Enterprise Transformation within Enterprise Engineering: Literature Review and Research Directions

Shoji Konno[1] and Junichi Iijima[2]
[1]Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro-ku, Tokyo 152-8550, Japan
[2]Tokyo University of Science, 1-11-2 Fujimi, Chiyoda-city, Tokyo 102-0071, Japan

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Abstract: In response to the rapid changes in the world, such as digital transformation, there is a growing demand for efficient and effective enterprise transformation. Research artifacts related to the transformation have been increasingly emerging as new standardized several description artifacts suitable to provide practices for particular enterprise transformations. Enterprise has many aspects, such as their architecture, processes, and organizational form, but their efforts in transformation are focused on silos such as enterprise system modelling, and dynamic capabilities. In this study, we assess the availability of topics that support the transformation and the fitness of enterprise engineering for fulfilling the modelling and managing requirements. The review was carried out, finding 349 relevant papers and a list of the few aspects and topics for classifying the focus points of enterprise transformation. Based on the analysis and results of the review, brief suggestions to stimulate further research on the design, improvement, and application of the enterprise transformation management framework are also derived.

1 INTRODUCTION

In the past, many ideal forms of enterprise transformation have been drawn by consultants, practitioners, and researchers. The latest example is digital enterprise transformations (Purchase et al., 2011) (Weill and Woerner, 2015). Various ideal frameworks and big pictures, or both, are drawn, but the transformation has failed (Kotter, 1995) (Davenport and Westerman, 2018) (Bughin et al., 2018).

Enterprise has many aspects, such as their architecture, processes, and organizational form, but their efforts in transformation are focused on silos such as enterprise system modelling, and dynamic capabilities. Companies try to improve and transform in silos according to individual frameworks and concepts (Konno and Iijima, 2019). Research artifacts related to the transformation have been increasingly emerging as new standardized several description artifacts suitable to provide practices for particular enterprise transformations. In this study, we assess the availability of topics that support the transformation by fitting enterprise engineering to fulfil the modelling and managing requirements. Today, as we support corporate transformation, we interview with pre-made questions based on some ideal form of digital transformation, assess the current status, and set future goals and ambition goals. However, it may be that enterprise transformation will fail due to the lack of interoperability with other related perspectives and things, or both. In order to improve this situation, it is necessary to determine what research results are related to enterprise transformation, what is lacking, and where research should be concentrated (Konno and Iijima, 2019).

In order to provide an outline for this literature review, Section 2. gives background and related work around the capability of supporting enterprise transformation. Section 3 describes the overall process of the literature review, including a further specification of the research goals by defining research questions. Additionally, the process and results of the paper selection are described. Section 4 deeply analyses the literature. A summary and outlook are provided in Section 5.

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2 BACKGROUNDS

In a nutshell, an enterprise is reforming towards digital transformation. We can find five central states of the transformation through paper research.

1. Management scope is shifted from IT to digital (business technology): Compared to the peak of the literature on IT management (the year 2012), it has decreased by 57%. In contrast, literature on digital technology increased 2.4 times from the year 2012.
2. Management perspective is shifted from IT organization to the customer: Compared to the peak of literature on IT organizations (the year 2015), it is now down 20%. In contrast, the literature on customers has increased 1.7 times.
3. Focus point is shifted from solo function to extended enterprise: Compared to when the literature related to digital began to rise (the year 2015), the number of solo function literature remained flat. In contrast, literature on extended enterprise increased 3.3 times.
4. Strategy scope is shifted from IT strategy to digital strategy: Compared to when digital literature began to rise (the year 2015), the number of works of literature on IT strategy decreased by 26%. In contrast, literature on digital strategy has doubled.
5. A great many blueprints for change have been proposed. For example, the digital transformation literature has grown rapidly since 2015. (Fig. 2).

In these cases, the enterprise has faced significant issues described below.

1. Nobody knows the right direction for the To-Be blueprint.
2. No proper steps for transformations,
3. You need to master a wide variety of tools and methods designed to support the transformation,
4. There are different perspectives and dimensions for describing the transformation,
5. There is no unified way to design and manage each blueprint and the transformation.

As the state of an enterprise transformation project, we can summarize the target for transformation management is complicated and mysterious. Many enterprises are applying existing frameworks to siloed and specific enterprise elements (such as architecture, process, model, capability, HR) or both. It is difficult to control and lead enterprise transformation by fully orchestrating each activity. Around enterprise transformation projects, we cannot be done without considering various things that require a lot of time and effort. We think there is no inter-solution, inter-framework, inter-operability, or both for managing enterprise transformation.

Before this study, we examined and classified the perspectives, dimensions, and capabilities described in the enterprise transformation. Only one paper currently describes a literature survey on enterprise transformation, targeting the soviet enterprises in 1999 (Liuhto, 1999). In this study, we will investigate the literature related to enterprise transformation further and identify several research areas, ideas, and framework approaches.

2.1 Enterprise Engineering

According to the Enterprise Engineering Manifesto (Dietz and Hoogervorst, 2011), Enterprise Engineering is an emerging discipline that deals with developing theories, models, methods, and other artifacts for the analysis, design, implementation, and governance of enterprises in a theoretically rigorous and practically relevant manner. In this case, “Engineering” means the “activity of constructing the implementation model of a system from its ontological model” (Dietz and Hoogervorst, 2017).

In (Yildiran et al., 2018), they have described an example of enterprise engineering framework application and related issues such as a business process, workforce management, diversity, international collaboration, collaboration system, the business model in India, etc.

In (Ross et al., 2006), EA is defined as the “fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution.”

EAM (Enterprise Architecture Management) has a holistic perspective of enterprise architecture management (Labusch and Winter, 2013). It is a framework for the successful implementation of ETM, and it is effective for capturing activities to be implemented. ACET (Architectural Coordination of Enterprise Transformation) (Proper et al., 2017) (Kinderen, 2017) is one of the practices to coordinate enterprise transformation. Based on a program and project management perspective, ETM has content on how change is promoted within the enterprise.

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. It is considered to be the latest among the existing EA forms. At the beginning of the history of the enterprise model, the model formed like a pyramid

with several layers, for example, infrastructure, technology, data, information, and business process.

Korhonen has proposed "enterprise transformation capability" (Korhonen, 2018). The proposal is to associate the CIO's capability with the enterprise's capability in transformation. The CIO's capability mainly focuses on the skill dimension. There is no mention of the capability maturity framework model that we propose. This model has lined up the organizational and individuals' capabilities patterns during enterprise transformation.

3 SYSTEMATIC LITERATURE REVIEW

3.1 Objectives of this Review

Although many academics and professionals use the term "enterprise transformation" in their publications, it remains vague what is meant. At present, it seems that there is no comprehensive view of the term "enterprise transformation." As a result of conducting a preliminary literature survey, at present, no document summarized a literature review on enterprise transformation comprehensively. This research aims to identify the current state of the art in enterprise transformation research.

Systematic literature reviews aim to provide a trustworthy and verifiable evaluation of an existing research topic using a rigorous methodology. This systematic literature review is based on the guidelines provided by Kitchenham (Kitchenham, 2004). Following the guidelines, we organized the review in three stages: (1) protocol development, (2) conducting the review, and (3) analysis and reporting. In this section, we first present the search strategy. Second, the inclusion and exclusion criteria for the different stages are presented. Third and last, we detail the data extraction and analysis process. In this section, we first explain this study's literature selection and screening steps.

This review targeted peer-reviewed articles on something studies on enterprise transformation published between January 1, 1999, and December 31, 2019. Only articles in English were included.

Given the above scopes and constraints, three hundred and six papers were collected through keyword-based searching in the last 20 years ranging from 1999 to 2019 (but excludes 2019 since our document collection was in mid-2019). After performing a personal screening with the above criteria, 116 papers were removed, and 58 papers were finally acquired.

3.2 Research Questions

To reach this goal, we pose the following research questions:

RQ1: How many papers on enterprise transformation are written per year?
RQ2: What research areas are covered in the papers related to enterprise transformation per year?
RQ3: What kind of capabilities are associated with enterprise transformation?
RQ4: What study has been done on modelling and frameworks that support enterprise transformations?
RQ5: What are the main models, techniques, and ideas to address modelling for enterprise transformation?

The selection criteria for "capability," "dimension," and areas to address modelling in the RQ are as follows.

1. In (Hall & Rosenberg, 2010), the definition is "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 change management because change changes the company's routine business processes. Therefore, the term "capability" was used as a search word to explore dynamic capabilities related to enterprise transformation.
2. According to (Bernus et al., 2012), "Structure," "Behavior," and "Value" are illustrated as the major dimensions. They also pointed out "all of which are interrelated and understanding these should improve the Enterprise." The focus was on subdividing the enterprise model to improve the company's performance. It has not been defined in anticipation of relationships or impacts in line with transformation or other elements. Therefore, "dimension" was used as a search word for dimensions related to enterprise transformation.
3. When transforming a company, there is a high possibility that various stakeholders will be involved. That is, things will be seen from various perspectives. We thought that the difference in perception at that time would affect the success or failure of the transformation. We also believe that enterprise engineering is effective as a way of thinking to solve these problems. Therefore, we decided to search for modelling on enterprise transformation.

3.3 Data Sources

The research involved seven online databases as data sources: ACM Digital Library, Elsevier, IEEEXplore Digital Library, SpringerLink, Taylor & Francis, Wiley, and Google Scholar.

The analysis process is oriented along the guidelines for a systematic literature analysis (Kitchenham, 2004). The review process is divided into four different parts. The first activity is to identify conference series, journals, and catalogs likely to represent state-of-the-art research on the topic of interest. Here, a base set of papers for review is extracted by keyword search. The second step is the exclusion/inclusion of papers based on title and abstract. Then, the remaining papers have to be classified, and data about the research questions must be extracted. The fourth and last step is to analyze the extracted data.

In order to ensure that the literature gathered addresses combining "Enterprise transformation" with several words, useful data sources, keywords, and criteria should be determined first.

3.4 Data Extraction and Analysis

In the first stage, we entered the search key into Google Scholar in January 2020, which resulted in 816 articles: 206 (25.25%) published in journals, 247 (30.27%) in conference proceedings, and 399 (44.48%) in books and others. Others include books, journal articles, tools, presentation files, reports, working papers, transactions, and university dissertations. For the journals, we included only those hits in Academic Accelerator searches. Here, we conducted a similar search to see if there were any omissions in data sources other than Google scholar. For these 102 articles in the journal and 247 articles, we collected the full documents. The total number of targets for our review is 349 articles (TABLE 1).

Every article that matched the search criteria was recorded, and we then reviewed and re-reviewed each article and was imported into and managed in Mendeley. Among others, it is found by keyword search that if it is found that it should be targeted as a reference, it will be subject to a final review. In particular, we expect it to be found a lot in books.

Next, a keyword search of titles and abstracts was used to find relevant articles in the above sources. Keyword combinations took examples from three distinct categories: keywords on alignment contents, including "enterprise transformation," "modelling," keywords on alignment expressions, including "governance," "management," "operation," "strategy," and "plan;" keywords on architecture, including "enterprise architecture," "business architecture," and "organization architecture." The three kinds of keywords ensure the integrity for collecting modelling related to enterprise transformation. The keywords for searching should combine at least one term in each kind. We used the following search terms, each combined using an AND operator:

"enterprise transformation" OR ("enterprise" OR "transformation")

"Perspectives" OR "dimensions" OR "capability" OR "maturity model" OR "stage model"

Keywords extracted from each title of 349 papers like a "theory", "lean", "agility", etc.

Finally, in order to remove studies that only mention enterprise transformation and modelling in passing, several criteria were considered for further screening: the inclusion of the definition of enterprise transformation; the inclusion of the definition of modelling; a discussion of the relationship between modelling and enterprise transformation; and conclusions that follow from combining modelling with enterprise transformation.

Every article that matched the search criteria was recorded (this resulted in 1858 candidate articles), and the first author then reviewed and re-reviewed each article. As suggested by (Kitchenham, 2004), we used the following inclusion and exclusion criteria:

Inclusion:

(1) English peer-reviewed studies applicable to Academic Accelerator;
(2) Proceedings of conference and workshop;
(3) Studies related to enterprise transformation.

Exclusion:

(1) Studies not in English;
(2) Duplicated studies;
(3) Short articles and case studies.
(4) Studies not related to enterprise transformation

Table 1: Studies Retrieved Through Search Engines.

Source	Found	Journal	Proc.	Others
ACM DL	12	1	9	2
Elsevier	12	2	8	0
IEEE	90	5	80	3
Springer	66	7	38	21
T & F	40	39	0	0
Google Scholar	585	45	107	371
Wiley	11	3	5	2
Total	816	102	247	399

4 RESULTS

In this section, we present the results of our analysis. First, we indicate the transition of the number of articles on enterprise transformation submissions per year. Second, we present the result of having extracted the line-up of the research area relevant to enterprise transformation. Third, we provide the result of extracting the line-up of the capability relevant to enterprise transformation. Fourth, we present the result of extracting the line-up of papers related to the modelling of enterprise transformation. Fifth, we provide the result of having extracted the line-up of the paper relevant to the modelling target related to enterprise transformation. Towards the end, we show the identified future ideas of enterprise transformation modelling.

After analyzing each paper's title, authors, year of publication, research questions, research domains, research motivations, research challenges, research models, and techniques, comparatively analyzing each paper and classifying the similar terms, we acquired the results of the above five questions.

4.1 Numbers of Papers That Include the Term "Enterprise Transformation" per Year (RQ1)

In this subsection, we present the answer to the RQ1. Figure 1 shows the number of papers in the last 20 years, from 1999 to 2019. Several findings were discovered in Figure 1.

Several years from 2004, when represented by the "IT doesn't matter," began to threaten the significance of the IT department, and companies were forced to transform IT management (Carr, 2003). On the business side, there have been many flows of outsourcing IT operations that do not fall under the core operations. At that time, it can be understood that the first peak in the number of articles concerning enterprise transformation had occurred.

The next peak starts from around 2010, and many contents of change for cloud shift are written (Gill et al., 2014). The third peak is the content of DX involving end users by the spread of utilization of digital technology like smartphones and smart devices with the Internet of Everything (IoE).

This graph shows that discussions on enterprise transformation at conferences and the like have been activated, but journals have not been activated as expected. This difference is one of the points that need scrutiny. Regarding enterprise transformation, the suspension of the journal seems to have had an effect, but we would like to work on revival in the future.

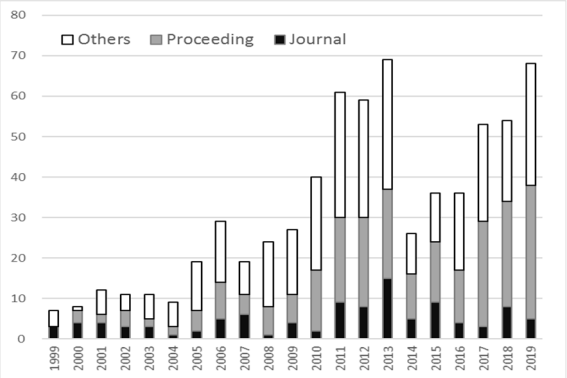

Figure 1: Numbers of papers that include the term "enterprise transformation" (RQ1).

4.2 Research Target Areas Related to "Enterprise Transformation" (RQ2)

This section aims to answer RQ2. Each publication's research question(s) may be similar or different. Distinguishing all the research questions of the samples helps understand the research trends in the research area modelling for enterprise transformation. Figure 2 shows the numbers of the nine categories.

In Figure 2, the numbers of the last three categories far exceed that of the first six categories. The last three areas attracted attention, but the first three areas did not. This difference can be said that the content related to EA and management is more than the content about enterprise transformation modelling, how to catch it, and its maturity. Therefore, the modelling and understanding of enterprise transformation itself, as well as the study of their maturity, is valuable.

What is striking is the rapid growth of the literature on digital transformation. Although not many in journals, proceedings have increased considerably. Digital transformation is one of the enterprise transformations and the hottest topic, so it is a natural result. We believe that the enterprise transformation management-related frameworks (such as methodologies, practices, and theories) should be further developed to withstand that focus.

The limited number of analysed papers might bias the results of this study. However, using the method of a systematic literature review, it is assumed that a representative cross-section of scientific literature has been considered. Thus, there is a good possibility of generalization.

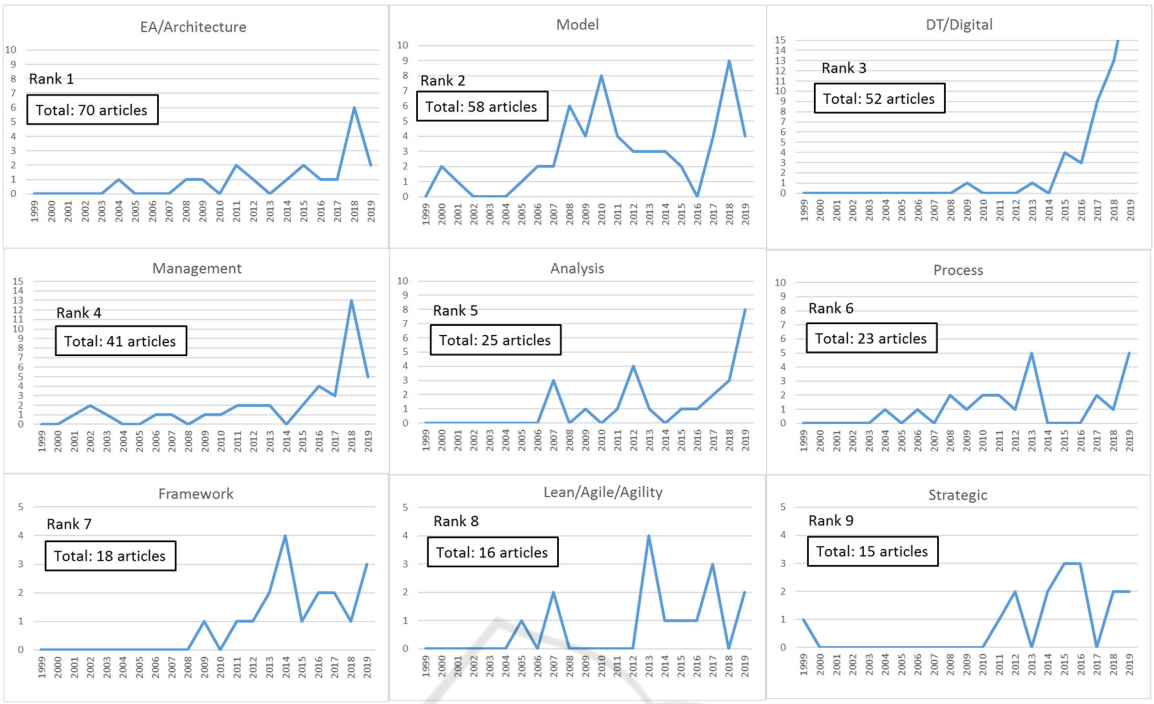

Figure 2: Statistical number of nine main research target areas (RQ2).

On the other hand, the following keywords could be picked up to indicate the inactive area. We would like to see them as candidates for themes to be focused on future enterprise transformation research. Inactive Areas: Metrics, Informatics (Braunstein and Detmer, 2016), Analytics, Dimension, Requirements, Governance, Measurement, Enabling, Capability, Theory, Engineering, Building Blocks.

4.3 Capability Specification Concerns "Enterprise Transformation" (RQ3)

This section aims to answer RQ3. Several findings were discovered in Table 2. At this point, we have picked up 11 enterprise transformation-related capabilities.

Hesselberg describes five dimensions of agility (Hesselberg, 2018). Among the five dimensions (Technology, Organizational Design, People, Leadership, and Culture), it will be a reference for the focus on clarification and research on Leadership and Culture found in this review. The results of this research will be beneficial as materials for the Dimension design for the enterprise transformation we are promoting. In addition, when applying the agile/lean concept and style to enterprise transformation, it is judged to be a valuable reference by referring.

Karvonen, Sharp, and Barroca refer to the capability of agile enterprise transformation (Karvonen et al., 2018). In particular, the concept of agility is seen as a solution to address problems faced by an uncertain, quickly changing competitive environment.

We think that paper dealing with Lean can be divided into two categories. In our efforts, we decided to use the latter as a reference and picked up this document. The contents deal with the transformation to lean enterprise and apply the lean's concept to enterprise transformation.

The tool includes three sections (Nightingale and Srinivasan, 2011): lean transformation leadership, life cycle processes, and enabling infrastructure. Fifty-four lean practices are included in the tool. These practices were chosen as indicators of the behaviours that lean organizations should engage in rather than comprehensive. It is judged that it is effective as a tool for evaluating whether Enterprise has changed to one with Lean characteristics.

Nightingale and Srinivasan make additional new principles to the field by moving further away from the manufacturing sector and redefining lean principles in the context of enterprise transformation

Table 2: Paper Identifications and Selections Related to Enterprise Transformation Capability (RQ3).

Term of capability	Authors and Ref.
Collaborate/Integrate	(Petrie, 1992).
Model	(Huhns et al., 1992).
Lean Enterprise Assessment	(Nightingale and Mize, 2002).
Model	(McGinnis, 2007).
Lean Enterprise Transformation	(Nightingale and Srinivasan, 2011).
Continuous improvement	(Fathallah et al., 2012).
Collaborate/Integrate	(Zhang et al., 2012).
Assess	(Cil and Turkan, 2013).
Continuous improvement	(Wiseman et al., 2014),
Govern/Lead	(Korhonen and Molnar, 2014).
Transform	(Henkel, Bider, and Perjons, 2014).
Analyze	(Zimmermann et al., 2016).
Agile Enterprise Transformation	(Hesselberg, 2018).
Enterprise Agility	(Karvonen, Sharp, and Barroca, 2018).
Plan	(Kar and Thakurta, 2018).
Model	(van Gils et al., 2018).
Assess	(Zotova and Mantulenko, 2019).
Manage	(Assar and Hafsi, 2019, July) and (Reichstein et al. 2019).
Measure	(Mao, 2019).
Enable	(Maasoumy, 2019).

in general (Nightingale and Srinivasan, 2011). They suggest the set of seven principles: adopt a holistic approach to enterprise transformation; secure leadership commitment to drive and institutionalize enterprise behaviours; identify relevant stakeholders and determine their value propositions; focus on enterprise effectiveness before efficiency; address internal and external enterprise interdependencies; ensure stability and flow within and across the enterprise; and emphasize organizational learning. Such a holistic systems approach to transformation highlights enterprise inter-connections, identifies enterprise waste, and creates strategies to translate waste into opportunities for value creation.

4.4 What Study Is There on Modelling (RQ4)?

This section aims to answer RQ4. Several findings were discovered in Table 3. At this time, we have picked up 16 items as enterprise transformation-related dimensions for utilizing the model. The selection criteria here is whether or not the paper includes content that can be used as dimensions in the framework.

In (DeLone et al., 2018) described it as the stage of the governance model, but do not mention dimensions in the context of transformation among Business-IT alignment (BITA) focus points. In our future study, we will define the details of those dimensions' specifications.

In (Hay, 2011), enterprise model patterns have been summarized. Those patterns are focused on data-centric descriptions of enterprise activities by using some predefined parts. We think this work is unsuitable for our research because there are no specific patterns in enterprise transformation.

In (Gassmann et al., 2014), business model patterns have been summarized. The model pattern appears to depend on the requirements of enterprise transformation.

Since the model survey takes time, we plan to clarify the relationship and affinity with enterprise transformation in another paper in the future.

4.5 What Study Is There on Models, Techniques, and Ideas (RQ5)?

This section aims to answer the RQ5. Several findings were discovered from Table 4. We have picked up 13 items as enterprise transformation-related models, techniques, and ideas for supporting the modelling. Studies dealing comprehensively with this theme could pick up the study (Dionísio et al., 2014). It was seen that new theories and ideas were applied in each study in order to promote enterprise transformation effectively. We will respect these achievements and use them as a reference when considering organizational capabilities and dimensions within our framework. In RQ4, we looked at what has been considered from the perspective of capturing corporate transformation. Here, we look at what kind of thinking, ideas, and modelling is effective for solving problems in corporate change management.

Because enterprise transformation is complex, long-term, or costly, there have been relatively many efforts on Lean and Agile (Nightingale and Mize, 2002) (Bondar et al., 2017) (Hesselberg, 2018). Efforts on this topic are still small. In the future, we will scrutinize each idea and use it as a reference for our research.

Table 3: Studies Related to Modelling for Each Enterprise Dimensions (RQ4).

Candidates of Dimensions	Paper found	Existing Frameworks	Ref. and Year
Enterprise Governance	7	Modelling enterprise strategy.	(Doumi et al., 2011)
		Stage model of Digital IT Governance.	(DeLone et al., 2018)
Enterprise Ontology	15	Using Ontology and Modelling Concepts for Enterprise Innovation and Transformation.	(Okpurughre et al., 2017)
Enterprise Architecture	115	exploratory analysis of EA management support.	(Assar and Hafsi, 2019)
Enterprise Process	47	Enterprise Process Modelling.	(Hoggett and Shah, 2013)
Enterprise Model	26	Enterprise model patterns.	(Hay, 2011)
		Business model navigator.	(Gassmann et al., 2013)
Enterprise Alignment	1	BITA.	(Zhang et al., 2018)
		Reasoning on Uncertain Enterprise Technology Alignment.	(Bunting, 2012)
Enterprise Capability	4	Enterprise Capability Modelling.	(Loucopoulos et al., 2015)
		Ontological Analysis of Capability Modelling.	(Miranda et al., 2016)
		Process Innovation, Enterprise Maturity, and Dynamic Capability Approach.	(Kurniawan and Zander, 2019)
Enterprise Culture	3	Relationship among business model, organization, and corporate culture.	(Jettern et al., 2009)
Enterprise Business	1	Linking Drivers of ES-enabled Business Value to the Business Value Created.	(Bhattacharya, 2019)
Enterprise System	23	System-Thinking Development and Experiential Learning.	(Lopez et al., 2014)
Enterprise Infrastructure	1	GERAM.	(Bernus et al., 2015)
Enterprise Formation	1	Organizational Formation Transition.	(Terpening, 2015)
Enterprise Resource	25	Resource Matching.	(Wang, Chen, and Ao, 2015)
Enterprise Management	17	Radar Management Model.	(Zhang et al., 2011)
		Enterprise Management Maturity Model (E3M).	(Li et al., 2012)
Enterprise Execution	6	Business Execution Model.	(Ross et al., 2006)
Enterprise Knowledge	29	Enterprise Knowledge Modelling with CODEC.	(Loucopoulos and Kavakli, 2016)
Enterprise Risk	1	Enterprise Risk Modelling with ArchiMate.	(Band et al., 2015)

Table 4: Models, Techniques, and Ideas Retrieved of Enterprise Modelling (RQ5).

Research Area	Paper found	Candidate	Ref. and Year of Selected Papers
Theory	4	2	(Rouse, 2005).
Lean	33	5	(Nightingale and Mize, 2002).
Agility/Agile	6	2	(Hesselberg, 2018).
			(Bondar et al., 2017).
Engineering	10	2	(Whitcomb et al., 2017).
			(White, 2015).
Enabling	6	2	(Hanna, 2009).
Analysis/Analytics/Analyze	15	1	(Zimmermann et al., 2016).
			(Webster and Watson, 2016).
Evaluation	3	2	(Xue and Zhu, 2002).
			(Mao, 2019a).
Measurement	4	1	(Edgeman, and Eskildsen, 2014).
Informatics	2	1	(Braunstein, and Detmer, 2016).
Innovation/Innovative	18	1	(Lazonick, 2002).
Governance/Leadership	2	1	(Basole and Putrevu, 2014).
Framework	2	1	(Hanna, 2010).
Upgrading/Upgrade	18	10	(Mao, 2019b).

5 DISCUSSIONS

After answering the above five Research Questions, a comprehensive understanding of enterprise transformation research has been acquired. Several conclusions are extracted from the results.

There were many active announcements at the conference but unexpectedly few journals. Although there are many enterprises transformation-related studies, it is clear that the area is vast, and many things are involved in a complicated manner, and it is challenging to clarify them and construct theories for efficient and effective change. Given the vigour of research on digital transformation in the last few years, we believe that theories and frameworks should be strengthened as soon as possible. Based on the results of this research, we have decided what capabilities are needed to make enterprise transformation work well and what impacts and parts will have on a specific transformation. We would like to pursue further research into the extent to which they must be controlled and what must be well controlled.

5.1 Lessons Learnt

The purpose of this study is the evaluation the elements of enterprise related to transformation. In particular, in the future, we will develop enterprise transformation management methodologies and frameworks based on the enterprise engineering concept. Each answer for five RQs is described below:

Answer for RQ1: Initially, 816 works of literature were found. A flat growth rate and a small number of papers for the first five years from 1999. There were three peaks in literature growth starting in 2004, 2007, and 2014. Overall, the number of journals is small, contrary to expectations. On the other hand, the number of conference proceedings and other articles is high. It seems that incidents that affect the operation of the enterprise, such as "IT doesn't matter," Cloud, DX, etc., are affecting.

Answer for RQ2: Although "EA/architecture," "Model," "Digital Technology," and "Management" are active, there are still many areas to be addressed. On the other hand, there is significantly less work on "Measurement," "Analytics," "Evaluation," "Governance," "Decision making," and "capabilities."

Answer for RQ3: We have picked up 11 enterprise transformation-related capabilities. The capabilities we picked up will be a reference for our capability design for enterprise transformation management. Conversely, areas other than those that could be picked up require a new design in the future. For example, "Evaluate" (Frank, 2002) (Frank, 2014), "Innovate", "Optimize", "Design", "Architect", "Mature", etc. are considered as the target.

Answer for RQ4: We have picked up 16 items as enterprise transformation-related dimensions for utilizing the model. There are a wide variety of models, such as Enterprise Engineering (Dietz and Hoogervorst, 2011) (Dietz and Hoogervorst, 2017) (Yildiran, 2018), Enterprise Model Patterns (Hay, 2011), etc. In our research activities, these can be examined to see if they can be interpreted as dimensions that characterize the transition of enterprise transformation.

Answer for RQ5: We have picked up 13 items as enterprise transformation-related models, techniques, and ideas for supporting the modelling. Lean and Agile initiatives are relatively high profile, but there are still a few overall.

Others: Every time new transformational themes such as sourcing utilization, cloud utilization, ecosystem development, and DX are raised, new enterprise modelling, necessary organizational capabilities, frameworks for management, and mechanisms for measuring the degree of goal achievement are considered and proposed each time. We think that it was necessary to consider (i) how to proceed with the transition from the current situation to the desired transformation theme, (ii) how to visualize how far the transition has progressed, and (iii) how to define, manage, and improve the requirements for transformation. We believe that it is necessary to have a framework and management method that can be used universally for new transformation themes that will arise in the future, rather than methods of transition, evaluation indicators, and management of requirement definitions that are specialized for individual transformation themes.

5.2 Future Research Directions

Based on our analysis, we conclude that separating the enterprise transformation management capability and the enterprise transformation stage to form a model would lead to a successful corporate transformation. Overall, the current situation is characterized by a lack of definitions of dimension, maturity, and capability for driving enterprise transformation.

In future work, we intend to (i) reshape the new enterprise transformation management model consisting of technology, business, BITA, and DX

perspectives as a new enterprise transformation management world based on the combination of 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.

6 CONCLUSIONS

The goal of this study was to identify the current state of enterprise transformation research, and mainly it was research targets, frameworks, concepts, and theories related to enterprise transformation by using a systematic literature review method based on guidelines (Kitchenham, 2004). We identified 816 papers in which enterprise transformation was subject to something, and we did an in-depth analysis of 349 papers useful for our research.

Our main contributions to this paper are (1) statistical analysis of state of the art in dimensions, maturity, and capability related to enterprise transformation, (2) candidates for future advanced research themes related to enterprise transformation, (3) capabilities related to enterprise transformation, (4) tools and methods related to modelling enterprise transformation, and (5) resources and artifacts related to enterprise transformation.

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