

Enterprise Transformation Management based on Enterprise Engineering Approach with Unified Enterprise Transformation Dimensions

Shoji Konno and Junichi Iijima

Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro-ku, Tokyo 152-8550, Japan
{Konno.s.ad, iijima.j.aa}@m.titech.ac.jp

Keywords: Business-IT Alignment (BITA), Enterprise Transformation Management (ETM), Business Capability, Technology Capability, Dimension, Enterprise Model, Literature Review.

Abstract: In the enterprise transformation (ET), there are so many ideal models, blueprints and situations. The ideal pictures are provided by practitioners and researchers one picture by one change is predicted or occurs on the business environment, for example, “digital enterprise transformation” by “business model at digital age”, etc. Indeed, a variety of approaches were proposed in the literature. On the other hand, under our literature survey, existing management frameworks are addressing one specific perspective of enterprise management and focusing on one kind of measurement. There is no significant adoption in the state of the enterprise transformation management systems based on the relationship between architecture and transformation practices yet. The goal of this work is, therefore, to propose a holistic management framework to support the transformation based on enterprise engineering. All the dimensions, analysis perspectives, impact analysis of those change practices together support among adaptable enterprise architecture world and real transformation world. It aims to enable the framework to be used in state-of-the-art enterprise change environments.

1 INTRODUCTION

1.1 Motivation

In the enterprise transformation (Purchase et al., 2011), there are so many ideal models, blueprints and situations (Goerzig and Bauernhansl, 2018). The ideal pictures are provided by practitioners and researchers one picture by one change is predicted or occurs on business environment, for example, “digital enterprise transformation (Weill and Woerner, 2015)” by “business model at digital age”, etc. Indeed, a variety of approaches were proposed in the literature concerned with the solution for treating those transformation. Various ideal frameworks and/or big pictures are drawn but transformation has failed (Flyvbjerg and Budzier, 2011) (Kotter, 1995) (Westerman, 2018) (Davenport and Westerman, 2018) (Bughin et al., 2018). Rather than promoting change with ad-hoc way blindly, we think that we should incorporate ideas to support the practice of enterprise transformation (Labusch et al., 2014) capability based on multi-dimensional impact analysis.

On the other hand, under our preliminary literature survey, existing management frameworks are addressing one specific perspective of enterprise management and focusing on one kind of improvement. There is no significant adoption in state of the enterprise transformation management systems based on relationship between architecture and transformation practices yet. Companies try to improve and transform in silos according to individual frameworks and concepts. Evaluate As-Is in assessments and interviews based on previously created ideals, and highlight To-Be and ambition. Close to the frameworks and concepts used at that time, it seems that the assessment and subsequent plans have been successfully done. However, isn't there a situation where the enterprise transformation that should be achieved does not progress because the enterprise's interoperability with other related things is lacking or not? Even if individual frameworks have formed completed forms, I thought that frameworks that can be transformed and transformation operation platforms that embody them would be necessary while maintaining their interoperability.

The goal of this work is, therefore, to propose a holistic management framework to support the transformation by using enterprise engineering (Dietz and Hoogervorst, 2017) thinking-frame. All the dimensions, analysis perspectives, impact analysis of those change practices together support among adaptable enterprise architecture world and real transformation world.

Enterprise engineering (Dietz, 2011) (Dietz and Hoogervorst, 2017) is conceptual thinking methodology to apply engineering approach to enterprise architecture management by describing the model of enterprise, governance model and business model. Enterprise engineering have the potential for solve those problems describer in Section 1 between enterprise model and enterprise transformation activities on the real business world and/or physical enterprise. For example, we can use enterprise engineering method to clarify the influenced area of enterprise on ET management (ETM) activities.

On the other hand, at the research area of Enterprise modelling, the formation of the capturing the enterprise has influenced by the change of business environments. For example, at the digital age the form of enterprise has shift from traditional pyramid style to networked ecosystem style. At the scene, several research activities have proposed each sophisticated and specific framework for representing the structure of ideal enterprise structure.

Those frameworks mentioned above has hard barriers between each thinking methodology. We are thinking the combination those method and theories at the management scene. At the management activities of those transformation, we must clarify the mechanism that how to influence the activities for the transformation to enterprise model at each transformation scenario. It is important to connect various frameworks and theory about enterprise through enterprise dimensions (Bernus et al., 2012) for supporting the transformation.

1.2 Our Goal

At the end of this work, we will establish the framework for supporting platform and solution as a service (Figure 1). At the scene, the start point of the solution will be definition the requirements for a transformation activity (Labusch et al., 2017) by using requirements engineering think-frame (Ivarsson and Gorschek, 2009), etc (Figure 1).

The solution will take next steps for supporting the enterprise transformation management;
(Step-1) Clarify requirements of the transformation

- (Step-2) Co-create expectation tree of the transformation
(Step-3) Target enterprise capability for the transformation based on enterprise engineering think-frame
(Step-4) Visualize the value network
(Step-5) Take an impact analysis
(Step-6) Execute ETM

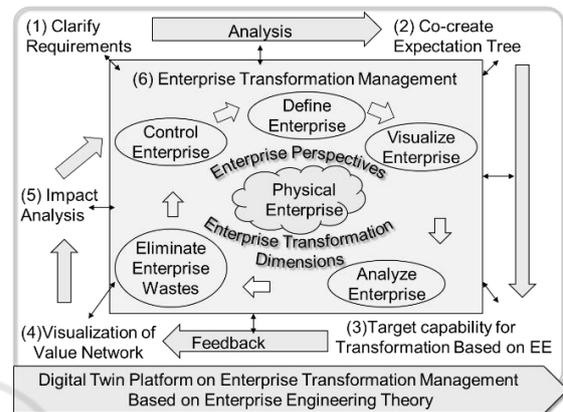


Figure 1: Our Goal.

Ultimately, we aim to design, develop and provide a platform for digital twin on ETM realized on the own framework proposed in this work. This will reduce costs and labours on achieving various types of transform from the traditional ETM world to the new fully digitally ETM world. We think that the core components of the platform are to have the ability to connect with change capability, business model, architecture and so on.

1.3 Research Questions

After preliminary literature review concerned with those research areas, we have defined the research question for our work. These questions are below.

(RQ1) "How does enterprise engineering methodology support enterprise transformation with capability maturity framework?"

(RQ2) "How does enterprise capability maturity affect to enterprise dimensions?"

(RQ3) "What is a relationship between enterprise dimensions and enterprise transformation?"

In this paper, we define "enterprise dimensions" as "a collection of elements related to the enterprise that cannot be reconstructed as a whole if one is missing".

Furthermore, we will clarify the next points in this work as the secondary research question.

(1) What are there as perspectives and dimensions related to the enterprise? How do they influence each

other during enterprise transformation? How can enterprise engineering support enterprise transformation?

(2) The relationship between models related enterprise, “business model”, “enterprise model” and “execution (operation) model”, etc.

(3) How to define the dimensions for capturing organizational transformations

(4) How to apply enterprise engineering approach to the enterprise transformations

(5) How should I define those dimensions for modelling and assessing those transformation including

(6) how to evaluate the impact of each transformation

(7) The relationship between “enterprise model” and enterprise capability

(8) The relationship between “transformation dimension” and enterprise capability

(9) For example, how to apply this method to “digital enterprise transformation”?

1.4 Hypotheses

Based on the research questions and our goal, we define the following main proposition:

Main Proposition:

Improvements in enterprise capability maturity has a positive impact on the outcomes of all the components associated with enterprise transformation with less effort and faster.

Based on above, we formulate the following hypotheses for addressing the research questions:

Hypothesis 1 (H1):

There are relationships between enterprise transformation capabilities and others concerned with enterprise.

Hypothesis 2 (H2):

There are unified enterprise dimensions and influencers for enterprise transformation.

Hypothesis 3 (H3):

Enterprise dimension reference model and body of knowledge related to each specific transformation theme is key contents of ETM framework.

2 BACKGROUND CONCEPTS

2.1 Enterprise

Many frameworks and concepts with "enterprise" seem to exist. Sometimes it may be a subtle difference, such as pointing to an enterprise system or pointing to an enterprise organization. Even without

"enterprise", some seem to be closely related to enterprise system and enterprise organization. In this study, we decided to target enterprise defined in (Jan and Dietz, 2006). The definition is “the term “enterprise” is used to refer in the most general way to human cooperatives, like companies, institutes, projects, etc., as well as to networks of enterprises, like supply chains.”. According to (Jan and Dietz, 2006), the term “business” is “typically used to refer to the function perspectives on the enterprise by its customers (but applies also to other stakeholders).” And by the “organization” of an enterprise is “strictly meant the construction perspective (white-box) on the enter-prise, disregarding all function perspectives (black-box).”.

2.2 Enterprise Architecture

The enterprise architecture (EA) is “a conceptual blueprint that defines the structure and operation of an organization” (Ross et al., 2006). The intent of enterprise architecture is “to determine how an organization can most effectively achieve its current and future objectives” (Tamm et al, 2011). EA is “often used to frame IS evolution by putting more focus on future requirements; it is about developing a long-term IT strategy including multiyear objectives, activity planning, and staff requirements to support evolving business needs and interests” (Tamm et al, 2011) (Lange et al., 2016). As we will mention in Section 6, it is changing its shape as the enterprise environment changes. It is necessary to consider the dimension in line with the change of architecture.

2.3 Enterprise Transformation

According to (Purchase, 2011), enterprise transformation concerns change, not just routine change but fundamental change that substantially alters an organization’s relationships with one or more key constituencies, e.g., customers, employees, suppliers, and investors. Transformation can involve new value propositions in terms of products and services, how these offerings are delivered and supported, and/or how the enterprise is organized to provide these offerings. Transformation can also involve old value propositions provided in fundamentally new ways.

Enterprise transformation (ET) can involve new value propositions or change the inner structure of the enterprise. Further, ET could involve old value propositions provided in fundamentally new ways (Rouse, 2005). Examples are significant mergers & acquisitions, replacements of legacy IT systems or

business model changes (Gollenia et al., 2012). EA management (ETM) is concerned with the establishment and coordinated development of EA in order to consistently respond to business and IT goals, opportunities, and necessities (Labusch et al., 2014).

2.4 Capability and Dynamic Capability

The definition of “capability” is published by past research papers and books (Table 1). In (Wißotzki, 2018), the definition is focus on “perform a set of coordinated tasks, utilizing organizational resources, for the purposes of achieving a particular end result”.

Table 1: Definitions on capability.

Definition	Source (Ref.)
perform a set of coordinated tasks, utilizing organizational resources, for the purposes of achieving a particular end result.	Dynamic resource-based view (Helfat and Peteraf, 2003)
an ability that an organization, person, or system possesses.	TOGAF (Open Group. (2009)
represents the ability of an enterprise to join information and roles able to execute a specific activity with available resources in order to support strategy goals under consideration of its context.	Enterprise Architecture Capabilities (Wißotzki and Sandkuhl, 2015)
the quality of being capable; of having the capacity or ability to do something; of being able to achieve declared goals and objectives.	IT-CMF (Capability Maturity Framework) (Curley et al, 2016)

In (Wißotzki, 2015), the types of capability are already summarized by literature review. We are updating the summary for our study (Table 2). Those capabilities have individual perspective and organization perspective. In our research activities, the target is organization perspective.

In (Michell, 2011), the focus point of these capabilities (Figure 2) is a little bit difference from others (Table 2). The numbers in parentheses in the figure 2 represent the year in which the definitions were published.

The capability is linked with enterprise resources and processes. One focus area on the research is “Resource-based” relation and the second is “Operation theory based” relation.

In (Teece, 2010), dynamic capabilities are based on “the skills, procedures, organizational structures, and decision rules that firms utilize to create and capture value.”. We think that the dynamic capability will be the core engine in enterprise transformation

management because transformation is not to mature but to change the company's routine business processes to other suitable ones.

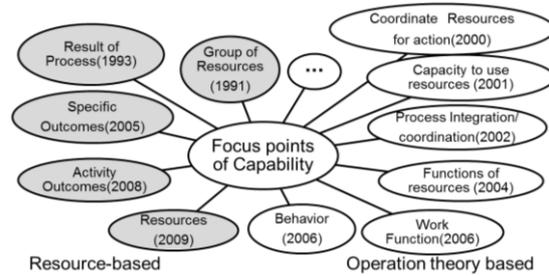


Figure 2: Focus points of capability.

Table 2: Types of capability.

Description	Type (Ref.)
the focus of dynamic capabilities is broader than of all others since a dynamic capability deals directly with the business environment and its contemporary dynamic behaviour.	Dynamic Capability (Kim, G. et al, 2011)
they represent the execution of core competencies within a business process for the purpose of providing either products or services.	Core Capability (Wißotzki, 2015)
referred to a corporate business goal the aim of business capabilities is to activate, use and maintain resources for specific business activities.	Business Capability (Helfat et al, 2003)
describes the specific combination of know-how in terms of organizational knowledge, procedures and resources able to externalize this knowledge in a specific process with appropriated and available resources to achieve a specific outcome for a defined strategic initiative that change an EA.	EAM Capability (Wißotzki, 2015)
to manage their IT resources in order to realize agility. The central goal of IT-capability represents the realization of business value and maintenance of competitive advantages in terms of IT services and/ r IT products.	IT Capability (Mithas, 2011)
the capability of enterprise acquisition, processing and application of information resources and information technology, which is also a source of sustainable competitive advantage.	Information Capability (Xu, 2014)

2.5 Dimensions of Enterprise

According to (Bernus et al., 2012), “Structure”, “Behaviour” and “Value” are illustrated as the major

dimensions of architecture. Bernus et al. also pointed out “all of which are interrelated and understanding these should improve the enterprise”. At (Bernus et al., 2012), the focus was on how to subdivide the enterprise model for improvement in the company's performance. It has not been defined in anticipation of relationships or impacts in line with transformation or other elements.

2.6 Foundation for Execution and Operating Model

In (Ross et al., 2006), J.Ross has defined the foundation for execution model for traditional enterprise. They say that an organization’s operating model should determine its enterprise architecture, which, in turn, should guide the building of its foundation for execution (i.e., the operating platform). According to (Ross et al., 2006), operating model is “the necessary level of business process integration and standardization for delivering goods and services to customers”. As with other concepts and frameworks, the operating model has also changed in response to changes in the environment surrounding the enterprise, such as digital transformation (Goerzig and Bauernhansl, 2018) (Weill and Woerner, 2015). In this study, although the relationship between EA and Capability is illustrated, but dimensions on enterprise transformation has not been mentioned.

In (Hafsi and Assar, 2016), Hafsi, M. etc. pointed out that execution model should be changed align with causing digital transformation at enterprise.

2.7 Business Model

In (Gassmann et al., 2013), Gassmann et al. summarized 55 patterns of business model by the difference between “What?”, “Who?”, “Why?”, and “How?” axes and “Value Proposition”, “Value Chain”, and “Revenue Model”. In enterprise transformation, these transitions are also treated as one of the enterprise transformation dimensions.

In (Fleisch, 2015), business models on digital business has defined. Although some overlap with general business models, many new models are presented in the book, for example, “Freemium” and “Subscription”, et al.

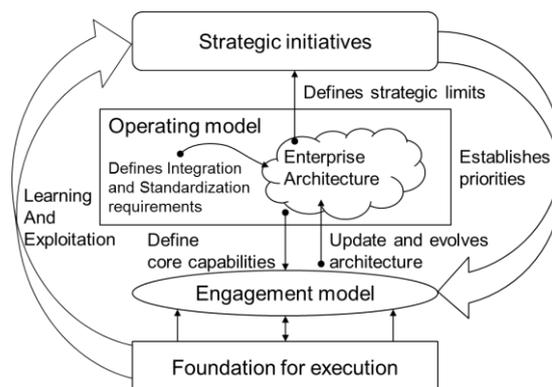


Figure 3: Foundation for execution models.

3 RESEARCH DESIGN

In this research, we choose the methodology based on the design science research (DSR) (Hevner et al., 2008) (Wohlin and Aurum, 2015). We have set the research steps below. Note that these steps do not end in one direction, and can be reordered or repeated as needed.

(Step1) - Clarify problems to be Studied: Describe main research questions and support research questions.

(Step2) - Propose new Solutions: Study the existing theory/framework/body of knowledge around the problem area in order to envision a possible solution, based on literature review action.

(Step3) - Define Research Model: Build research model, make hypotheses and familiar with the selected research methodologies and tools for the solution.

(Step4) - Realize New Solutions: Define commonly available artefacts focusing on enterprise transformation. The main artefacts are enterprise dimensions for supporting various types of enterprise transformation, for example, digital transformation.

(Step5) - Collect Data from Case Examples: Define commonly available enterprise dimensions for existing frameworks and ideas related to enterprise, focusing on enterprise transformation.

(Step6) - Validate Hypothesis: Apply to some model cases on enterprise transformation management such as digital transformation in Japan, Europe and US. In this step, we will use design science as primary method. The detailed process, method, validation points and measurement for the validation will be defined in this step, later.

(Step7) - Evaluate Research Results: Evaluate the artefacts to ensure that all intended goals and benefits

ware achieved. The detailed process, method, evaluation points and measurement for the evaluation also will be defined in this step, later.

(Step8) - Extend Research Model: Refine our research model based on the research results obtained through research steps described above.

(Step9) - Conclusion: Complete this research with the evaluation of the results and the presentation. By posting journals at international conferences, we will obtain expert opinions and feedbacks in this area, and will continue to participate in discussions as a member of the research community in that area.

4 RELATED WORK

4.1 EAM (Enterprise Architecture Management)

EAM has the holistic perspective of enterprise architecture management (Labusch et al., 2014). It is a framework for successful implementation of ETM, and it is effective for capturing activities to be implemented. (Labusch et al., 2014) has "eight major groups of ETM activities". Those activities are "ET Meta", "ET Performance", "ET Strategy", "ET Execution", "ET HR", "ET IT", "ET Structure" and "ET Relationship". These perspectives are very useful in considering the transformation dimensions in our study.

4.2 Adaptive Enterprise Architecture

Adaptive Enterprise Architecture (Korhonen et al., 2016) has four perspectives derived from the need for and underpinnings of a reconceptualization of enterprise architecture from the enterprise ecological adaptation (i.e. adaptive enterprise) point of view:

- Perspective 1: Enterprise Ecological Adaptation,
- Perspective 2: Vertical Contingency,
- Perspective 3: Enterprise as Living System,
- Perspective 4: Adaptive Enterprise Design.

It is considered to be the latest among the existing EA forms. It is thought that the transition shown in the figure 3 has been achieved until this form is reached. It is used as a material to identify those that are universal and those that are not in these changes. In addition, we think that the viewpoints dealt with in this framework are also useful for the consideration of our dimensions.

4.3 ACET (Architectural Coordination of Enterprise Transformation)

ACET (Proper et al., 2017) (de Kinderen, 2017) has the holistic perspective of enterprise architecture management. The purpose of the ACET is to coordinate enterprise transformation. ACET integrates and aggregates local information and provides different viewpoints. By using ACET, the stakeholders of an enterprise transformation can create and share the understanding.

5 RESEARCH DESIGN FOR OUR FUTURE WORK

In this research, we will apply enterprise engineering think-frame to enterprise transformation management (Figure 4). As first step, we summarised the candidate of enterprise transformation dimensions in this paper.

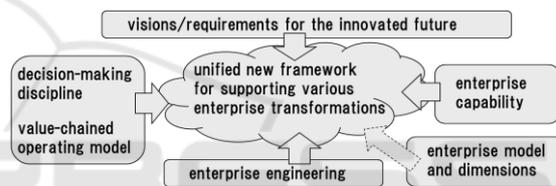


Figure 4: Our research approach.

5.1 Historical Review of Enterprise Architecture

Based on the preliminary historical literature review (Kotusev, 2016), we can describe the history of the transformation in the real business world (Figure 5).

			
Traditional	Service Oriented	Ecosystem	Value Chain Centric
Enterprise Architecture	Service Oriented Architecture	Ecosystem Oriented Architecture	Value creation Approach
[Rigdon (1989)]	[Halley (2005)]	[Ferronato (2007)]	[De Vries (2008)]
			
Business-IT Alignment	Network	Adaptive	
BITA Oriented Architecture	Network Centric Architecture	Complex Enterprise Architecture	
[Fritscher (2011)]	[Lazarov (2015)]	[Gill (2016)]	

Figure 5: History of the shape of enterprise architecture.

At the beginning of the history, the enterprise model formed like a pyramid separated with several layers, for example infrastructure layer, technology layer, data layer, information layer, business process layer. We will extract the characteristics of each representation for clarifying what dimension is changing by transform the shape (Rigdon et al., 1989) (Halley and Bashioum, 2005) (Ferronato, 2007) (De Vries and Van Rensburg, 2008) (Fritscher and Pigneur, 2011) (Lazarov et al., 2015) (Korhonen et al., 2016). In these changes, we think that the universal part, the part that is not so can reveal our dimension.

5.2 Types of Enterprise Organizational Formation

According to (Korhonen and Halen, 2017), traditionally enterprise architecture has focused on process standardization and integration, not on continuous adaptation to the changing business, information, social and technological landscape. Furthermore, (Haffke et al., 2016) has described about “changing role of EA and technological catalysis along different phases of the adaptive loop”. Depend on those change of environments of business, the formation of enterprise has been transformed like the formation describer in Figure 6.

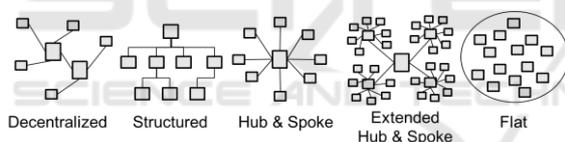


Figure 6: Enterprise formation.

We will extract the characteristics of each formation of enterprise for clarifying which influencers will impact to the enterprise model at when a transformation occurs by referring (Chui et al., 2012) (Srivastava, 2015) (Moreira et al., 2018). These characteristics is one of the candidates as the transformation requirements. We can extract some dimensions of enterprise transformation from the comparison. In the future, we will continue to study from two directions and define the dimensions of enterprise formation, based on a deeper survey of the literature.

5.3 Enterprise Model, Business Model and Organization Model

In (Hay, 2011), enterprise model patterns have summarized. Those patterns are focused on data centric descriptions of enterprise activities by using some

predefined parts. We think this work is not suitable for our research because there are no specific patterns on enterprise transformation. In (Gassmann et al., 2013) and (Fleisch, 2015), business model patterns have summarized. We think those patterns are depends on the requirements for enterprise transformation. In (Agostinhoa, 2014) and (Santa and Nurcan, 2016), we can find the patterns of organization model. We think the organization model is similar with “Types of Enterprise Organizational Formation” in this paper.

These patterns of several models are one of the candidates as the dimensions for enterprise transformation.

5.4 Transition on Enterprise Systems Innovation

In (Kapoor et al., 2015), they described the difference between SoR (Systems of Record), SoE (Systems of Engagement) and SoI (Systems of Insight). Based on the description, we can define the as enterprise systems innovation dimensions like Figure 7.

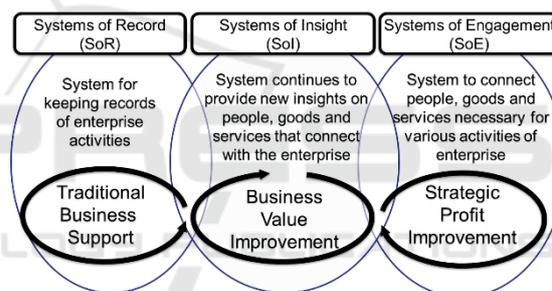


Figure 7: Transition on enterprise systems innovation.

SoR is a traditional business support system like an ERP package for recording the DIK (Data, Information, Knowledge) of the activities on the enterprise. The system architecture is defined by using EA methods.

In next innovated system world, SoE is the key infrastructure in a connected world like IoT. SoE has different system architecture and characteristics between SoR and SoI described in Figure 7. The transition from SoR to SoE will influence to EA, models, capabilities and so on related to enterprise transformation will be changed.

SoI is one of cutting-edge architecture based on analytics function like AI (Artificial Intelligence) and Cognitive Computing. SoI must take a collaboration with SoR and SoE, closely. In the case of transition from SoR and SoE, the direction of the transformation is “Business Value” centric. These types of systems transitions are one of the candidates as the dimensions for enterprise transformation, too.

5.5 It Capability Maturity Model

As the concept of IT capability maturity was introduced by (Ross et al., 1996) (Curley, 2016). We select IT-CMF (Curley, 2016) which more impact on digital transformation for explaining enterprise transformation with capability perspective. The framework has capability maturity model. In the model, vertical axis is divided into five levels of the transformation from initial state to optimizing state and horizontal axis is divided into four key strategic areas for the management of IT. From these circumstances, we will clarify what is necessary to consider our dimensions in the future, based on the relationship between artefacts treated at each capability and another dimensions.

At the scope of BITA, IT-CMF has also several candidates of our dimensions for enterprise transformation. In the column “Managing IT like a business” of the maturity model, the direction of the transformation is from “Cost Centre” to “Value Centre”. In the case “Managing the IT budget”, the direction is from “Predicted” to “Sustainable”. Next case “Managing the IT capability”, the direction is from technology-centric “Technology Supplier” to customer-centric “Corporate Core Competency”. In the final column, the direction is from “TCO” to “Optimized value”.

These directions of maturity model are one of the candidates as the dimensions for enterprise transformation, too.

6 DIMENSIONS FOR ETM

We will define the dimensions related enterprise transformation based on existing several dimensions and models (Figure 8). From some literature review concerned with enterprise transformation, there are so many styles of representation for figuring out the characteristics of To-Be picture of future enterprise. We think the dimensions is key role among enterprise transformation management with multi-directions connected influencers. The influencers will be derived from several theories, frameworks, existing dimensions and models referred in this paper.

In Figure 8, “Enterprise Governance” represents the high-level dimension for decision-making style. The detailed dimensions will be defined in our future study. Same as “Enterprise Governance”, we can define the relationship between each high-level dimension with specific perspective on enterprise transformation.

Enterprise Model: models related enterprise,

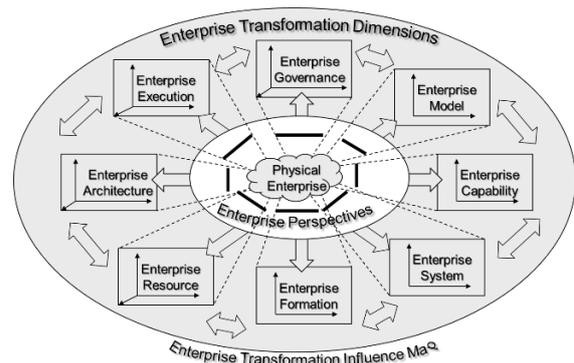


Figure 8: Enterprise perspectives and enterprise transformation dimensions.

like business models.

Enterprise Capability: capabilities related enterprise, like IT capability/business capability.

Enterprise System: systems related enterprise, like SoR/SoE/SoI.

Enterprise Formation: organic styles of enterprise, like hierarchy/networked/ecosystem/...

Enterprise Resource: resources of enterprise, like platform/infrastructure/staff...

Enterprise Architecture: architecture of enterprise, like traditional/.../adaptive.

Enterprise Execution: capability and competency, like IT-CMF/IT Management Competency

Many companies are focusing digital transformation at all industries around the world. On the other hand, many existing issues concerned with current business model and/or enterprise formation are still remain. This paper provides overview of the dimensions. It aims to enable the framework to be used in state-of-the-art enterprise change environments. From the recognition that there is confusion of viewpoints, perspectives and dimensions, we will formulate our enterprise transformation dimensions after clarifying the distinction as shown in Figure 9, based on the perspectives described in this chapter.

7 CONCLUSIONS

As summary message, we describe the relationship Ross’s “foundation of execution” (Ross et al., 2006) and our dimensions in Figure 9. We believe that the dimensions discussed in this paper promote strategic transformation of complex entities, such as digital enterprise transformation.

Many companies are focusing digital transformation at all industries around the world. On

the other hand, many existing issues concerned with current business model and/or enterprise formation are still remain. This paper provides overview of ongoing research results and plan the remaining steps.

It aims to enable the framework to be used in state-of-the-art enterprise change environments.

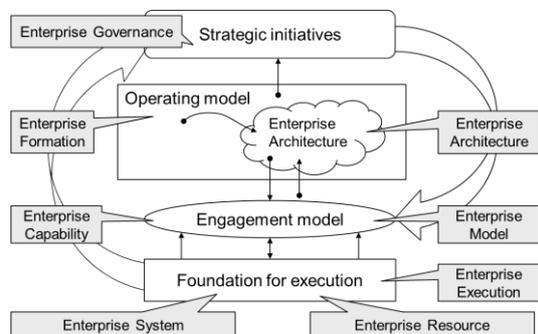


Figure 9: Relationship with Ross's execution model and our high-level enterprise dimensions.

As future work, we intend to (i) reshape new enterprise architecture model consist of enterprise dimensions based management framework as new enterprise architecture world for supporting enterprise transformation based on the combination enterprise engineering and dynamic capabilities; (ii) propose how to describe the requirements for the transformation; (iii) examine the clarifying the relationship on influencing between architecture world and transformation world by using common dimensions and influencers for leading the transformation; and finally, (iv) formalize the prototype management support tool for the transformation.

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