How Enterprise Engineering Methodology support organizational transformation with Capability Maturity Framework

Shoji Konno, Junichi Iijima[Supervisor]

Department of Industrial Engineering and Management
Tokyo Institute of Technology, Tokyo 152-8550, Japan
Konno.s.ad@m.titech.ac.jp, iijima.j.aa@m.titech.ac.jp

Abstract.
In response to changes in the environment surrounding an enterprise, many occasional To-Be models like IT Governance models and IT service management models have been proposed. Recently, digital enterprise model has attracted attention. The concepts, frameworks, and methodologies dealing with the enterprise have also changed in response to the movement. While we are leading enterprises to the transformation to the To-Be model from various perspectives, and it is difficult to promote transformations that maintain interoperability across them, while viewing the enterprise from various perspectives. It seems that we are working on the closed framework of individual frameworks and methodologies that deal with the same enterprise. The goal of this paper is to define commonly available dimensions related to the enterprise and apply a mechanism for analyzing the influence of the change based on those dimensions collaborate with the concept of enterprise engineering on enterprise transformation.

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

1 Introduction

1.1 Motivation

Historically, as changes in the business environment are predicted or occurs, so many post-transformation pictures are provided by consultants, practitioners and researchers. We can find digital enterprise transformation [1,4] as the latest cases. In the Enterprise Transformation [2], there are so many future states of post-transformation would be achieved [3]. 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 [5,6,7,8,9]. Rather than promoting change with ad-hoc way blindly, we think that we should incorporate ideas to support the practice of enterprise transformation [10,11] 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, it may be that the reason why enterprise transformation will fail due to the lack of interoperability with other related perspectives and/or things. 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.

1.2 Our goal

The goal of this work is, therefore, to propose a holistic management framework to support the transformation by using Enterprise Engineering [12] 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 [12,13] 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 DEMO method to clarify the influenced area of enterprise on ET management 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.

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 [14] for supporting the transformation.

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 [15] by using requirements engineering think-frame [16], etc (Figure 1).

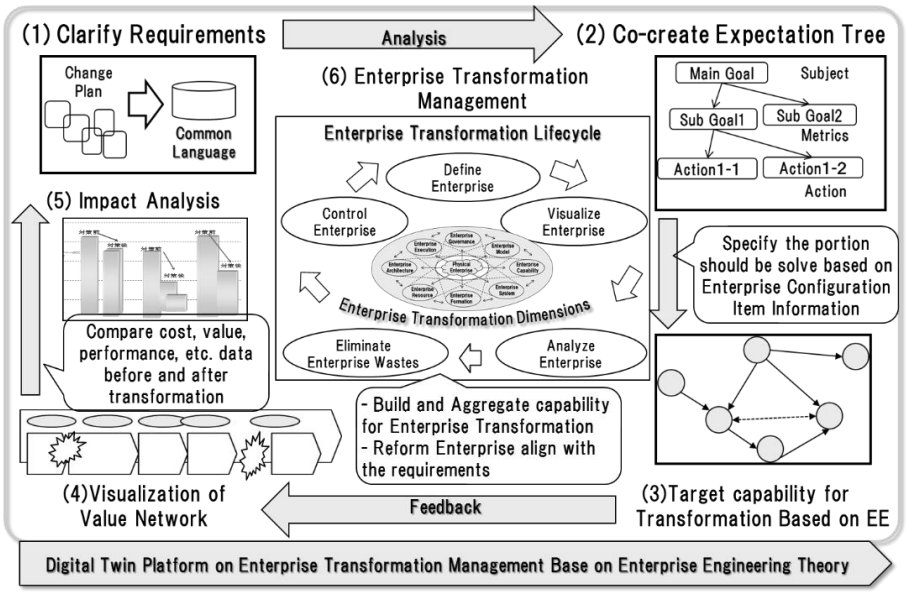

Figure 1: Our Goal.

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 IT/Business 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

Ultimately, we aim to design, develop and provide a platform for Digital Twin on Enterprise Transformation Management realized on the own framework proposed in this work. This will reduce costs and labors 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.

In Section 2 we summarize the underlying scientific foundations are briefly discussed. The related work is mentioned in Section 3. In Section 4 we state the goals to reach and the research question for solving the problems described above. In Section 5 we present the research method used in this work. In Section 6, the ongoing and future work is summarized. In Section 7 we conclude and plan future work.

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 [20]. 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 [20], 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 enterprise, disregarding all function perspectives (black-box).”.

2.2 Enterprise Lifecycle

According to [21], the enterprise life-cycle describes the history of the enterprise from the initial concept of a business in the mind of an entrepreneur, through a series of phases as the enterprise grows, until the business venture ends. The enterprise life-cycle consists of three general, distinct stages: development, deployment, and operation. Enterprise lifecycle is strongly focusing on “Enterprise System”. Development covers the engineering phases to create an enterprise system, deployment is the change management process to implement the enterprise system, and operation is the management of the enterprise system and its continuous improvement. The typical enterprise life-cycle phases as:

1. System identification – The system boundaries, purpose, and project scope are defined.
2. Analysis – The system problems are analyzed; requirements are generated.
3. Design – The system design is generated.
4. Construction – The system is built.
5. Implementation – The system is implemented and deployed into its environment.
6. Operation and Maintenance – The system is operated and maintained.
7. Decommission– The system is retired.

In our work, it is necessary to form an ET management life cycle in relation to the existing life cycle.

2.3 Enterprise Architecture

The Enterprise Architecture (EA) is “a conceptual blueprint that defines the structure and operation of an organization” [22]. The intent of enterprise architecture is “to determine how an organization can most effectively achieve its current and future objectives” [23]. 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 multi-year objectives, activity planning, and staff requirements to support evolving business needs and interests" [23][24]. 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.

2.4 Enterprise Transformation

According to [2], 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 [25]. Examples are significant mergers & acquisitions, replacements of legacy IT systems or business model changes [26].

2.5 Digital Enterprise Transformation

According to [52], digital enterprise is a widely used term, but it means different things to different people. And there are no agreed universal definitions. In this research activity, digital enterprise transformation is defined as 'transforming enterprise by using digital technologies and networks in activities within enterprise and with other partners on own ecosystem'.

2.6 Enterprise Transformation Management

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 [27,28].

2.7 Dynamic Capability

In [29], the definition is "the skills, procedures, organizational structures, and decision rules that firms utilize to create and capture value.". We think that the DC will be the core engine in change management because change is to change the company's routine business processes.

2.8 Enterprise Dimensions

According to [14], "Structure", "Behavior" and "Value" are illustrated as the major dimensions. [14] also pointed out "all of which are interrelated and understanding these

should improve the Enterprise". At [14], 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.

2.9 Foundation for Execution and Operating Model

In [22], 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 [22], 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 [3,4]. In this study, although the relationship between EA and Capability is illustrated, but dimensions on enterprise transformation has not been mentioned.

2.10 Enterprise Model and Business Model

According to [51], a business model consists of two essential elements – the value proposition and the operating model. The value proposition has three dimensions: "Target Segment(s)", "Product and Service Offering" and "Revenue Model". The operating model has three critical areas: "Value Chain", "Cost Model" and "Organization". In this paper, the enterprise model means the output of enterprise modeling like a DEMO methodology connected with business model dimensions and elements described above.

3 Related Works

3.1 EAM

EAM (Enterprise Architecture Management) has the holistic perspective of enterprise architecture management [30]. It is a framework for successful implementation of ETM, and it is effective for capturing activities to be implemented. [30] 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.

3.2 Adaptive Enterprise Architecture

Adaptive Enterprise Architecture 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. 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.

3.3 ACET

ACET (Architectural Coordination of Enterprise Transformation) [31,32] 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.

3.4 COBIT

COBIT (Control Objectives for Information and Technology) [50] has introduced "Design Factors" in the latest version. The "Design Factors" consist of eleven elements, "Enterprise Strategy", "Enterprise Goals", Role of IT", "Enterprise Size", at al. It could drive the design for the governance system of the enterprise. It will clarify from the enterprise goals to process goals. The design factors influence the sort of governance system your organization needs and elevates the required capabilities. The new design factors in COBIT 2019 can also influence the importance of one or more components or require specific variants. I think this is also one of ideal picture of enterprise governance structure and processes.

4 Research Scope

4.1 Research Question

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

(RQ1) " How Enterprise Engineering Methodology support organizational transformation with Capability Maturity Framework?"

(RQ2) "How impact Business and Technology Capability to Enterprise dimensions".

Furthermore, we will clarify next points in this work as the secondary research question. In next items, no description of "related to" means there are some relations with both RQ.

(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. (Related to RQ2).

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

(4) How to apply "DEMO" notation to the organizational transformations

(5) How should I define those dimensions for modelling and assessing those transformation including (Related to RQ2).

(6) How to evaluate the impact of each transformation (Related to RQ2).

(7) The relationship between "Enterprise model" and Capabilities related to Enterprise like a dynamic capability

(8) The relationship between "Enterprise dimensions" and Capabilities related to enterprise like a dynamic capability on transforming enterprise successfully

(9) For example, how to apply this method to "Digital Enterprise Transformation"?

4.2 Hypotheses

We formulate the following hypotheses for addressing the research questions:

Hypothesis 1 (H1): related to RQ1

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

Hypothesis 2 (H2): related to RQ1

There are unified enterprise dimensions and influencers for enterprise transformation.

Hypothesis 3 (H3): related to RQ1 and RQ2

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

5 Research Design

In this research, we choose the methodology which this thesis follows is based on the design science research (DSR) [17], [18].

In this PhD acquisition activities, we conduct "Applied Research (I-1-b)" as Research Outcome according to "Deductive Research (I-2-b)" logic, we choose "Descriptive(I-3-b)" as Research Purpose and "Critical (I-4-c)" as Research Approach. In the approach, we use "Design Science (II-6-c)" with "Qualitative (II-5-b)" data, obtained from "Archival Research (III-7-c)" and "Survey (III-7-d)" of design options and "Hermeneutics (III-8-c)". By using Design Science method, we validate the enterprise transformation management specific artifacts proposed in this research.

Table. 1: Research Design Space Description (based on [19])

Research Design Space			
Phase	**Decision point**	**Options and Selected One (shaded cell)**	
(I) Strategic	(1) Research Outcome	(a) Basic Research	(b) Applied Research
	(2) Research Logic	(a) Inductive Research	(b) Deductive Research
	(3) Research Purpose	(a) Explanatory	(b) Descriptive
		(c) Exploratory	(d) Evaluation
	(4) Research Approach	(a) Positivist	(b) Interpretivist
		(c) Critical	
(II) Tactical	(5) Research Process	(a) Qualitative	(b) Quantitative
		(c) Mixed Approach	
	(6) Research Method	(a) Case Study	(b) Action Research

		(c) Design Science	
(III) Operational	(7) Data Collection Method	(a) Interviews	(b) Observation
		(c) Archival Research	(d) Survey
		(e) Simulation	(f) Experiment
	(8) Data Analysis Method	(a) Grounded Theory	(b) Thematic Analysis
		(c) Hermeneutics	(d) Statistical Analysis

Based on the Research Decision Space Description (Table 1), 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 artifacts focusing on enterprise transformation based on enterprise engineering. The main artifacts are enterprise dimensions for supporting various types of enterprise transformation, for example, digital enterprise 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 artifacts 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 making presentations and 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.

6 Ongoing and Future Work

In this research, we will apply enterprise engineering think-frame to enterprise transformation management (Figure 2).

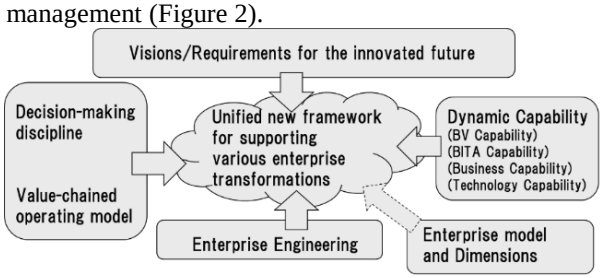

Figure:2 Our Research Approach.

6.1 Historical review of Enterprise Architecture

Based on the preliminary historical literature review [33], we can describe the history of the transformation in the real business world (Figure 3). 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 [33,34,35,36,37,38,39,40]. In these changes, we think that the universal part, the part that is not so can reveal our dimension.

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

Figure 3: History of the shape for representing Enterprise.

6.2 Types of Enterprise Organizational Formation

According to [41], traditionally enterprise architecture has focused on process standardization and integration, not on continuous adaptation to the changing business, information, social and technological landscape. Furthermore, [42] 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 4.

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.

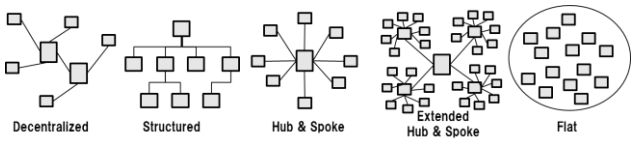

Figure 4: Enterprise Organizational Formation.

6.3 Characteristics of each Enterprise Business Evolution

We define the characteristics of each Enterprise formation (Figure 5) by referring [43,44,45]. These characteristics is one of the candidates as the transformation requirements. We can extract some dimensions of enterprise transformation from the comparison. When comparing Figures 4 and 5, differences can be seen in the comparison items and the transition axis. 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.

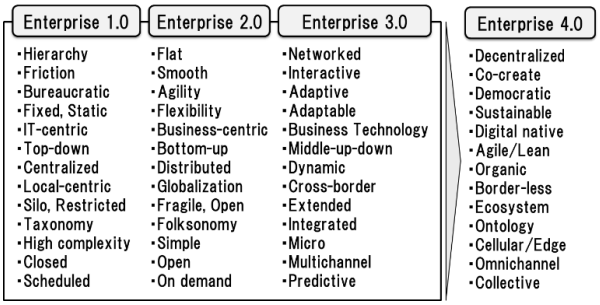

Figure 5: Characteristics of each Enterprise Business Evolution.

6.4 IT Capability and the Maturity Model

As the concept of IT capability was introduced by Ross, Beath and Goodhue [46]. We select IT-CMF [47,48] which more impact for digital transformation for explaining this method. IT Capability has also changed to technology-centric, service-centric, business-centric, and customer-centric in response to changes in the global enterprise environment (Figure 6). From these circumstances, we will clarify what is necessary to consider our dimension in the future.

Figure 6: IT Capability Maturity Model of IT-CMF.

6.5 Dimensions related to enterprise transformation

We will define the dimensions related enterprise transformation based on existing several dimensions and models mentioned above. 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. Figure 7 is the overview of the dimensions model currently under development. After a fundamental literature review around this work area, we will reshape the model, in the future.

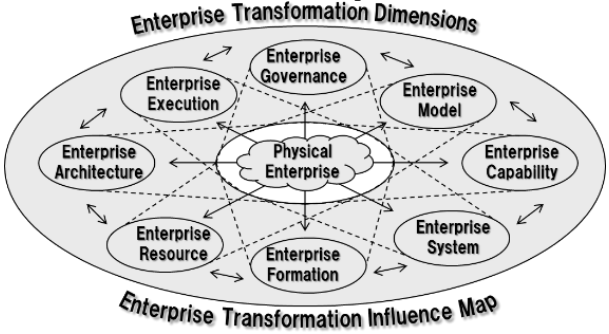

Figure 7: Future image on our enterprise transformation management world.

In Figure 7, "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" represents models related enterprise, like business models. "Enterprise Capability" represents capabilities related enterprise, like dynamic capability. "Enterprise System" represents enterprise systems, like Systems of Record [52]. "Enterprise Formation" represents organic styles of enterprise, like hierarchy/networked/ecosystem/…. "Enterprise Resource" represents resources of enterprise, like platform/infrastructure/staff… "Enterprise Architecture" is architecture of enterprise, like traditional/…/adaptive.

7 Conclusion and Future Research

Nowadays, many enterprises like companies, governments and also society 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. Efforts and new ways of thinking in specific areas have been shown, but it is difficult to proceed with change while achieving mutually beneficial effects siloed. This paper provides overview of ongoing research in authors PhD program and plan the remaining steps. It aims to enable the framework to be used in state-of-the-art enterprise change environments.

As future work, we intend to (i) reshape new enterprise transformation management model consist of technology, business and BITA perspectives as new enterprise transformation management world 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 platform for the transformation with low cost and high speed.

References

1. Xu, J. (2014). Foundation of Digital Enterprise. In Managing Digital Enterprise (pp. 1-25). Atlantis Press, Paris.
2. Purchase, V., Parry, G., Valerdi, R., Nightingale, D., and Mills, J. (2011). Enterprise Transformation: Why are we interested, What is it, and What are the challenges? In Journal of Enterprise Transformation, 1(1), pages 14-33.
3. Goerzig, D., & Bauernhansl, T. (2018). Enterprise architectures for the digital transformation in small and medium-sized enterprises. Procedia CIRP, 67, 540-545.
4. Weill, P., and Woerner, S. L. (2015). Thriving in an increasingly digital ecosystem. In *MIT Sloan Management Review*, 56(4), pages 27-34.
5. B. Flyvbjerg and A. Budzier, "Why Your IT Project May Be Riskier Than You Think," Harvard Business Review, vol. 89, pp. 23-25, 2012.
6. J. P. Kotter, "Leading Change: Why Transformation Efforts Fail," Harvard Business Review, vol. 73, pp. 59-67, 1995.
7. Westerman, George. "Your Company Doesn't Need a Digital Strategy." MIT Sloan Management Review 59.3 (2018): 1-5.
8. Thomas H. Davenport and George Westerman, "Why So Many High-Profile Digital Transformations Fail", Harvard Business Review, 2018, https://hbr.org/2018/03/why-so-many-high-profile-digital-transformations-fail
9. Bughim, J., Catlin, T., Hirt, M. and Willmott, P. (2018). Why digital strategies fail. In: McKinsey Quarterly, www.mckinsey.com/business-functions/digital-mckinsey/our-insights/why-digital-strategies-fail
10. Labusch, N, Aier, S. and Winter, R.: (2013). Beyond Enterprise Architecture Modeling – What are the Essentials to Support Enterprise Transformations? Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft fur Informatik (GI).
11. Labusch, N., Aier, S. and Winter, R.: (2014). A Reference Model for the Information-Based Support of Enterprise Transformations. Pages 194-208. 10.1007/978-3-319-06701-8_13.
12. Dietz, J., Hoogervorst, J. (2017). Foundations of Enterprise Engineering. www.researchgate.net/publication/320353420_Foundations_of_Enterprise_Engineering accessed in January 2018
13. Dietz, J.L.G. (2011). Enterprise Engineering Manifesto. www.ciaonetwork.org/publications/EEManifesto.pdf accessed in January 2017.
14. Bernus, P., Nemes, L., & Schmidt, G. (Eds.). (2012). Handbook on enterprise architecture. Springer Science & Business Media.
15. Labusch, N. (2017). Information Requirements for Enterprise Transformation. In Architectural Coordination of Enterprise Transformation (pp. 111-121). Springer, Cham.

16. Ivarsson, M. and Gorschek, T. (2009). Technology transfer decision support in requirements engineering research: a systematic review of REj. In *Requirements engineering*, 14(3), pages 155-175.
17. Wohlin, C., & Aurum, A. (2015). Towards a decision-making structure for selecting a research design in empirical software engineering. Empirical Software Engineering, 20(6), 1427-1455.
18. Hevner, A., March, S. Park J., Ram. S.: Design Science in Information Systems Research. MIS Quarterly, 28.1, 75-105 (2004)
19. Peffers, K., Tuunanen, T., Rothenberger, M.A. Chatterjee. S.: A Design Science Research Methodology for Information Systems Research. Journal of Management Information Systems, 24.3, 45–78 (2008)
20. Dietz, J. L. G. (2006). Enterprise Ontology: Theory and Methodology. Springer.
21. Giachetti, R. E. (2016). Design of enterprise systems: Theory, architecture, and methods. CRC Press.
22. Ross, J. W., Weill, P., and Robertson, D. (2006). *Enterprise architecture as strategy: Creating a foundation for business execution*. Harvard Business Press.
23. Tamm, T., Seddon, P. B., Shanks, G., & Reynolds, P. (2011). How does enterprise architecture add value to organisations?. Communications of the association for information systems, 28(1), 10.
24. M. Lange, J. Mendling, J. Recker, "An empirical analysis of the factors and measures of Enterprise Architecture Management success", European Journal of IS (EJIS), 2015.
25. Rouse, W.B. (2005). A theory of enterprise transformation. Systems Engineering, volume. 8, no. 4, pages 279-295.
26. Gollenia, L. A., Uhl, A., & Giovanoli, C. (2012). Next Generation IT Strategy Approaching the Digital Enterprise.
27. Enterprise Transformation Management) Labusch, N. and Winter, R. (2013). Towards a conceptualization of architectural support for enterprise transformation. Association for Information Systems.
28. Labusch, N., Koebele, F., Aier, S., & Winter, R. (2013). The architects' perspective on enterprise transformation: An explorative study. In Working Conference on Practice-Driven Research on Enterprise Transformation (pp. 106-124). Springer, Berlin, Heidelberg.
29. Hall, B. H., & Rosenberg, N. (Eds.). (2010). *Handbook of the Economics of Innovation* (Vol. 1). Elsevier.
30. Labusch, Nils, and Robert Winter. (2013). Towards a conceptualization of architectural support for enterprise transformation. In Proceedings of 21st European Conference on Information Systems(ECIS) 2013, Completed Research, 116, Association for Information Systems.
31. Proper, H.A., Winter, R., Aier, S. and de Kinderen, S. Architectural Coordination of Enterprise Transformation. Springer, Heidelberg.
32. de Kinderen, S. (2017). ACET Constructs. In: Architectural Coordination of Enterprise Transformation. Springer, Cham, pages 169-173.
33. Kotusev, S. (2016b). "The History of Enterprise Architecture: An Evidence-Based Review", Journal of Enterprise Architecture, 12(1), pp.29-37.
34. W.B. Rigdon: Architectures and Standards, in Information Management Directions: The Integration Challenge (NIST Special Publication 500-167), E.N. Fong, A.H. Goldfine (Eds.), Gaithersburg, MD: National Institute of Standards and Technology (NIST), pp.135-150 (1989).

35. Halley, M. R., & Bashioum, C. (2005, July). Enterprise transformation to a service-oriented architecture: successful patterns. In IEEE International Conference on Web Services (ICWS'05). IEEE
36. Ferronato, P. (2007, February), "Architecture for Digital Ecosystems, beyond Service Oriented Architecture (IEEE-DEST 2007)", in Digital EcoSystems and Technologies Conference, 2007. DEST'07. Inaugural IEEE-IES (pp. 660-665), IEEE.
37. De Vries, M., & Van Rensburg, A. C. (2008). Enterprise Architecture-New business value perspectives. South African Journal of Industrial Engineering, 19(1), 1-16.
38. Fritscher, B., & Pigneur, Y. (2011, June). Business IT alignment from business model to enterprise architecture. In International Conference on Advanced Information Systems Engineering (pp. 4-15). Springer, Berlin, Heidelberg.
39. Lazarov, B., Kirov, G., Zlateva, P., & Velev, D. (2015). Network-Centric Operations for Crisis Management Due to Natural Disasters. International Journal of Innovation, Management and Technology, 6(4), 252.
40. Korhonen, J. J., Lapalme, J., McDavid, D., & Gill, A. Q. (2016, August). Adaptive enterprise architecture for the future: Towards a reconceptualization of EA. In 2016 IEEE 18th Conference on Business Informatics (CBI) (Vol. 1, pp. 272-281). IEEE.
41. Korhonen, J.J. and Halén, M. (2017). Enterprise Architecture for Digital Transformation. In *Business Informatics (CBI), 2017 IEEE 19th Conference on*, pages 349-358. IEEE Computer Society.
42. Haffke, I., Kalgovas, B., and Benlian, A. 2016. "The Role of the CIO and the CDO in an Organization's Digital Transformation," ICIS 2016 Proceedings (available at http://aisel.aisnet.org/icis2016/ISStrategy/Presentations/3).
43. Chui, M., Manyika, J., Bughin, J., Dobbs, R., Roxburgh, C., Sarrazin, H. et al. (2012). The Social Economy: Unlocking Value and Productivity Through Social Technologies., McKinsey Global Institute (MGI), http://www.mckinsey.com/insights/high_tech_telecoms_internet/the_social_economy
44. Srivastava, A. (2015). Excuse Me, Can You Tell Me the Way to Become an Enterprise 3.0? https://us.nttdata.com/en/blog/2015/september/way-to-become-an-enterprise-3-dot-0
45. Moreira, F., Ferreira, M. J., & Seruca, I. (2018). Enterprise 4.0–the emerging digital transformed enterprise? Procedia computer science, 138, 525-532.
46. Ross, J., Beath, C. and Goodhue, D. (1996). Develop longterm competitiveness through information technology assets. In Sloan Management Review, 38(1), pages 31-42.
47. Curley, M. (2004). Managing Information Technology for Business Value, Intel Press.
48. Curley, M. (2008). The IT Capability Maturity Framework: A Theory for Continuously Improving the Value Delivered from IT Capability (Doctoral dissertation, National University of Ireland Maynooth).
49. Mouaad, H., and Assar, S. (2016). What Enterprise Architecture Can Bring for Digital Transformation? An Exploratory Study. In Business Informatics (CBI), 2016 IEEE 18th Conference on, pages 83-89. IEEE Computer Society.
50. ISACA. (2018). COBIT 2019 Design Guide.
51. Lindgardt, Z., Reeves, M., Stalk, G., & Deimler, M. S. (2009). Business model innovation. When the Game Gets Tough, Change the Game, The Boston Consulting Group, Boston, MA.
52. Kapoor, S., Mojsilovic, A., Strattner, J. N., Varshney, K. R. (2015, September). From open data ecosystems to systems of innovation: A journey to realize the promise of open data. In Bloomberg Data for Good Exchange Conference.