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10-3-2024

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Nur Tanrıverdi

Bogazici University, nur.tanriverdi@std.bogazici.edu.tr

Aslı Sencer

Bogazici University, asli.sencer@bogazici.edu.tr

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Recommended Citation

Tanrıverdi, Nur and Sencer, Aslı, "Creating a Digital Transformation Maturity Model (Dx Mm) as A Single Solution" (2024). *MCIS 2024 Proceedings*. 34.

<https://aisel.aisnet.org/mcis2024/34>

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CREATING A DIGITAL TRANSFORMATION MATURITY MODEL (DX MM) AS A SINGLE SOLUTION

Research-in-Progress

Tanrıverdi, Nur Sena, Bogazici University, Istanbul, Turkey,
nur.tanriverdi@std.bogazici.edu.tr

Sencer, Asli, Bogazici University, Istanbul, Turkey, asli.sencer@bogazici.edu.tr

Abstract

Today, most companies have digital transformation on their agendas. Some structured digital transformation approaches have been defined and experienced so far in academia and industry. Digital transformation maturity models were developed to help with the transformation process. Maturity models provide a standardized approach for companies to examine a company's current status, identify the desired level, and guide the organization through transformation. It is also used as a benchmarking tool to compare companies within the same group and give insight to senior management. In the literature, maturity models are defined in various contexts. However, maturity models specifically designed for the manufacturing or information service industries exist in the literature. Moreover, the literature is significantly limited in applying a model designed for the manufacturing industry to the service industry. Research is designed to investigate whether it is possible to have a common maturity model for the manufacturing and information service industries. It will propose a maturity model based on comparing existing models, which can be adaptable for any industry under the categorization of manufacturing and information service industries. In this research-in-progress paper, the common and different elements of these models will be investigated as the first step of the research.

Keywords: Digital Transformation, Information Service Industry, Manufacturing Industry, Process-Based Maturity Model, Capability-Based Maturity Model.

1 Introduction

Digital transformation is one of the most popular subjects of today and such a topic that most companies have it on their agendas. What makes digital transformation a necessity for companies is twofold. Firstly, technology is evolving rapidly and changes the dynamics of competition (Hartl & Hess, 2017). On the other hand, customers' needs are changing today (Chanias, 2017). Their demands become more challenging for companies. So, it pushes companies to change their way of doing business.

Companies tend to develop a roadmap based on new dynamics. There are some structured digital transformation approaches defined and experienced so far in both academia and industry (Akarun et al., 2020; AZCA, 2020; Berger et al., 2020; Gollhardt et al., 2020; Valdez De Leon, 2016). To help this process digital transformation maturity models were developed. Maturity models provide a standardized approach for companies within the digital transformation process with supporting companies in examination of a company's current status, identification of the desired level, providing guidance to the organization through transformation and benchmarking within or across industry (Gollhardt et al., 2020). So, the maturity model should be fit to the company in order to have successful transformation.

In the literature maturity models are defined in various contexts as well. Gollhardt et al. (2020) indicated the existence of both "industry-specific" and "industry-agnostic" maturity models. However, a great majority of maturity models were developed for the manufacturing industry (Akarun et al., 2020; Ganzarain & Errasti, 2016; Jung et al., 2017; Lee et al., 2017; Lichtblau et al., 2015). The popularity of the Industry 4.0 subject in recent years may be the reason for the redundancy of maturity models in the manufacturing industry. On the other hand, there are some studies that focus on evaluating digital transformation maturity levels of specific industries under information service industry, such as telecommunication industry (Valdez De Leon, 2016), education industry (Al-Ali & Marks, 2021) or banking industry (Bandara, Vidanagamachchi & Wickramarachchi, 2019).

The final outputs of these two industries are different from each other. Manufacturing industry produces goods, while the information service industry creates services based on information (AZCA, 2021). According to the industry categorization of AZCA (2021) these categories are the two extremes of industry categorization. Therefore, maturity models specifically designed for either the manufacturing industry or information service industry exist in the literature. Most of the models in the literature are created for the manufacturing industry, because of that application of them to the service industry is significantly limited in the literature (Bandara et al., 2019).

However, a maturity model in digital transformation provides a concrete structure to follow through the journey. It does not only provide a standardized solution, but also enables companies to compare themselves to their competitors and peers in the transformation process (Valdez De Leon, 2016). Moreover, maturity models can also work as a benchmark during the digital transformation of companies within the same group (Valdez De Leon, 2016). According to an expert who works in one of the Big Four Companies as a director, and has experiences in digital transformation in holding companies, senior management of a holding company needs to objectively compare all companies in order to create their strategies and make investment plans. The expert has exemplified a holding company that both manufacturing companies and information service companies exist. Therefore, in this case usage of a maturity model for both information service industry companies and manufacturing industry companies can be needed to make a comparison among them.

This study aims to investigate whether it is possible to have a common maturity model for the manufacturing industry and information service industry, and proposes a maturity model based on the comparison of existing maturity models which can be adaptable for any industries under manufacturing and information service industry categorization. With this purpose following research question is created:

RQ: What is the possible digital transformation maturity model considering both the manufacturing industry and information service industry?

In this research-in-progress paper, what common and different elements of these models had will be investigated as the first step of the research.

2 Background Information

2.1 Digital Transformation Maturity Model

Digital maturity though as a desirable vision (Berger et al., 2020) is a target of digital transformation effort. Digital maturity makes companies stronger against digital disruption (Berger et al., 2020). It can be considered as a digital transformation level.

To improve digital maturity, a structured measurement approach is required. The demand for digital transformation maturity models to evaluate the level of a company's digital transformation to respond with digitalization is increasing (Berger et al., 2020). Therefore, in the literature, digital transformation maturity models are defined and developed.

Digital transformation maturity models are constituted by certain elements, namely dimensions, measures and scoring (AZCA, 2020). A subject's maturity is organized into a set of dimensions that together describe the entire subject (Gollhardt et al., 2020). Dimensions represent impacted business areas which are critical and fundamental for the company (Mettler et al., 2010).

A maturity model is a set of maturity levels for a specific class of objects (Beker et al., 2009). Beker et al. (2009) indicates that it depicts an expected, desired, or typical evolution path of these objects in the form of distinct stages.

2.2 Industries and Digital Transformation

Companies' end-products, which can be products, services, or a mixture, are changed according to their industries. In order to provide these products/services to their customers, companies conduct various internal and external processes. So, these processes are specialized to their needs to make the product or service. Requirements for producing a product or providing a service are mainly different. Based on a final output as a product or service, AZCA (2021) categorized industries into two main groups: manufacturing and service industry. According to this division, the manufacturing industry includes pharmaceuticals, transportation equipment, civil engineering/construction/architecture, electric/electronic equipment, etc. On the other hand, the service industry is divided into two industries: physical and information services (AZCA, 2021). Some examples of physical service industry are retail, public service, health/medical/welfare services, etc., while information service industry examples are finance/insurance, human resources/education services, real estate, telecommunication service, and software development, etc.

As it can be understood from service industry examples, provided services are different from each other. Based on the final output, the manufacturing and information service industries can be considered two extreme industries. Companies that conduct their operations under these different industries have different necessities to create, collect, and enable the final product or service, fulfill customer demand, and achieve customer value. Companies from two different industries have different aims and digital transformation solutions which make these companies successful are different from each other.

Aims of digital transformation and transformation speed can also be changed from company to company under the effect of their industry, product/service, operations and customer profile (Werth et al., 2020). That's why the digital transformation maturity model used for measuring the digital maturity level of a company should be compatible with the conditions, features, characteristics, and capabilities. The model should reflect the current situation of the company and ease the process of generating realistic targets and an applicable roadmap for the transformation of the company.

3 Research Method

In this study, a similar development process with existing literature is proposed to be followed. Becker et al.'s (2009) framework development approach, followed by studies conducted by Akarun et al. (2020), Gollhardth et al. (2020) and Valdez De Leon (2016), will be followed.

In this approach Becker et al. (2009) provide a well organized process for maturity model development in an iterative manner. As a first step in the process, it compares current maturity models. Then previous studies on maturity models are compiled. For the next step, expert opinions will be obtained and the model will be validated with an iterative approach. Comparison of maturity models are only performed in this paper.

4 Maturity Model Design

4.1 Maturity Model Selection

Maturity models of manufacturing and information service industries in the literature were chosen accordingly. There was no model that provides common usage for the information service industry or service industry. However, some exceptions were explained in Section 2.2 Background information.

Maturity models created for the manufacturing industry (Akarun et al., 2020; Berger et al., 2020) and information service industry (Al-Ali & Marks, 2021; Bandara et al., 2019; Gollhardt et al., 2020; Valdez De Leon, 2016) were chosen. The chosen information service industry models are different specific industries: the education industry, banking industry, telecommunication industry, and IT company, as given in Table 1.

Source	Model	Industry Focus
Akarun et al. (2020)	D3A Model	Manufacturing industry
Berger et al. (2020)	Multi-Dimensional Maturity Model	Manufacturing industry
Al-Ali & Marks (2021)	Digital Maturity Model for Education Enterprise	Education industry
Gollhardth et al. (2020)	Digital Transformation Models for IT Companies	Information service industry (an IT company)
Bandara et al. (2019)	Industry 4.0 Maturity Level of Banking Sector	Banking industry
Valdez De Leon (2016)	Digital Maturity Model for Telecommunications Service Providers	Telecommunications industry

Table 1. Selected models for comparison.

4.2 Comparison of Existing Maturity Models

Comparison is also performed based on dimensions and the structure of models. Commonalities and differences in model dimensions are analyzed. Also, how maturity models measure positions of companies is evaluated, whether capability-based or process-based are also evaluated. In the following sections, these analyses will be given.

4.2.1 Differences in Model Structure

Maturity model approaches are also different. Except for two maturity models, Al-Ali and Marks' (2021) and Berger et al.'s (2020), maturity models define dimensions, and based on these dimensions, they evaluate the digital transformation progress of the whole company and finally calculate digital transformation maturity levels (Akarun et al., 2020; Bandara et al., 2019). However, the other two models are different from them.

The Al-Ali and Marks' (2021) process-based model enables companies to define their companies as processes; maturity level is evaluated based on the determined processes of companies. On the other hand, Berger et al. (2020) provide a capability-based model. They defined capabilities under dimensions, and they classified dimensions into focus areas. Each capability equally supports maturity level, and a company can select suitable capabilities. Based on this structure, the model enabled companies to determine areas that needed to change for successful digital transformation (Berger et al., 2020).

4.2.2 Common Dimensions

In the Akarun et al. (2020) study, hypotheses regarding the relationship between dimension scores and overall digitalization maturity score were tested, and organization and innovation dimensions were found as significant dimensions to determine the overall maturity level. The organization dimension of Akarun et al.'s (2020) maturity model, which reflects the company's strategy development methods, decision-making methods, digitalization strategy, and employee development approaches, is equal to the strategy dimension in other maturity models. Therefore, the existence of strategy and innovation dimensions in chosen maturity models is evaluated. Fortunately, these two dimensions are common dimensions of maturity models. Even if dimensions were named differently in models, they have addressed similar concepts.

Companies in either information service or manufacturing industries need a business strategy and a vision to create and customize products or provide services (Bandara et al., 2019; Valdez De Leon, 2016). Therefore, the strategy dimension is defined as having a vision (Al-Ali & Marks, 2021; Valdez De Leon, 2016), strategy implementation and planning approach (Akarun et al., 2020; Berger et al., 2020; Gollhardt et al., 2020; Valdez De Leon, 2016). Moreover, innovation is essential for customer satisfaction and improvement in business operations, processes, and infrastructure (Bandara et al., 2019). Innovation requires building a company culture (Bandara et al., 2019; Berger et al., 2020), research and development structure (Akarun et al., 2020), governance structure (Al-Ali & Marks, 2021) and flexible and agile activities (Akarun et al., 2020; Valdez De Leon, 2016).

Additionally, the technology dimension is discovered in all maturity models except Gollhardt et al.'s (2002) model for IT companies. The technology dimension is related to building technology infrastructure (Al-Ali & Mark, 2021; Akarun et al., 2020), including data and security processes (Berger et al., 2020), planning and deployment of digital technologies (Valdez De Leon, 2016), and use of these technologies (Bandara et al., 2019).

Table 2 presents common dimensions, strategy, innovation, and technology, and how models named these dimensions are given.

Dimension	Information Service Industry Models (Related-Dimension(s) in the model & Reference)	Manufacturing Industry Models (Related-Dimension(s) in the model & Reference)
Strategy	<ul style="list-style-type: none"> ● DT Vision, Strategy, Leadership and Communication - Al-Ali & Marks (2021) ● Strategy - Gollhard et al. (2020) ● Strategy & Organization - Bandara et al. (2019) ● Strategy - Valdez De Leon (2016) ● Operations - Valdez De Leon (2016) 	<ul style="list-style-type: none"> ● Organizational Structure - Akarun et al. (2020) ● Focus area approach - Berger et al. (2020)
Innovation	<ul style="list-style-type: none"> ● DT Vision, Strategy, Leadership and Communication - Al-Ali & Marks (2021) ● Culture - Gollhardt et al. (2020) ● Ecosystem - Gollhardt et al. (2020) ● Operations - Gollhardt et al. (2020) 	<ul style="list-style-type: none"> ● Product Development - Akarun et al. (2020) ● People & Culture / Innovation Culture - Berger et al. (2020)

	<ul style="list-style-type: none"> • Strategy & Organization - Bandara et al. (2019) • Innovation - Valdez De Leon (2016) 	
Technology	<ul style="list-style-type: none"> • DT Technology Infrastructure - Al-Ali & Marks (2021) • <i>No dimension</i> - Gollhardt et al. (2020) • Technology & Resources - Bandara et al. (2019) • Technology - Valdez De Leon (2016) 	<ul style="list-style-type: none"> • Organizational Structure - Akarun et al. (2020) • Data, Infrastructure - Berger et al. (2020)

Table 2. Common dimensions of models.

4.2.3 Different Dimensions

Differences are seen in specific dimensions. The production dimension is only included in manufacturing models, while service provision is covered only in information service industry models. However, it is understood from the comparison that these two dimensions correspond to each other in terms of providing output as a result of operations and used with similar aims.

In manufacturing industry models, “production management” and “product development” are included in Akarun et al.’s (2020) model as the production dimension. They mainly covered product development processes, including how products are created, customized, and digitalized, and what kind of services are used to collect data from a product. Besides product development, production management processes that reflect a product's lifecycle, such as planning, scheduling, maintenance, material movements, and quality control, are also included in this model. Similarly, in Berger et al.’s (2020) model, these processes are covered under four dimensions; “customer integration”, “offering”, “production flexibility”, “product assembly”. These four dimensions correspond to three focus areas; “customer”, “business model”, “process”. The only issue with Berger et al.’s (2020) model proposes dimensions differently than Akarun et al.’s (2020) model is that they emphasize the customer’s involvement in product design processes. In information service industry models, the service provision dimension exists. Valdez de Leon (2016) has an operation dimension that focuses on service provision-related capabilities in the telecommunication industry, which provides digitalization, automation, and flexibility in operations. Product customization, digitalization (Bandara et al., 2019), and launching services based on digital technologies (Gollhardt et al., 2020) are determined for this dimension in models.

Another different dimension of models is sales and marketing. The sales and marketing dimension seems more relevant to the manufacturing industry. Because traditional physical products are the outcome of manufacturing industries, and distribution and sales of these products are two of the main processes in manufacturing industries (Akarun et al., 2020; Berger et al., 2020). Digital transformation of these channels and customer management are essential for information service industries. Therefore, Akarun et al. (2020) have a customer management dimension, while Berger et al. (2020) have distribution and sales channels in the models.

On the other hand, the sales and marketing dimension is not frequently included in information service industry models. Gollhardt et al. (2020) and Valdez De Leon (2016) didn't have this dimension. Al-Ali and Marks’ model (2021) includes sales and marketing as a process, but they don't have sales and marketing as a dimension. The only information service industry model that addresses digital marketing is Bandara et al.’s (2019) model, which includes digital marketing services.

Table 3 shows differences in dimensions, production, service provision, and sales and marketing.

Dimension	Information Service Industry Models (Related-Dimension(s) in the model & Reference)	Manufacturing Industry Models (Related-Dimension(s) in the model & Reference)
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Production	<i>There is no related dimension.</i>	<ul style="list-style-type: none"> • Production Management - Akarun et al. (2020) • Product Development - Akarun et al. (2020) • Customer / Customer Integration - Berger et al. (2020) • Business Model / Offering - Berger et al. (2020) • Process / Production flexibility - Berger et al. (2020) • Process / Product Assembly - Berger et al. (2020)
Service provision	<ul style="list-style-type: none"> • DT Processes, Controls and Digital Technologies - Al-Ali & Marks (2021) • Operations - Gollhardth et al. (2020) • Products & Services - Bandara et al. (2019) • Operations - Valdez De Leon (2016) 	<i>There is no related dimension.</i>
Sales & Marketing	<ul style="list-style-type: none"> • <i>No dimension</i> - Al-Ali & Marks (2021) • <i>No dimension</i> - Gollhardth et al. (2020) • Products & Services - Bandara et al. (2019) • <i>No dimension</i> - Valdez De Leon (2016) 	<ul style="list-style-type: none"> • Customer Management - Akarun et al. (2020) • Business Model / Distribution channel - Berger et al. (2020) • Business Model / Sale channel - Berger et al. (2020)

Table 3. Different dimensions in models.

5 Conclusion

In this research, a comparison was performed, and as a result of the comparison, commonalities and differences in maturity models were identified. Differences in models show that manufacturing and information service industry models have specific dimensions, reflecting differences in operations and processes regarding producing goods and providing services. Sales and marketing is another different dimension. It is mostly covered in the manufacturing industry because of differences in the requirements related to sales and distribution of goods and services. However, this dimension can also be defined for the information service industry model. Strategy, innovation, and technology dimensions whose importance on overall maturity level has been proven in previous research were covered in all models. Besides these dimensions, all maturity models have similar dimensions, even if different names express them.

Three types of models were found in the chosen models. Two of them, capability-based models and process-based models, seem more adaptable to different companies. These models are comprehensive enough to cover possible dimensions to represent a company fully. These models already provide flexibility even if they were designed for specific industries. These two types of models can be adapted for using both the manufacturing and information service industries.

The capability-based model, production, and service-related capabilities included a model that can also be suitably used in manufacturing and information service industries. Process-based models are also convenient to use in both industries. It does not require any change in dimensions based on industry adaptation, whereas the capability-based models' dimensions and capabilities should be arranged before running the model. However, before using process based model practitioners should determine the processes of the subject company. So, these two models require preparation for field application.

As a result of this research, common and different dimensions of both models were discovered. In the next step, dimensions will be defined to cover the commonalities and differences. Satisfying the

comprehensiveness and representation of an industry is an important consideration. Especially for different dimensions, it is possible to define flexible dimensions in models. However, providing modularity for a company while keeping the same structure and detail level is important. Additionally, decisions will be made among capability-based model and process-based model, and the new model will be created and validated based on Becker et al.'s (2009) model development approach.

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