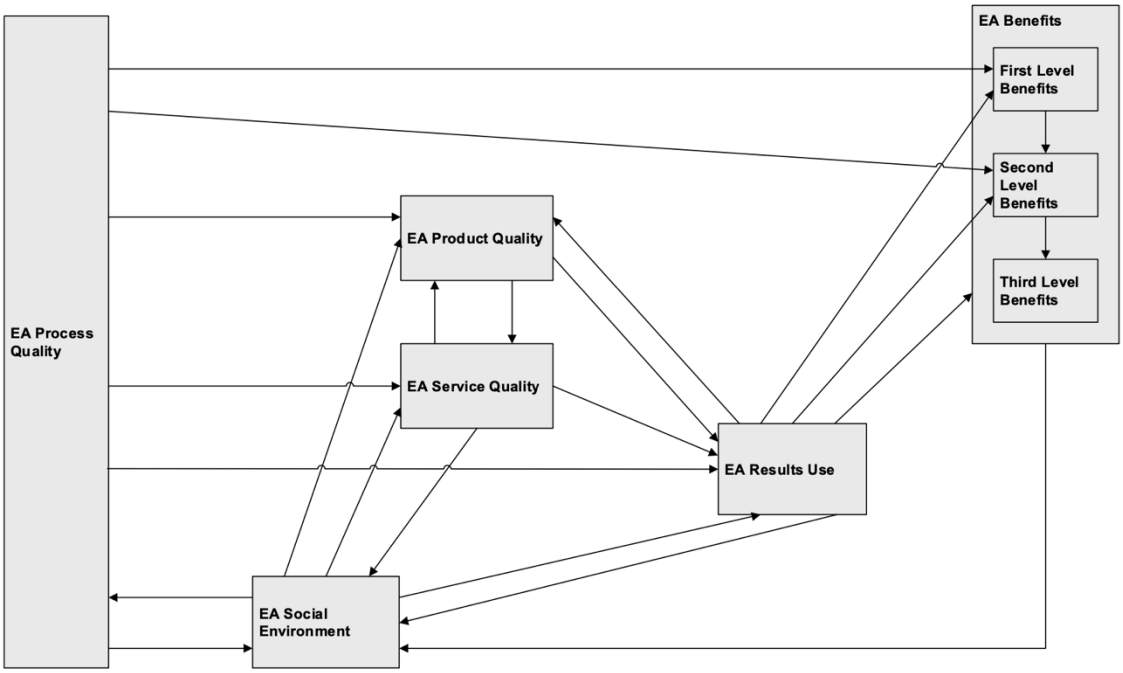

FIGURE 3 Interacting constructs in EAM benefit realization by Niemi and Pekkola (2016)

EA Social Environment, especially having a common approval and understanding of EA[M], has an impact on several of the other constructs, namely *EA Process Quality, EA Product Quality, EA Service Quality*, and *EA Results Use*. Top management commitment was found to impact *EA Process Quality*, *EA Product Quality,* and *EA Results Use*. Apart from influencing the other constructs, *EA Social Environment*, as well as every other construct in the model, is itself influenced by other constructs (or one construct in the case of *EA Process Quality*). *EA Social Environment* is influenced by *EA Process Quality, EA Service Quality, EA Results Use,* and *EA benefits*. (Niemi and Pekkola, 2016)

In the proposed model, *EA Process Quality* includes the development, maintenance, and governance of EA documentation. Itself affected by only the *EA Social Environment*, *EA Process Quality* affects *EA Product Quality, EA Service Quality, EA Results Use, EA Benefits,* and *EA Social Environment*. High-quality EAM processes are required to create high-quality EAM products and services, which in turn have an impact on EAM value creation. Looking closer, the authors' analysis reveals that regarding *EA Process Quality*, the most mentioned causal

factors were resource availability, cohesion with other governance methods, EA framework quality, and EA modeling tool quality. The source material used to develop EA descriptions also plays a major role, and stakeholder participation in EA documentation creation resulted in more accurate EA products compared to those created solely from other documentation. (Niemi and Pekkola, 2016)

EA Product Quality is impacted by *EA Process Quality, EA Social Environment, EA Service Quality,* and *EA Results Use*. Specific causal factors influencing *EA Product Quality* include EA framework quality, EA modeling tool quality, support documentation quality, and resource availability – to name a few. The construct itself further impacts *EA Service Quality* and *EA Results Use*, mainly in the availability of the EA products. However, also granularity, cohesion and uniformity, and usefulness of the products influence their use in practice. As aforementioned, the construct of *EA Results Use* impacts *EA Product Quality*, as different use cases require different types of EA products in e.g., level of abstraction. Thus, the usefulness of the EA products depends on the use case. (Niemi and Pekkola, 2016)

From products to services, *EA Service Quality* is impacted by *EA Process Quality* and *EA Social Environment,* as well as by *EA Product Quality* where the only impacting factor is available EA products. Specific causal factors influencing *EA Service Quality* include cohesion with other governance methods, resource availability, and common approval and understanding of EA – again to name a few. *EA Service Quality* impacts *EA Social Environment, EA Product Quality*, and *EA Results Use*. Again, the availability of EA services is the most significant factor in creating EA benefits through EA services. However, stakeholders may not be aware of the EA services available to them, requiring active suggestions of service consumption to ensure value creation. In addition to availability and activeness, the factors of EA staff competence and EA service usefulness impact EA service utilization. (Niemi and Pekkola, 2016)

Finally, as seen in exploring the other constructs, *EA Results Use* is affected by several of them, namely *EA Process Quality, EA Product Quality, EA Service Quality,* and *EA Social Environment*. The specific causal factors impacting *EA Results Use* are various, including common approval and understanding of EA, availability of EA products and services, cohesion with other governance methods, and stakeholder participation in EAM process. *EA Results Use* further has an impact on *EA Product Quality*, *EA Social Environment*, and *EA Benefits*. As discussed in exploring *EA Product Quality*, different use cases require availability of different types of EA products and services. The EAM results used and motives of the use causally affect determined *EA Product Quality*. (Niemi and Pekkola, 2016)

EA Product Quality and *EA Service Quality* do not directly cause any EAM value. They create EAM benefits through *EA Results Use*. The model shows *EA Process Quality* and *EA Results Use* to be the only two constructs contributing directly to *EAM Benefits*. Direct contribution here means that the benefits were direct results of the EAM activities. The most mentioned direct benefits from EAM include identifying dependencies, providing overview, providing standards, providing a guiding framework, providing common vocabulary, providing example, and improving alignment. These direct benefits further cause indirect

benefits, of which providing requirements and restrictions, increasing interoperability between solutions, speeding up project initialization, and improving decision making were mentioned most. (Niemi and Pekkola, 2016)

2.4.2 Model by Foorthuis et al. (2016)

Next, let us study another model explaining EAM value creation mechanisms in detail. According to Foorthuis et al. (2016), EAM value creation involves six linked constructs (FIGURE 4). These constructs are *EA Approach*, *Project Compliance with EA*, *Architectural Insight, EA-Induced Capabilities, Project Performance,* and *Organizational Performance*. Similarly to Niemi and Pekkola (2016), Foorthuis et al. (2016) link some of the constructs directly with EAM value, while the others affect EAM value through intermediating constructs. (Foorthuis *et al.*, 2016) Now, let us explore the model through the presented constructs and their found predictive relationships.

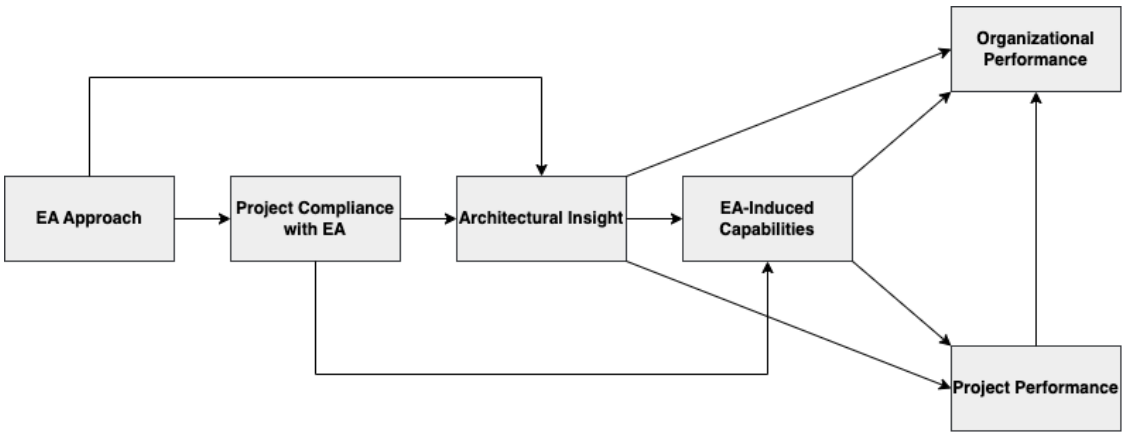

FIGURE 4 EA benefit delivery model according to Foorthuis et al. (2016)

The *EA Approach* construct is the practices the organization uses in its EAM configuration. The construct comprises the following factors: requiring formal approval of EA, EA choices of the organization, management commitment to EA[M], organizing compliance assessments, arranging knowledge exchanges between architects, arranging knowledge exchanges between architects and projects, providing assistance to development projects, creating project start architectures, offering document templates, and implementing financial incentives to utilization and compliance. The *EA Approach* construct is the fundamental grounding to the organization's EAM work. (Foorthuis *et al.*, 2016)

The *EA Approach* construct directly positively influences *Project Compliance with EA* through arranged knowledge exchanges between architects and project members, management commitment to EAM, and organized compliance assessments. Formally approving EA products, however, was found to have a significant direct negative influence on *Project Compliance with EA* – meaning, that the practice results in less compliance. In addition to *Project Compliance with EA*, *EA Approach* also has a significant direct positive influence on *Architectural Insight* through arranged knowledge exchanges between architects and by tying the EAM concerns to the enterprise's business goals – showing that EAM work

strives to achieve joint objectives. The projects need to perceive EAM to *help* them achieve their objectives rather than be something straining their resources. (Foorthuis *et al.*, 2016)

Project Compliance with EA is the measure of how well projects in the organization follow the EAM conventions. As we saw, the construct is significantly impacted by the *EA Approach*. Further, *Project Compliance with EA* positively affects *Architectural Insight* and *EA Induced Capabilities*. These positive effects arise indirectly through knowledge sharing effects mediated by the development projects. Further, the *Architectural Insight* construct represents a common organizational understanding of the EA in its current and target forms. It includes a deep common knowledge of the organizational complexity, the organization's target state, the EAM conventions, as well as the effective communication of these among the organization. *Architectural Insight* positively impacts *Organizational Performance*, *EA-Induced Capabilities*, and *Project Performance*. (Foorthuis *et al.*, 2016)

EA-Induced Capabilities represent capabilities formed by EAM work in the organization. As we saw, *Project Compliance with EA* and *Architectural Insight* positively influence *EA-Induced Capabilities*. The authors compare these capabilities to direct EAM benefits that also act as intermediating capabilities to reach indirect EAM benefits. These capabilities include the abilities to align business and IT, improve processes and process alignment, manage complexity, and collaborate with other organizations. *EA-Induced Capabilities* and *Architectural Insight* are the only two of the discussed constructs with a direct impact to *Project Performance* and *Organizational Performance*. (Foorthuis *et al.*, 2016)

Finally, *Project Performance* represents EAM value obtained on the project level. The model suggests *Project Performance* to include benefits to project budget, quality, risk control, functionality, timely completion, project complexity management, and initialization speed. This construct is positively impacted by *Architectural Insight* and *EA-Induced Capabilities*. *Project Performance* further directly impacts *Organizational Performance*. *Organizational Performance* represents EAM value obtained on the organizational level, namely enterprise-wide total optimization (rather than partial optimization), cost control, and organizational agility. In addition to *Project Performance*, *Organizational Performance* is directly impacted also by *Architectural Insight* and *EA-Induced Capabilities*. (Foorthuis *et al.*, 2016)

2.4.3 Model by Lange et al. (2012a)

Moving on to the third model, Lange et al. (2012a) propose a model (FIGURE 5) with interacting dimensions, similar to constructs in the previous models. The proposed dimensions are *EA Product Quality, EA Function Setup Quality, EA Service Delivery, EA Cultural Aspects, Intention to Use, Use,* and *EA Net Benefits*. These dimensions include independent success factors that EAM value creation depends on. (Lange, Mendling and Recker, 2012a) Following, the dimensions and their relations are explored more closely to facilitate a deeper understanding of the model.

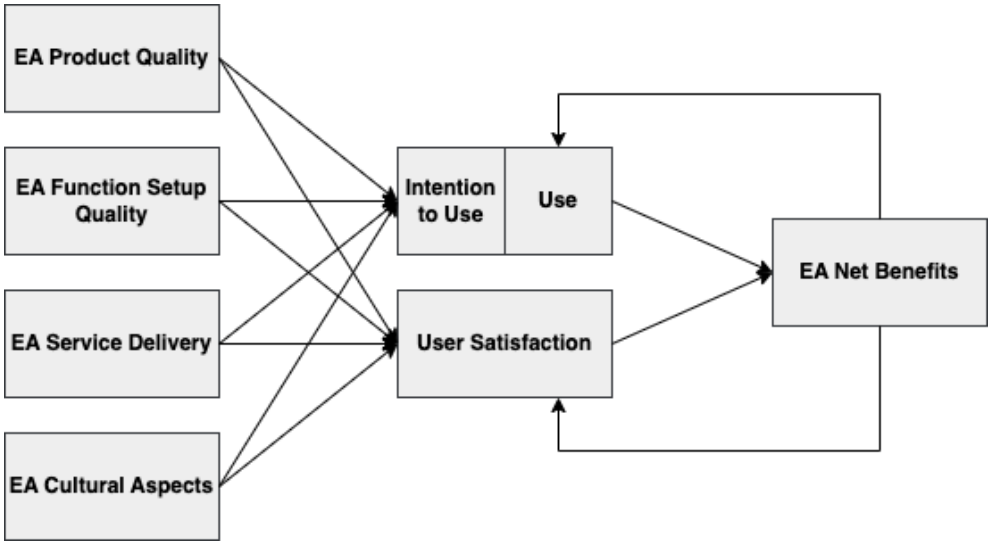

FIGURE 5 EA benefit realization model according to Lange, Mendling, and Recker (2012a)

EA products are the documentation created as part of EAM operations. The *EA Product Quality* dimension impacts *Intention to Use, Use*, and *User Satisfaction*. To drive value creation, EAM needs to provide a current and complete as-is architecture – the overall current implementation of business processes, IT systems, and IT infrastructure – as well as a to-be architecture reflecting the up-to-date desired state by the decision makers. These documents should have the right level of detail for the intended use. In addition to the as-is and to-be architectures, EA products should include a roadmap on how the as-is state is transformed to the to-be state. Such roadmap should be realistic and feasible in the specific organization. For the *EA Product Quality* dimension, the as-is architecture, to-be architecture, and the EA roadmap descriptions are stated as factors that EAM benefit creation depends on. (Lange, Mendling and Recker, 2012a)

EA Function Setup Quality is concerned with the conditions in which the EAM operations are taking place. *EA Function Setup Quality* has a direct impact on *Intention to Use, Use*, and *User Satisfaction*. The model suggests clear EAM mandate and scope, clear EAM decision-making accountabilities, EAM decision-making governance mechanisms, suitable EA frameworks and tools, clear EA principles, and well-trained and integrated EAM staff to all be factors that EAM benefit creation depends on. Central EAM governance is stated to be crucial for achieving organization-wide benefits. (Lange, Mendling and Recker, 2012a)

EA Service Delivery represents the services provided to EAM stakeholders external to the EAM function. Such services may be e.g., project compliance validations or EAM-related communication support. The *EA Service Delivery* does not include regular EAM activity such as updating EA documentation. In EA services, it is crucial that the service is delivered considering the consumer's situation and viewpoint. This means the EA services should be *stakeholder specific*. (Lange, Mendling and Recker, 2012a) Similarly to Niemi and Pekkola (2016), Lange et al. (2012a) also found EAM staff activeness to be essential in creating EAM value. EA services should be actively offered and communicated to EAM stakeholders. In addition to EAM stakeholder communication, project EA compliance and EAM decision-making support, and active involvement of EAM staff

in projects are stated to be factors that EAM value creation depends on. Again, EA Service Delivery affects the dimensions of *Intention to Use, Use,* and *User Satisfaction*. (Lange, Mendling and Recker, 2012a)

The *EA Cultural Aspects* dimension is much similar to the *EA Social Environment* construct in the model by Niemi and Pekkola (2016). It includes the values and customs that control interactions among the people of the organization and the peoples' attitude towards EAM. In *EA Cultural Aspects*, EAM benefits depend on leadership commitment, high awareness of EA among EAM stakeholders, and common understanding of EA among both business and IT. Top-management support means the EAM function will have required resources to successfully conduct EAM. Similarly to the previously discussed dimensions, *EA Cultural Aspects* impact EAM value indirectly through the dimensions of *Intention to Use, Use*, and *User Satisfaction*. (Lange, Mendling and Recker, 2012a)

The mediating dimensions of *Intention to Use*, *Use* and *User Satisfaction* are impacted by *EA Product Quality, EA Function Setup Quality, EA Service Delivery,* and *EA Cultural Aspects. Use* and *User Satisfaction* are additionally impacted by *EA Net Benefits*, creating mutual interrelationships between the dimensions. *EA Net Benefits* are directly impacted by only the dimensions of *Use* and *User Satisfaction*. (Lange, Mendling and Recker, 2012a)

2.4.4 Synthesis

This chapter provides synthesis of the studied models in previous literature. Additionally, it proposes a simple synthesized high-level model of the constructs impacting EAM value creation discussed by the mentioned studies.

EAM value creation is a complex process. EAM operations produce products and services that can be further used in e.g., decision making and project operations. However, EAM results use is affected by the EAM function – e.g., setup and product and service quality. According to previous theory, value is created both directly from EAM operations as well as indirectly through intermediating constructs. In all previous EAM value creation models, EA results use plays a significant role in EAM value creation. In other words, value is not created if the EAM results are not used appropriately.

Diving deeper, EAM value creation mechanisms involve interconnected constructs, such as *EA Culture/Social Aspects, EA Process Quality, EA Product Quality, Project Compliance,* and *EA Results Use*. EAM value is created through creating, maintaining, and using EA products and services. The use of EAM results is influenced greatly by factors such as availability of EA products and services, EAM staff activeness, and common approval of EAM in the organization. However, using the EAM results also impacts the cultural aspect of EA as well as EAM processes. Direct benefits from EAM may also cause indirect benefits as well as strengthen the EAM related culture, making the *EA Benefits/EA-Induced Capabilities* a significant construct in the studied models. As was seen, the constructs are closely intertwined and mechanisms complex.

None of the existing models are exactly similar. However, they share many similar traits and overall, clearly describe similar phenomena. The main

constructs of all the models discuss similar sets of factors – EA products, EA services, use of EA[M] results, and EAM benefits that take part in EAM value creation. (Boh and Yellin, 2006; Foorthuis *et al.*, 2010, 2016; Tamm *et al.*, 2011; Lange, Mendling and Recker, 2012a; Aier, 2014; Niemi and Pekkola, 2016) Niemi and Pekkola (2016) describe the interrelationships between the different constructs to most detail, resulting in a model with high explanatory potential but also of structural complexity. In contrast, Lange et al (2012a) place little attention to the relationships between the foundational dimensions of *EA Product Quality, EA Function Setup Quality*, and *EA Service Delivery*.

Organizational characteristics and organizational culture are less discussed in the three models explored in depth. Given, Niemi and Pekkola (2016) and Lange et al. (2012a) do acknowledge and include cultural aspects in their model. However, the impact of these aspects to EAM value creation is emphasized in many models. (Boucharas *et al.*, 2010; Tamm *et al.*, 2011; Aier, 2014)

Value creation models are a compromise between accuracy and generalizability. Understandably, the majority of models in previous theory are limited in their context to provide better accuracy. Foorthuis et al. (2010), Aier (2014), and Boh and Yellin (2006) all describe EAM related operations or EAM value with a narrower focus on EA standards use, project EA compliance, and EA principles respectively. However, in all the identified models explaining EAM value creation mechanisms, EAM value was in some way created through the use of the EAM results (Boh and Yellin, 2006; Foorthuis *et al.*, 2010, 2016; Tamm *et al.*, 2011; Lange, Mendling and Recker, 2012a; Aier, 2014; Niemi and Pekkola, 2016).

To wrap up the vast number of models discussed and provide generalized understanding, FIGURE 6 presents simple synthesized constructs argued in previous literature to impact EAM value creation. These constructs and their impact on EAM value are further referred to here as *model*. In order to reach some generalizability, the model is structurally simple. The synthesized high-level model includes the foundational dimensions of:

- *EA Product Quality*,
- *EA Service Quality*, and
- *EA Culture*.

EA Product Quality and *EA Service Quality* are in some form present in all the studied models. However, as discussed for general value creation in Chapter 2.3 and seen in the models presented in this chapter, quality products and services and a positive EA culture *alone* do not typically result in value. Thus, the synthesized model presents the factors of *EA Product Use* and *EA Service Use*. These factors can be assumed to impact EAM value creation, turning the resources into perceived value. EAM results, meaning EA products and services, use is presented as a construct in many models (Boh and Yellin, 2006; Foorthuis *et al.*, 2010; Tamm *et al.*, 2011; Lange, Mendling and Recker, 2012a; Aier, 2014; Niemi and Pekkola, 2016). The presented dependent high-level factor is *EAM Value*, a factor discussed in all models and in depth in chapter 2.2.

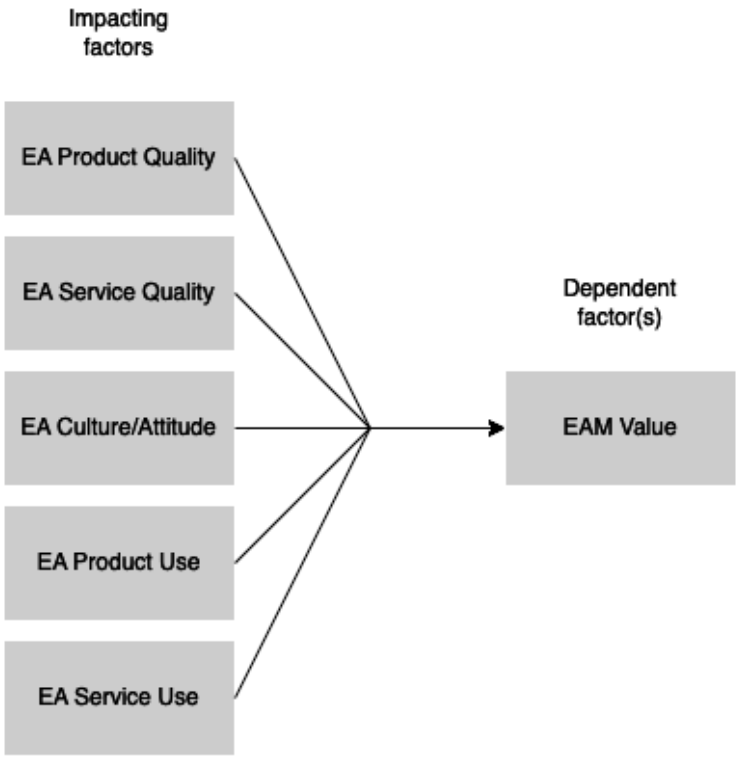

FIGURE 6 Synthesized constructs from previous literature

3 METHODOLOGY

3.1 Literature Review

The literature review explored what previous studies have concluded on the central concepts of this study, namely EAM value and its value creation mechanisms. The discussed literature was selected with two techniques – keyword search on Google Scholar and a technique called "snowballing".

First, previous literature was searched simultaneously from multiple portals utilizing Google Scholar. Used keywords in the search were "Enterprise Architecture", "Enterprise Architecture Value", "Enterprise Architecture Benefits", "Enterprise Architecture Value Creation", "Enterprise Architecture Benefit Creation", and "Enterprise Architecture Value Creation Mechanisms". The search was limited to articles and conference papers or proceedings, and only results in English were considered. The first one or two pages of search results were taken into account in the collection, as they may be assumed to fit the search criteria the best. Results with no apparent access to the study through any portal were excluded as well as studies which were not accessible with the University of Jyväskylä access. The literature was gathered during the timeframe of September to December 2022. From this step, 25 articles were obtained for further analysis. Upon further study of the results, four studies were excluded as their value creation focus was not on EAM value creation (e.g., "Enterprise Architecture Contribution to Big-Data Analytics Value Realization…", "Social Media Based Value Creation…").

Second, to extend the literature review, a technique called "snowballing" was loosely adopted to reach a suitable scope of previous literature. Snowballing starts from a base of identified relevant studies and uses the central references of those studies to obtain literature (Wohlin, 2014). The base set was formed from the most relevant papers included as result of the Google Scholar search. As the references added to the literature base began to repeat, the set was concluded sufficient.

Regarding the analysis of previous literature, some remarks of interpretation are seen necessary. As is seen in chapter 2.1, this paper supports the distinction between the concepts of EA and EAM. In the analysis of previous literature, EA is interpreted as EAM if it is clear the author is referring to the *management* activities of the EA. Further, several studies provided insight into EAM benefits. In case the author of the study discussed these benefits as creating value – or if the notion of benefit, as presented by the author, fits the definition of EAM value provided in chapter 2.2 – they are included in the analysis on EAM value in previous literature.

3.2 Data Collection

Due to the challenges in EAM value measurability discussed in chapter 2.2, the empirical study focuses on value perceived by EAM stakeholders. Here, EAM stakeholders are business and IT professionals working especially in development, planning, and management roles in organizations where EAM practices are implemented. Data was collected with a web survey. The web survey and provided answers were in Finnish. The link to the survey was distributed by email campaigns. Additionally, the link was published on social media (Linkedin) and distributed via professional networks. The responses were gathered during June-September 2023. The campaigns were intended to reach EAM stakeholders working in Finland as this demographic was of special interest to the researcher.

The email containing the survey link was sent to over a hundred recipients. The recipient list was gathered through Linkedin search, searching for professionals with keywords "Enterprise Architect", "Solution Architect", "IT-Architect", "System Designer", "Business Analyst", "Product Owner", "IT-Manager", "Transformation", "Engineer", and "Designer". The list was narrowed down to suitable persons deemed as EAM stakeholders, e.g., graphic designers and traditional architects (physical infrastructuce/buildings) were excluded from the recipient list. A total of 47 responses were obtained. The survey was opened 259 times and answering was started 82 times, meaning 43% of respondents that began answering the survey did not finish answering it. This could be at least partially explained by the significant length of the survey.

The survey included two major parts: EAM activities, resources, and culture presented as 'factors impacting perceived EAM value' and perceived value. The first part contained questions determining the EA products and services available to the respondent, their use, and their own as well as their organization's culture and attitude towards EAM. The questions were presented as claims and answers were recorded on a likert scale according to how largely the respondent agrees with the presented claim. The likert scale contained the options of:

(1) Completely disagree,
(2) Somewhat disagree,
(3) Somewhat agree, and
(4) Completely agree'.

Not having a, so to say, middle option of 'do not disagree nor agree' was a conscious choice to support contentful answers. Additionally, the respondents were given the option to answer 'I cannot say/I do not know'. The second part focused on perceived value from EAM. Again, a set of claims were presented, and answers recorded on a similar likert scale according to how largely the respondent agrees with the claim. Again, the respondents were given the option to answer 'I cannot say/I do not know'. The claimed EAM values were those found in the literature review.

The survey also contained a few initial questions to determine the respondents' demographic in the following areas:

- whether the respondent positions themself more as an IT/technology or business professional
- the respondent's working role
- organization size (less than a 100 employees / 100-500 / 501-1000 / more than a 1000 employees)
- whether or not the respondent's organization operates in Finland.

70% of the respondents positioned themselves more as an IT/technology professional than a business professional. 30% positioned themselves more as a business professional. The roles of the respondents varied greatly but were all suitable for the purpose of this research. Some examples of multiple respondents' roles are *System Architect, IT Manager, IT Specialist, Requirements Engineer, Transformation/Development Manager, System Designer,* and *IT Architect*. The great majority of respondents, 55%, worked in large organizations with over a thousand employees. The rest worked in organizations of following sizes: 21% in organizations with 501-1000 employees, 17% in organizations with 100-500 employees, and only 7% in organizations with less than a hundred employees. The respondents' organization sizes are visualized in FIGURE 7. Only one of all the respondents stated their organization does not operate in Finland, meaning almost all the respondents worked in organizations operating in Finland. Thus, this is the demographic most applicable for the achieved results.

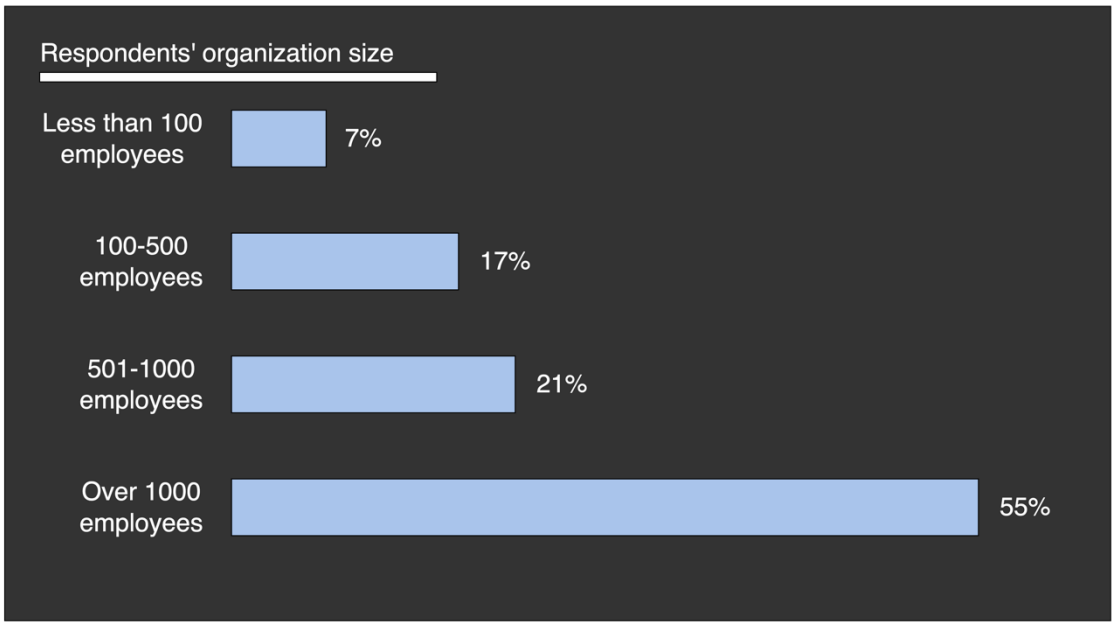

FIGURE 7 Respondents' organization size

3.3 Data Analysis

The gathered data was extracted and analyzed. The data analysis was conducted in stages. To begin, the data was coded and prepared to be suitable for the quantitative analysis. The methods and further details of coding and preparation are presented in this chapter. As a very first step to answer the first research question of "what EAM value is perceived by EAM stakeholders?", the respondents' perceived EAM value was analyzed based on average values – what kind of EAM value they acknowledged to have experienced more and what less. To answer the second research question of "what kind of EAM value creation mechanisms can be found in practice?", a more complex set of analyses was performed as presented next. The initial aim was to summarize the found preconditions and activities as factor sums for the factors presented in FIGURE 6, namely EA Product Quality, EA Service Quality, EA Culture/Attitude, EA Product Use, and EA Service Use, and analyze their impacts on EAM value. First, factor analysis was executed to determine the suitability of the data and validate the predictive factors' interrelationships. Following, a set of initial multiple regression analyses were conducted to explore the relationships in the recorded data. The transpired relationships were tested in the main regression analysis. These data analysis stages are visualized in FIGURE 8 and explained further in this chapter.

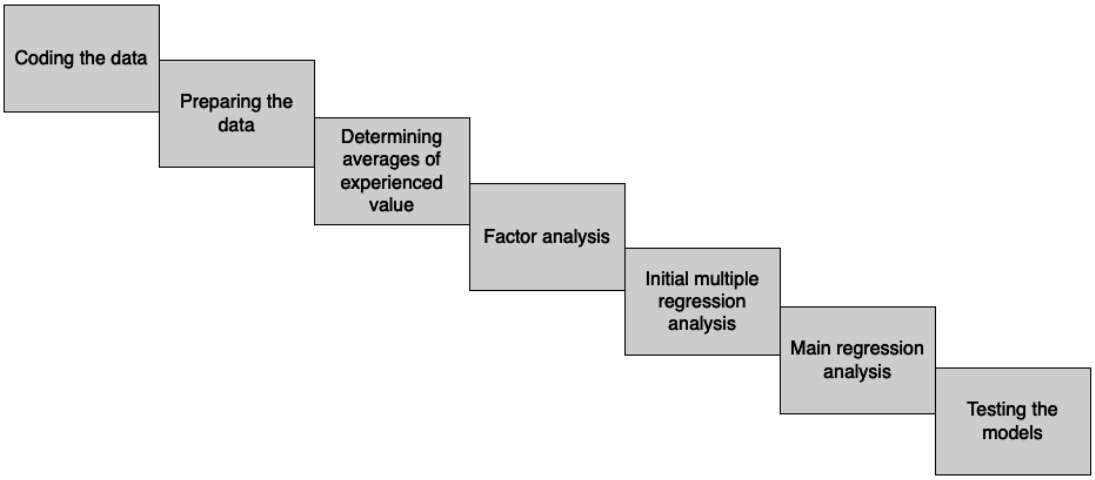

FIGURE 8 Data analysis stages

The proposed independent factors (EA Product Quality, EA Service Quality, EA Culture/Attitude, EA Product Use, and EA Service Use) were broken down to their variables (coded as PQ, SQ, CA, PU, and SU respectively), as some factors had several questions in the survey determining their impact on the dependent factor, i.e., the proposed perceived EAM value. The coded predictive variables are presented in total in TABLE 2. In addition to the predicting factors, the dependent factor, EAM value, was also divided into variables (coded as V) describing the nature of the perceived EAM value. The coded dependent variables are presented in TABLE 3. In total, the recorded response data comprised 3384 data items for 25 variables representing the different

independent factors and 47 variables representing the different perceived EAM value.

TABLE 2 Coded independent variables

	Independent variables per factor				
Factor	EA Product Quality	EA Service Quality	EA Culture/Attitude	EA Product Use	EA Service Use
	PQ1	SQ1	CA1	PU1	SU1
	PQ2		CA2	PU2	
	PQ3		CA3	PU3	
	PQ4		CA4	PU4	
	PQ5		CA5	PU5	
	PQ6		CA6	PU6	
	PQ7		CA7		
	PQ8		CA8		

TABLE 3 Coded dependent variables

Dependent variables		
EA Value		
V1	V21	V41
V2	V22	V42
V3	V23	V43
V4	V24	V44
V5	V25	V45
V6	V26	V46
V7	V27	V47
V8	V28	
V9	V29	
V10	V30	
V11	V31	
V12	V32	
V13	V33	
V14	V34	
V15	V35	
V16	V36	
V17	V37	
V18	V38	
V19	V39	
V20	V40	

For data preparation, two steps were deemed necessary. Firstly, even though all other questions in the survey asked the respondents to determine observed phenomena, one of the questions was negated, meaning it measured if a certain positive phenomenon was *not* observed. The data for this item had to be reversed to fit the set. Therefore, the question setting as well as all the answers were turned around to explain whether the positive phenomenon was detected according to the respondents.

Secondly, as all questions were not specified as mandatory and 'cannot say' was given as an answer option, the data set had missing values. For these values, averages of the recorded answers were adopted to create solid data sets. While this approach does miss possible nuances in the individual answers, the positive effects on the width of the data set were seen worthwhile.

Moving to the analysis, factor analysis was performed to identify latent variables and find hidden structures in the gathered data as well as analyze the possibility of factor sums in the main analysis. Chosen extraction method in the factor analysis was chosen to be Principal Component Analysis with a hundred iterations and as many factors as there were variables in the given sets. In all simplicity, this phase of the analysis was conducted to answer the question "do all these variables measure what we here call XXX?", XXX being the abovementioned theoretical variables of EA Product Quality, EA Culture/Attitude etc.

As can be seen in TABLE 4, TABLE 5, and TABLE 6, the factors with several variables were mainly covered with only a few variables in the sets. However, the results also described some variability among the factors. Meaning, all variables in the factor sets did not sum up to measure one and the same phenomena. Thus, no factor sums were formulated for further analysis but rather the effects of the single variables were studied. Additionally, the independent variables each included highly relevant information on EA actions, resources, and culture, and all this information was seen vital for the results of this research. All variables were kept in the scope of the analysis. EA Service Quality and EA Service Use factors only had one variable, thus not suitable for or even requiring the factor analysis stage.

TABLE 4 Factor analysis results for EA Product Quality

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,84	53,8%	53,8%	4,84	53,8%	53,8%
2	1,27	14,1%	67,8%	1,27	14,1%	67,8%
3	,86	9,5%	77,4%	,86	9,5%	77,4%
4	,63	7,0%	84,3%	,63	7,0%	84,3%
5	,45	5,0%	89,4%	,45	5,0%	89,4%
6	,33	3,6%	93,0%	,33	3,6%	93,0%
7	,24	2,6%	95,6%	,24	2,6%	95,6%
8	,22	2,5%	98,1%	,22	2,5%	98,1%
9	,17	1,9%	100,0%	,17	1,9%	100,0%

Component Matrix

	Component								
	1	2	3	4	5	6	7	8	9
PQ1	,84	,08	-,07	,11	,44	-,14	,23	,10	,00
PQ2	,78	-,18	,47	,15	-,07	,18	-,02	,29	,02
PQ3	,59	-,65	,31	-,01	-,22	-,14	,14	-,19	,08
PQ4	,64	-,53	-,35	,14	,09	,05	-,14	-,04	-,36
PQ5	,80	,42	,03	-,20	-,07	,21	,19	-,19	-,15
PQ6	,76	,10	,27	-,48	,20	-,08	-,26	-,05	,03
PQ7	,67	-,13	-,55	-,34	-,24	-,01	,05	,18	,17
PQ8	,69	,55	,03	,22	-,31	-,20	-,07	,05	-,18
PQ9	,80	,13	-,19	,38	,05	,08	-,14	-,17	,33

TABLE 5 Factor analysis results for EA Culture/Attitude

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,76	34,5%	34,5%	2,76	34,5%	34,5%
2	2,61	32,6%	67,1%	2,61	32,6%	67,1%
3	1,03	12,9%	80,0%	1,03	12,9%	80,0%
4	,62	7,8%	87,8%	,62	7,8%	87,8%
5	,34	4,2%	91,9%	,34	4,2%	91,9%
6	,24	3,0%	94,9%	,24	3,0%	94,9%
7	,21	2,6%	97,6%	,21	2,6%	97,6%
8	,19	2,4%	100,0%	,19	2,4%	100,0%

Component Matrix

	Component							
	1	2	3	4	5	6	7	8
CA1	,72	,32	,37	-,38	,11	-,21	,20	-,01
CA2	,62	,60	-,13	-,13	-,43	,13	-,01	,10
CA3	,86	,33	-,10	,03	,15	-,01	-,30	-,19
CA4	,69	-,54	-,24	-,12	,23	,30	,11	,11
CA5	,46	-,71	-,35	,19	-,19	-,11	,17	-,23
CA6	,29	-,37	,83	,25	-,10	,16	,00	-,07
CA7	,43	-,82	,05	,05	-,06	-,21	-,17	,25
CA8	,40	,66	-,07	,59	,12	-,06	,12	,13

TABLE 6 Factor analysis results for EA Product Use

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,15	52,5%	52,5%	3,15	52,5%	52,5%
2	1,11	18,5%	71,0%	1,11	18,5%	71,0%
3	,59	9,8%	80,8%	,59	9,8%	80,8%
4	,48	8,0%	88,8%	,48	8,0%	88,8%
5	,42	7,0%	95,8%	,42	7,0%	95,8%
6	,25	4,2%	100,0%	,25	4,2%	100,0%

Component Matrix

	Component					
	1	2	3	4	5	6
PU1	,79	-,06	,12	,59	-,08	,02
PU2	,70	-,51	,16	-,16	,40	-,20
PU3	,77	,31	-,29	-,03	-,01	-,48
PU4	,78	,03	-,23	-,06	,16	,56
PU5	,51	,80	,26	-,17	,05	,06
PU6	,76	-,35	,08	-,27	-,47	,04

Following, to determine the possible relationships between the predicting factor variables and experienced EAM value, a wise set of initial linear regression analyses were conducted. Linear regression analysis was determined suitable for the characteristics of this study as the aim was to find possible predictive relationships between EAM value and EAM activities, resources, and culture. As is common practice, statistical significance was recognized for relationships with a significance P-value of <0.05. The analysis focused on positive relationships, where the independent variables had a positive impact on the dependent variables. Meaning, the analysis did not focus on negative relationships.

First, a total of 235 multiple regression analyses explored the relationships between the different variables comprising the independent factors and each of the different possible perceived EAM values. These analyses were conducted per predicting factor and per value, meaning an analysis setting e.g., selecting all EA Process Quality variables as independent variables and a specific value variable as the dependent variable to explore possible relationships. For these analyses, statistically significant positive relationships were recorded.

Further, to validate and enrich the models, another set of regression analyses were conducted. These analyses explored the relationships between all the predictive variables together, meaning all variables for all factors, and each of the 47 dependent value variables. All additional statistically significant positive relationships were recorded. As a last step to the initial multiple regression analysis, all the recorded models, i.e., the sets of independent variables with explanatory power over dependent variables, were tested separately. Variables, whose relationships here were determined statistically insignificant, were removed from the models. Again, statistical significance was recognized for relationships with a P-value of <0.05. From the total set of results data, dependent (value) variables for which no statistically significant explanatory relationships were found in the initial regression analysis, were removed from the data. The same was done for independent variables that did not contribute to any significant explanatory relationship.

As the final phase, the main set of linear regression analyses measured the significance of the transpired models – the found relationships between the predictive variables and EAM value items. All the variables in these models had a statistically significant explanatory relationship with the dependent EAM values. The standardized coefficients and adjusted R square values were recorded for

each predictive variable and model. The final results of the data analysis are presented in TABLE 7 and explained in more detail in the following chapter. The width of the variable pool in the analysis is somewhat novel in the research field. Thus, the complexity of such novel research and its effects on the results are acknowledged and stated in the limitations of this study.

TABLE 7 Results of main regression analysis

STANDARDIZED COEFFICIENTS OF THE MODEL VARIABLES																																	
Action or resource	Value																																TOTAL
	V1	V2	V3	V5	V7	V8	V10	V11	V12	V13	V15	V16	V17	V18	V19	V21	V22	V23	V27	V29	V31	V32	V34	V35	V36	V38	V41	V43	V44	V45	V46	V47	
CA4									0,47		0,41	0,42	0,39	0,42	0,5		0,55					0,43		0,3					0,33		0,37		4,59
PU5				0,45	0,32	0,5	0,42					0,3							0,36	0,45						0,5							3,3
SU1	0,39		0,31					0,35																								0,35	1,4
PU1																0,4								0,48				0,47					1,35
PU4		0,56											0,29		0,31																		1,16
SQ1		0,31																			0,3				0,36								0,97
CA7																		0,45					0,47										0,92
PQ8										0,43																							0,43
PU3	0,43																																0,43
PQ1														0,36																			0,36
CA1																											0,36						0,36
PQ4																														0,31			0,31
CA8																		0,31															0,31
Adj. R2	0,41	0,42	0,07	0,19	0,08	0,23	0,16	0,11	0,2	0,17	0,15	0,25	0,27	0,38	0,41	0,15	0,29	0,17	0,11	0,19	0,07	0,17	0,2	0,35	0,11	0,23	0,11	0,2	0,09	0,07	0,12	0,1	

4 RESULTS

This section presents the findings of the research in detail to provide answers to the set research questions. The methodology was presented in the previous chapter. Based on the results, the first chapter provides answers to the first research question of "what EAM value is perceived by EAM stakeholders?" and the second chapter provides answers to the second research question of "what kind of EAM value creation mechanisms can be found in practice?".

4.1 Perceived EAM Value

The data suggests that EAM stakeholders do indeed experience value from EAM. Item V1 "I see EAM work as beneficial for my organization" was agreed with. Apart from one respondent 'completely disagreeing' and one respondent 'somewhat disagreeing' with the claim, the respondents either 'somewhat agreed' or 'completely agreed' with the claim. The large majority, 60%, of respondents 'completely agreed' with the claim.

The results provide information on how the respondents see their organization's EAM work in general. Only 19,2% of respondents see their organization's current EAM practices to support the whole business. 40,4% see their organization's current EAM practices to somewhat support the whole business. 72,3% of respondents completely agree with seeing EAM as a possibility for their organization. None of the respondents completely agree with being satisfied with their organization's current EAM practices. About 70% disagree with the claim.

Moreover, the results bring clarity to the types of value perceived by EAM stakeholders. Claims for experiencing the first four value items in TABLE 8 – V30 higher solutions integration, V17 better communication and information sharing, V14 improved transparency of dependencies, and V3 better decision making – were on average most agreed with. Thus, it can be stated these types of values were most experienced by the respondents. The following table excludes aforementioned V1 "I see EAM work as beneficial for my organization", as it measures generally perceived value rather than certain *type* of value.

The four most experienced value items are of different categories – integration and interoperability related, communicational, knowledge management related, and strategic and political. The mentioned categories are in general well represented in perceived EAM values. However, apart from two exceptions, no obvious patterns arise regarding the categories of the experienced values. The first exception is 'economic' values, which are somewhat experienced but not significantly. The second exception are the values in the category 'inter-organizational' as they are some of the least experienced EAM values in the context of this study.

TABLE 8 Perceived EAM Value

AVG.	PERCEIVED EAM VALUE	Category after Gong and Janssen (2019)
Most frequently experienced		
3,07	Higher solutions integration (V30)	Integration and interoperability related
3,05	Better communication and information sharing (V17)	Communicational
3,02	Improved transparency of dependencies (V14)	Knowledge management related
3,02	Better decision making (V3)	Strategic and political
Experienced		
2,98	Increased business/IT alignment (V2)	Strategic and political
2,98	Better management of complexity in projects (V22)	Transformational
2,95	Better compliance with regulations, standards, and quality requirements (V6)	Strategic and political
2,93	Increased control on organizational complexity (V4)	Strategic and political
2,93	Increased project quality (V21)	Transformational
2,93	Clear requirements and restrictions (V26)	Transformational
2,92	Improved operational excellence (V5)	Strategic and political
2,89	Common vocabulary (V19)	Communicational
2,86	Improved business continuity (V7)	Strategic and political
2,85	Better data integration (V32)	Integration and interoperability related
2,85	Increased upfront detection of development problems (V43)	Other
2,85	Easier scoping of development projects (V46)	Other

2,84	Improved risk management / less risky operations (V8)	Strategic and political
2,83	Increased reusability of IT assets (V34)	Integration and interoperability related
2,82	Increased organization-wide standardization, integration, and deduplication of assets (V31)	Integration and interoperability related
2,81	Increased organizational learning (V12)	Knowledge management related
2,79	Better project efforts alignment with overall corporate strategy (V20)	Transformational
2,78	Availability of information on EA (V18)	Communicational
2,76	Improved/harmonized business processes (V33)	Integration and interoperability related
2,73	Increased process synergies (V35)	Integration and interoperability related
2,71	Create competitive advantage (V11)	Strategic and political
2,68	Clear overview of organization (V13)	Knowledge management related
2,67	Less inconsistency and redundancy in IT (V36)	Integration and interoperability related
2,66	Better resource management (V9)	Strategic and political
2,65	Lower IT resource heterogeneity (V37)	Integration and interoperability related
2,65	Lower IT costs (V41)	Economic
2,59	Dissolution of information silos (V15)	Knowledge management related
2,52	Increased business stability (V10)	Strategic and political
2,50	Lower operational costs (V40)	Economic

Less frequently experienced		
2,49	Improved organizational capability to change (V23)	Transformational
2,47	Increased ability to respond to customer and market needs (V38)	Flexibility and agility related
2,45	Increased adoption of modern technologies (V44)	Other
2,43	Lower project costs (V42)	Economic
2,40	Better management of external relationships (V27)	Inter-organizational
2,38	Increased strategic agility (V39)	Flexibility and agility related
2,37	Faster project initialization (V24)	Transformational
2,32	Timely completion of projects (V25)	Transformational
2,32	Better understanding of organization's vision (V16)	Knowledge management related
2,31	Faster time-to-market and delivery (V45)	Other
2,28	Improved innovation capabilities (V47)	Other
2,21	Increased external collaboration (V29)	Inter-organizational
2,13	Increased customer intimacy (V28)	Inter-organizational

4.2 EAM Value Creation Mechanisms

Interpreted from the relationships revealed by the regression analysis, some of the independent variables were more prominent in EAM value creation than others. First, this chapter presents the variables with significant impact on EAM value described by the regression analysis results presented in TABLE 7. Following, the chapter presents more detailed emergent value creation mechanisms found for some of the individual dependent values.

Overall, of the synthesized constructs of EA Product Quality, EA Service Quality, EA Culture/Attitude, EA Product Use, and EA Service Use, presented in chapter 2.4.4, all were present in EAM value creation. As previous literature suggested, EA results use had a notable positive impact on EAM value creation. The five individual independent variables with most explanatory power on EAM value creation were all but one regarding EA product or service use. The one not addressing EA results use was regarding EA Culture/Attitude, specifically 'involving architects as essential part of development work (e.g., development projects)'.

Value creation mechanisms are influenced by the preconditions and environment present in the studied context (Shollo *et al*, 2022). Fortunately, the results bring insight to the state of the EAM practice in the respondents' organizations. Only 6,4% of respondents completely agree with the statement "my organization has developed comprehensive descriptions of information /data structures and their interrelationships (e.g. data models from business or technical viewpoints)". 44,7% of respondents somewhat agree with the claim, 31,9% somewhat disagree with the claim, and 14,9% completely disagree with the claim. Business processes were comprehensively documented in 14,9% of respondents' organizations. 12,7% of respondents completely disagreed with having business processes documented in their organization. On a different note – the majority – 40,4% of respondents completely agreed with the claim "my organization has developed comprehensive documentation on used information systems". However, inspected closely, the results reveal these systems to be simply mapped in the majority of cases, as their roles, relationships, and information flows were documented comprehensively in just 10,6% of respondents' organizations. The specific used technologies/technology products, networks, and devices were comprehensively documented in 14,9% of respondents' organizations. The great majority, 40%, of respondents *completely agree* with using EA products in their work. The percentage of respondents using EA products to some extent in their work, combining respondents that completely agreed and respondents that somewhat agreed with the claim, was about 70%.

70% of respondents use data/information layer EA products to some extent in their work. About 75% of respondents use business process descriptions to some extent in their work. About 60% of respondents use descriptions of roles and responsibilities to some extent in their work. Interestingly, significantly exceeding the proportion of respondents claiming to use EA products in general, 83% of respondents use application-layer EA products to some extent in their work. Finally, 53,2% of respondents use technology layer descriptions to some extent in their work.

Almost 50% of respondents do not have easy access to EA products and only 2.1% of respondents completely agree with their organization's EA products being up to date. However, over 90% of respondents either somewhat agree or completely agree with the claim "I understand how EA products benefit my work". Moving from products to services, 23,4% of respondents completely agree with having the possibility to get Enterprise Architects' help in development work. 40,4% of respondents have *some* access to Enterprise Architects' help in

their organization. Architects are working as essential parts of development projects in 36,2% of respondents' organizations.

Involving architects as essential part of development work (e.g., development projects) (CA4) predicted positive outcomes on several values – namely: common vocabulary (V19), increased organizational learning (V12), dissolution of information silos (V15), better management of complexity in projects (V22), better communication and information sharing (V17), better data integration (V32), increased process synergies (V35), easier scoping of development projects (V46), better understanding of organization's vision (V16), increased adoption of modern technologies (V44), and availability of information on EA (V18). The respondents that utilized technology layer EA products as part of their work (PU5) were more subject to experiencing improved risk management / less risky operations (V8), increased ability to respond to customer and market needs (V38), improved business continuity (V7), improved operational excellence (V5), increased business stability (V10), better understanding of organization's vision (V16), better management of external relationships (V27), and increased external collaboration (V29). Utilizing the Enterprise Architects' help in one's work predicted positive perceived overall EAM value (V1), better decision making (V3), competitive advantage (V11), and improved innovation capabilities (V47). Using data layer EA products, such as data models and data flow diagrams, in one's work predicted positive outcomes in increased upfront detection of development problems (V43), increased project quality (V21), and increased process synergies (V35). Finally, using application layer EA products in one's work predicted positive outcomes in increased business/IT alignment (V2), better communication and information sharing (V17), and common vocabulary (V19). This does not mean the activity itself automatically results in the value. Rather that these constructs were *part* of predicting the positive outcome of the value variable in *this set*.

A few detailed explanatory relationships were discovered for EAM activities, resources, and culture and the specific experienced EAM value items. For positive outcomes in these values, a small set of independent variables were discovered to have explanatory power worth addressing separately. Discovered results are presented here for explanatory models with a total adjusted R square of over 0,3.

- Greater perceived overall EAM value (V1) was impacted positively by utilizing the Enterprise Architects' help in one's work (SU1) and using business layer EA products describing actors and roles and their responsibilities (PU3). The predictive model comprising factors SU1 and PU3 had an adjusted R square of 0,41 – meaning 41% of the variability in V1 was explained by variables SU1 and PU3 alone. In statistical analysis, this can be interpreted as the variables having moderate level of predictive power over the experienced value.

- Increased business/IT alignment (V2) was impacted positively by using application layer EA products in one's work (PU4) and having the possibility to get Enterprise Architects' support in development

work (SQ1). The predictive model comprising factors SQ1 and PU4 had an adjusted R square of 0,42 – meaning 42% of the variability in V2 was explained by variables PU4 and SQ1. Such can be interpreted as the variables having moderate level of predictive power over the experienced value.

- Availability of information on EA (V18) was impacted positively by involving architects as essential part of development work (e.g., development projects) (CA4) and having data level EA described as e.g., conceptual data models (PQ1). The predictive model comprising factors CA4 and PQ1 had an adjusted R square of 0,38 – meaning 38% of the variability in V18 was explained by variables CA4 and PQ1 alone. Such can be interpreted as the variables having moderate level of predictive power over the experienced value.

- Common vocabulary (V19) was impacted positively by involving architects as essential part of development work (e.g., development projects) (CA4) and using application-level EA products in one's work (PU4). The predictive model comprising factors CA4 and PU4 had an adjusted R square of 0,41 – meaning 41% of the variability in V19 was explained by variables CA4 and PU4. Again, this can be interpreted as the variables having moderate level of predictive power over the experienced value.

- Increased process synergies (V35) were impacted positively by involving architects as essential part of development work (e.g., development projects) (CA4) and using data level EA products, e.g., conceptual data models, in one's work (PU1). The predictive model comprising factors CA4 and PU1 had an adjusted R square of 0,35 – meaning 35% of the variability in V35 was explained by variables CA4 and PU1. This proposes the variables have moderate level of predictive power over the experienced value.

5 DISCUSSION

The results present implications for both industry and academic practice. This chapter discusses the results of the research from academic and industry viewpoints. Additionally, it notes the limitations of this study and proposes suggestions for further research on the topic.

5.1 Implications for research

The benefits of this study to research are threefold. First, it provides required synthesis and categorization of EAM value. Secondly, the research brings insight to which types of EAM value are most frequently experienced by EAM stakeholders and on the contrary, which types of EAM value are more rarely experienced by EAM stakeholders. Third, the results validate and enrichen previous understanding on EAM value creation – a complex phenomenon interesting to researchers on the fields of business, strategy, and IT. Additionally, it provides relevant suggestions for further research and brings significant novelty and breadth to the pool of research on EAM value and EAM value creation. The threefold presented implications are all further discussed in the following paragraphs.

Previous literature is rather abundant in suggestions and arguments on what value or benefits may be achieved by EAM. Suggested value ranges from better decision making to improved risk management to lower operational costs. For this reason, one might have difficulty in grasping even a glimpse of the full picture of EAM value. (Foorthuis *et al*., 2016; Boucharas *et al*., 2010; Boh and Yellin, 2006; Tamm *et al*., 2011; Goethals *et al*, 2006; Niemi and Pekkola, 2016; Gong and Janssen, 2019) The literature review conducted as part of this study provides valuable synthesis on previously proposed EAM value. In addition to mapping the suggested types of EAM value, the research provides a categorization of the different values according to categories presented by Gong and Janssen (2019). This mapping and categorization may aid researchers and academics in understanding EAM value and its different types.

Several previous studies propose IT cost savings as potential value stemming from EAM work (Tamm *et al.,* 2011; Kappelman and Zachman, 2013; Niemi and Pekkola, 2016). While emergence of this value may be explained by more complex value creation mechanisms than discussed in the scope of this research, the results suggest IT cost savings to be some of the less frequently perceived value by EAM compared to several other types of value studied here. Overall, this study provides relevant data on which types of values are more typically linked to EAM by its stakeholders. Higher solutions integration proposed by Boh and Yellin (2006) and Niemi and Pekkola (2016), better communication and information sharing proposed by Cardwell (2008), improved transparency of dependencies proposed by Niemi and Pekkola (2016), and improved decision making proposed by Goethals et al. (2006), Bradley et al. (2011), Tamm et al. (2011), Foorthuis et al. (2016), and Niemi and Pekkola (2016) were experienced the most.

What is more, the results of this study validate the explanatory factors and constructs proposed in previous literature. Previously claimed constructs of EA process quality, EA social environment, EA product quality, EA service quality, EA results use, EA approach, project compliance, architectural insight, EA-induced capabilities, EA function setup quality, EA service delivery, EA cultural aspects, user satisfaction, and intention to use (Niemi and Pekkola, 2016; Foorthuis *et al*., 2016; Lange, Mendling and Recker, 2012a) were synthesized to the independent constructs of EA Product Quality, EA Service Quality, EA Culture/Attitude, EA Product Use, and EA Service Use according to their characteristics and similarities in claimed effects on EAM value creation. All the constructs were found to be present in EAM value creation. These preliminary results also support the observations of Boucharas *et al*. (2010), Tamm *et al*. (2011), and Aier (2014) that cultural aspects have a notable impact on EAM value creation. The cultural factor of involving Enterprise Architects as central parts in development projects was found to have most explanatory power on perceived EAM value.

Overall, this research is characterized by its novelty. It opens the door for new type of research and approach. However, as is stated in the limitations, the topic requires further research, and the results are thus recommended to be interpreted as preliminary in academic practice.

5.2 Implications for industry

As literature previously suggested, EAM practices help organizations achieve vital qualities, e.g., better management of complexity, enhanced alignment, and improved integration (Goethals *et al*., 2006; Alwadain *et al*., 2016). To achieve such benefits, organizations are required to invest and commit to EAM. Understanding what to expect in terms of both required inputs as well as anticipated outputs when investing in EAM is key to expectations management for the practice. (Rodrigues, L. S. and Amaral, L., 2010; Bernus *et al*., 2016; Gong and Janssen, 2019)

As was seen in both previous research and the results of this study, EA product quality, such as timeliness and the descriptions' availability to EAM stakeholders, is important for deriving value from EAM. It is widely suggested that developing EA products is not enough, they must also be used by EAM stakeholders in value-adding activities (Boh and Yellin, 2006; Foorthuis *et al*., 2010; Tamm *et al*. 2011; Lange, Mendling and Recker, 2012a; Aier, 2014; Niemi and Pekkola, 2016). This means e.g., that EAM is part of ensuring and creating organizational capabilities to perform value-adding activities, such as development work, with increased quality. However, unless organizations implementing EAM practices ensure the necessary development, maintenance, and communication work needed for the products to be and stay useful to strategically important value-adding activities, theorized potential value will most probably not be realized in the possible extent. On the same note, the results of the primary research conducted as part of this study suggest EAM stakeholder understanding of the possibilities of EA product and service use to be high. At the same time, the results reveal development potential in organizations' EAM practices. This

means there is strong demand for EA products and services in the represented population of EAM stakeholders.

Value stemming from EAM may be strategic and political, transformational, communicational, flexibility and agility related, integration and interoperability related, knowledge management related, inter-organizational, or economic (Gong and Janssen, 2019). The two latter seem to be rarer compared to the others according to the results of this research. The most common value from EAM experienced by the subjects of the primary research were higher solutions integration, better communication and information sharing, improved transparency of dependencies, and better decision making. Increased business/IT alignment, complexity management, increased development project quality, and clear requirements and restrictions were also prominent values experienced by the respondents.

However, as is noted on EAM value in chapter 2.2, direct measurability and causal mechanisms are its weaker points. Whereas some EAM value might be immediate or almost immediate, some EAM value realizes in the long-term (Niemi and Pekkola, 2016). Stakeholders may experience direct and immediate value from e.g., being guided by architects in development work. Yet, they may also experience indirect value over time when e.g., upfront detection of development problems, improved communication, and clear requirements and restrictions stemming from EAM have a positive impact to project delivery. Due to these characteristics, even if the less experienced types of EAM value arise indirectly and/or over time, stakeholders might not be able to link the perceived value to EAM practices.

The results provide insight on what type of value typically stems from EAM and what type of value is, at least directly, less linked to EAM by the stakeholders. Especially organizations experiencing challenges with poor solutions integration, issues in transparency, inefficient communication, decreased project quality, or complexity management may profit from EAM practices as improvements in these areas were typically linked with EAM by the professionals.

Some organizations may experience challenges in determining which EAM practices to implement. As discussed in chapter 2.1, EAM is a holistic practice, with frameworks and guides providing comprehensive methodologies for planning, conducting, and managing the structures. One cannot expect to implement EAM partially and achieve comprehensive results. However, the results of this study do shed *some* light on the significance of different variables in creating EAM value. Nevertheless, it is advised to remember the complexity of total EAM value creation mechanisms and the novelty of the research in interpreting the results.

The constructs suggested by previous research – EA Product Quality, EA Service Quality, EA Culture/Attitude, EA Product Use, and EA Service Use – were all found to impact perceived EAM value. Having excellent EA products and services does not automatically lead to any value (Boh and Yellin, 2006; Foorthuis *et al.*, 2010, 2016; Tamm *et al.*, 2011; Lange, Mendling and Recker, 2012a; Aier, 2014; Niemi and Pekkola, 2016). The results show EA product and service use to be prominent in predicting positive outcomes on EAM value. However, the practice of involving Enterprise Architects in development work, e.g.,

development projects, was also seen to predict positive outcome of EAM value. Based on these results, it may be advised for industry actors to involve Enterprise Architects as essential part of development projects to achieve potential value stemming from EAM practices.

Additionally, certain actions and resources were seen in the research to have a significant explanatory relationship with certain types of EAM value. Using application layer descriptions and having the possibility to get help from Enterprise Architects lead to positive outcomes in increased business/IT alignment. Thus, when seeking business/IT alignment, it may be advised to develop application layer descriptions, ensure their use, and offer employees tasked with e.g., development work the possibility to seek support and advice from Enterprise Architects. Information on the EA was experienced to be available when Enterprise Architects were involved in development projects and data-level descriptions were produced for the organization's information structures. The results suggest professionals that used application-level EA descriptions and worked in organizations with Enterprise Architects involved in the development work experienced positive outcomes in having a common vocabulary. Finally, increased process synergies were in part explained by having architects involved in development projects and using data level descriptions in one's work. Examples of such data level descriptions are information flow diagrams and conceptual level data descriptions. Organizations seeking especially these specific types of EAM value may be advised to ensure the presented conditions to be met in their EA practices.

5.3 Limitations

The results do not come without limitations to validity. With 47 respondents, the sample size of the primary research was significantly limited. The total methodology of the study was novel, with certain exploratory features. Thus, the results are advised to be interpreted as preliminary. The great majority of respondents worked in large organizations with over a thousand employees, meaning this demographic is best suited when interpreting the results. It may be that EAM value is more likely to be achieved in the complex environment of a large corporation. Additionally, all but one respondent worked in organizations operating in Finland, meaning the results do not in their large part represent the experiences of professionals working in organizations not operating in Finland. Thus, it can be concluded the results may not represent the complete population of EAM stakeholders.

Another notable limiting factor is difficulty in measuring EAM value due to its typically indirect and/or intangible nature (Kluge, Dietzsch and Rosemann, 2006; Tamm *et al.*, 2011). This does not mean attempting to measure EAM value is unnecessary but does have implications on the validity of such results. Additional value emerging through a series of more complex constructs can be assumed not to have been captured here. Efforts to capture these results are interesting especially for industry investment on EAM.

The results of this study represent the perceived EAM value by the involved professionals not validated with objective data. Thus, a notable amount of subjectivity may be present. In addition, as the questions used to capture the primary data were close ended, they can be assumed to only report narrow conclusions. However, the extensive amount of previous research with similar conclusions considered as part of the literature review does partly validate the results especially in answering the first research question.

Due to focusing on the positive impacts of the different factors on EAM value, this study did not take into account possible negative impacts of the related factors on perceived value. That said, some constructs may have diminishing effects on EAM value. Even though concluded here to have a positive impact on certain EAM value, the actions may have negative impact on another EAM value. The *total* impact of the factors thus requires more research for definite conclusions to be possible. The results should not be thus interpreted as the direct reality but rather as a guiding element.

5.4 Suggestions for further research

As mentioned in the previous chapter, this study focused on the positive effects of the acknowledged constructs on EAM value. To determine the total impact of the different factors, their *negative* impacts on EAM value could be researched. This is also a subject rather nonexistent in the pool of research available.

To validate the results of this study, similar research with a larger sample size and similar demographic could be beneficial. Although the overall validity is improved by the scale of previous research on the matter, especially studies focusing on private organizations operating in Finland would bring valuable support to interpreting the generalizability of the presented conclusions. This would be a significant research opportunity also regarding the novelty of such research methodology.

As was seen in chapters 2.2 and 2.4, many of the value-bearing effects of EAM are indirect. This suggests possible mediating factors to be present in EAM value creation. Thus, research on such mediating constructs may be recommended. Overall, the value creation mechanisms of EAM are still in their large extent relatively unclear. Further research on the subject is relevant for both academic and industry practice.

6 CONCLUSIONS

This research pursued to provide relevant understanding on the value created by EAM. Specifically, the questions of 'what EAM value is perceived by EAM stakeholders?' and 'what kind of EAM value creation mechanisms can be found in practice?'. A vast number of different types of value suggested to result from EAM practices were collected from previous research. To aid the understanding of such values, they were categorized by categories after Gong and Janssen (2019). The study synthesized EAM value creation models proposed by previous research, and researched the constructs' impacts on EAM value creation. The primary research gathered the experiences of 47 EAM stakeholders on EAM actions, resources, and culture as well as the professionals' insight on experienced EAM value. The results show EAM to result in higher solutions integration, better communication and information sharing, improved transparency of dependencies, and better decision making. Of EAM practices, the most influential over experienced value were ensuring EAM products and services use and involving Enterprise Architects as central part in development projects. Identified relationships agreed with previous research, suggesting use of EAM results and services as well as the organization's EAM culture and attitude to impact achieved EAM value. The results provide data and suggestions for academics and industry professionals working with or interested in EAM value creation as well as novel type of research on the field.

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APPENDIX 1 SURVEY QUESTIONS (IN FINNISH)

Kokonaisarkkitehtuurityön arvonluontimenetelmät

Työroolini painottuu (valitse sopivampi)

Teknologiaan/ITseen
Liiketoimintaan

Tarkempi roolini on

_____

Organisaatiossani on

Alle 100 työntekijää	
100-500 työntekijää	
501-1000 työntekijää	
Yli 1000 työntekijää	

Organisaationi toimii Suomessa

Kyllä	
Ei	

Kokonaisarkkitehtuurityöstä koettuun hyötyyn vaikuttavat tekijät 1/2

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
PQ1. Organisaatiossani on kuvattu kattavasti tietorakenteita ja näiden tietorakenteiden suhteita toisiinsa (esim. käsitemallein tai tietomallein)					
PU1. Hyödynnän tietoarkkitehtuurin tuotoksia työssäni					
PQ2. Organisaatiossani on kuvattu kattavasti liiketoiminnan prosessit ylätasolla (prosessilistaus, ylätasoinen arvoketju, prosessien välinen vuorovaikutus)					
PQ3. Organisaatiossani on kuvattu kattavasti liiketoiminnan prosessit tarkalla tasolla (prosessin tarkempaa kulkua kuvaavat kaaviot, työnkulkukaaviot, logiikkakaaviot)					
PU2. Hyödynnän liiketoiminnan prosessien kuvauksia työssäni					
PQ4. Organisaatiossani on kuvattu kattavasti toimijoita ja/tai rooleja sekä näiden vastuita (RACI, toimijoiden ja/tai roolien vastuulistaus)					

PU3. Hyödynnän toimijoiden ja/tai roolien vastuiden kuvauksia työssäni					
PQ5. Organisaatiossani on kuvattu kattavasti käytössä olevat tietojärjestelmät (tietojärjestelmälistaus)					
PQ6. Organisaatiossani on kuvattu kattavasti tietojärjestelmien suhteita toisiinsa (mitä tietoa liikkuu, tietojärjestelmien välinen vuorovaikutus)					
PU4. Hyödynnän tietojärjestelmäarkkitehtuurin tuotoksia työssäni					
PQ7. Organisaatiossani on kuvattu kattavasti käytössä olevat teknologiat (tuotteet, verkot ja laitteet)					
PU5. Hyödynnän teknologia-arkkitehtuurin tuotoksia työssäni					

Kokonaisarkkitehtuurityöstä koettuun hyötyyn vaikuttavat tekijät 2/2

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
CA1. Ymmärrän, mitä kokonaisarkkitehtuurityön tuotokset ovat					
PQ8. Kokonaisarkkitehtuurityön tuotokset ovat saatavillani					

CA2. Ymmärrän, miten kokonaisarkkitehtuurityön tuotokset hyödyttävät minua					
PU6. Hyödynnän kokonaisarkkitehtuurityön tuotoksia työssäni					
PQ9. Organisaationi kokonaisarkkitehtuurityön tuotokset ovat ajantasaisia					
SQ1. Arkkitehdeilta on organisaatiossani saatavissa tukea kehittämistyöhön					
CA3. Ymmärrän, missä arkkitehdit voivat minua auttaa					
SU1. Hyödynnän arkkitehtien apua työssäni					
CA4. Arkkitehdit ovat organisaatiossani keskeisessä roolissa kehitystyössä (esim. keskeisesti mukana kehitysprojekteissa)					
CA5. Organisaatiossani noudatetaan kokonaisarkkitehtuurin ohjeita, sääntöjä ja määrityksiä (esim. kehitysprojekteissa)					
CA6. Kokonaisarkkitehtuurityö on organisaatiossani puhdasta IT-tekemistä					

CA7. Kokonaisarkkitehtuurityö on organisaatiossani koko liiketoiminnan kehittämistä tukevaa työtä					
CA8. Näen kokonaisarkkitehtuurityön mahdollisuutena					
V1. Näen, että kokonaisarkkitehtuurityöstä on hyötyä organisaatiossani					
PM1. Olen tyytyväinen organisaationi kokonaisarkkitehtuurityöhön					

Kokonaisarkkitehtuurityö on…

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V2. parantanut liiketoiminnan ja IT:n yhteistoimintaa					
V3. helpottanut päätöksentekoa					
V4. helpottanut organisaation monimutkaisuuden hallintaa					
V5. parantanut toiminnan laatua (operational excellence)					
V6. helpottanut sääntöjen, standardien ja laatuvaatimusten noudattamista					

V7. parantanut liiketoiminnan jatkuvuutta					
V8. helpottanut riskienhallintaa					
V9. helpottanut resurssienhallintaa					
V10. lisännyt liiketoiminnan vakautta					
V11. luonut kilpailuetua (competitive advantage)					

Kokonaisarkkitehtuurityö on…

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V12. lisännyt organisaatio-oppimista					
V13. tarjonnut selkeän kokonaiskuvan organisaatiosta					
V14. parantanut riippuvuuksien läpinäkyvyyttä					
V15. poistanut informaatiosiiloja					
V16. helpottanut organisaation vision ymmärrettävyyttä					

Kokonaisarkkitehtuurityö on...

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V17. parantanut kommunikaatiota					
V18. lisännyt kokonaisarkkitehtuuritiedon saatavuutta					
V19. tuonut yhteistä termistöä					

Kokonaisarkkitehtuurityö on...

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V20. parantanut projektityön tavoitteiden sovitusta organisaation tavoitteisiin					
V21. parantanut projektien laatua					
V22. helpottanut monimutkaisuuden hallintaa projekteissa					
V23. parantanut organisaation kykyä muuttua					
V24. nopeuttanut projektien aloitusta					
V25. lisännyt projektien valmistumista aikataulussa					
V26. selventänyt vaatimuksia ja esteitä					

Kokonaisarkkitehtuurityö on...

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V27. auttanut ulkoisten suhteiden hallintaa					
V28. lisännyt läheisyyttä asiakassuhteissa					
V29. lisännyt ulkoista yhteistyötä					

Kokonaisarkkitehtuurityö on...

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V30. lisännyt ratkaisuiden yhteentoimivuutta					
V31. lisännyt organisaationlaajuista standardisaatiota, yhteentoimivuutta ja duplikaattiratkaisuiden välttämistä					
V32. parantanut tietojen (data) yhteentoimivuutta					
V33. harmonisoinut liiketoimintaprosesseja					
V34. lisännyt IT-ratkaisuiden uudelleenkäytettävyyttä					
V35. lisännyt prosessien synergioita					

V36. vähentänyt turhia IT-ratkaisuja					
V37. vähentänyt IT-ratkaisuiden hajautuneisuutta					

Kokonaisarkkitehtuurityö on...

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V38. lisännyt kykyä vastata asiakkaiden ja markkinoiden kysyntään					
V39. lisännyt strategista joustavuutta					

Kokonaisarkkitehtuurityö on...

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V40. vähentänyt liiketoiminnan kuluja					
V41. vähentänyt IT-kuluja					
V42. vähentänyt projektien kuluja					

Kokonaisarkkitehtuurityö on...

	En osaa vastata	1 Täysin eri mieltä	2 Jokseenkin eri mieltä	3 Jokseenkin samaa mieltä	4 Täysin samaa mieltä
V43. lisännyt kehityksen ongelmien tunnistamista ennalta					
V44. lisännyt nykyaikaisten teknologioiden käyttöönottoa					
V45. nopeuttanut tuotteiden tai palveluiden markkinoille tuomista ja toimittamista					
V46. helpottanut projektien laajuuden asetantaa					
V47. parantanut innovaatiokyvykkyyksiä					