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Digital Transformation Classification Types and Evolution Process for Established Companies

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ABSTRACT

This paper propose that digital transformation (DX) can be classified into three types: DX1.0, DX2.0, and DX3.0. DX1.0 is defined as "institutional optimization", where internal data is integrated across the company divisions. DX2.0 represents "value chain optimization" where the number of actors such as partners and supplier's increased, optimization is achieved in providing value to the end users. DX3.0 represents "new business value creation" where new value is created through new business models (for example, servitization, and platform business). This paper further clarifies the method used by companies for updating their business models by utilizing the data, working with other actors, and defining digital transformation classification types and the evolution processes. Digital transformation classification types evolve incrementally when their operation and systems are based on data-centric.

Keywords: Digital transformation, Business model innovation, Project management, Technology and innovation management

INTRODUCTION

With the development of Artificial Intelligence (AI) and cloud technology, handling big data has become much more manageable. This caused a significant impact on corporate management, where companies realize faster decision-making and labor-savings by analyzing Internet of Things (IoT) data from factories and logistics facilities and customer activity histories at sales and marketing sites. These are called digital transformations (Stolterman, 2004). On the other hand, there are many issues, such as how to acquire digital data, improve the digital literacy of staff due to the digitization of operations, and breaking away from dependence on vendors. The steps, which are leading up to digital transformation, are often divided into digitization, digitalization, and digital transformation (Figure 1).

These practical steps are few examples from a company management perspective. Analyzing the company's value chain from the management perspective and applying it to digital technology is essential instead of starting digitization which is in technical aspects. This paper illustrates the approach to digital transformation that should be taken from a management perspective, focusing on the customer's viewpoint. The research questions of this study.

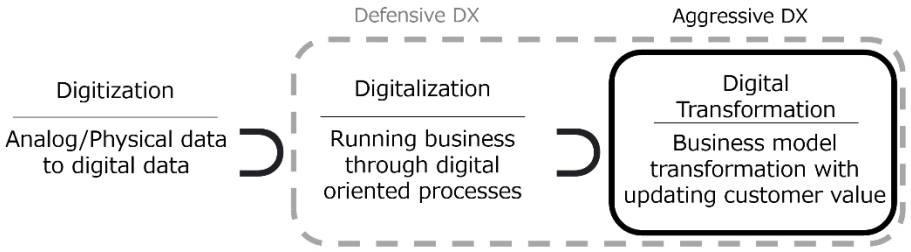

Figure 1: Digitization, digitalization, digital transformation.

RQ1: How can companies working on DX be classified?
RQ2: How is DX promotion evolving?

LITERATURE REVIEW

(1) Digital Transformation

Digital transformation has been the subject of much research attention in recent years. Focusing on company's own data and utilizing it for better management is essential step these days. Govindarajan & Immelt (2019) focused their research on data unique to large companies and argued that the survival of the manufacturing industry serve customers by integrating the brand power, customer base, industry knowledge, and assets of large companies into the software (Govindarajan & Immelt 2019). These often involve major corporate transformations, the misconception is that in promoting digital transformation, large companies tend to make decisions such as imitation or acquisition of start-ups or large-scale system infrastructure replacement, however these are only sometimes correct. Digital transformation does not necessarily have to be disruptive; it should be shaped by what can be done by focusing on the data (Furr & Shipilov 2019).

It is essential to quickly discover a model that can scale by simply trying processes and operations using established companies' resource strength. Mcgrath & Mcmanus (2020) presents several practical methods for digitizing business processes. Starting with what can be done and transformed using digital platforms. It is also important to classify the system infrastructure in promoting digital transformation. Sebastian et al. (2017) organized the system into two areas, the SoR area centered on Operational Excellence and the SoE area centered on Rapid Innovation. They also pointed out that the systems in the SoR and SoE domains are independent, and the development process is different.

(2) Digital Transformation Classification Types

Several papers explored various types of digital transformation, including Industry 4.0 in Germany, digital transformation in factories, and the use of AI in offices. Muller et al. (2018) categorized the impact of Industry 4.0 on the business model innovation of SMEs from three aspects: value creation, value capture, and value offer. Ibarra et al. (2018) divided the DX of manufacturing

companies into four stages. Ismail et al. (2022) proposed six steps for exploiting DX from previous research. Uchihira (2022) divided the value of the Smart factory into Defensive DX and Offensive DX and presented their characteristics and challenges. Okuda et al. (2021) presented a four-step process (see Figure 2) to exploit the work in order to be autonomous in a machine-learning application system, and Porter and Heppelmann (2014) proposed a product exploitation model. Both focus on the systems for data utilization. Berghaus and Back (2016) discovered the digital maturity model, including its criteria, difficulties, and maturity stages. Vrana & Singh (2021) summarized the characteristics of Digitization, Digitalization, and Digital transformation by industry. The authors suggested that internal transformation through digital technologies is necessary, but previous studies need to address the evolving business models. In this paper, the authors emphasize the significance of data in digital transformation, and propose a definition of this process as a form of business model innovation that relies on data exploitation. By leveraging data, companies can create new value propositions, enhance customer experiences, and optimize their operations, leading to a competitive advantage in the digital era.

Research Methods

This paper aims to clarify the digital transformation classification and its evolution process. Hence, the business model innovation in the case discussed in this study was not apparent. To explore the evolutionary process of the business model from the interviewees, the author adapted unstructured interviews as a data collection method. Based on Waseda University's alum list, the author negotiated companies promoting digital transformation and researched from eight cases that agreed on the interview (see Table 1). The authors interviewed executives of Japanese companies or people promoting digital transformation.

For the survey respondents, the authors were asked in lecture format to present the business and conducted a deep dive into interviews to discuss business characteristics and DX cases. To better understand this case, authors conducted additional interviews for four samples (see Figure 3). Lectures and interviews were transcribed and qualitatively analyzed. Through this analysis,

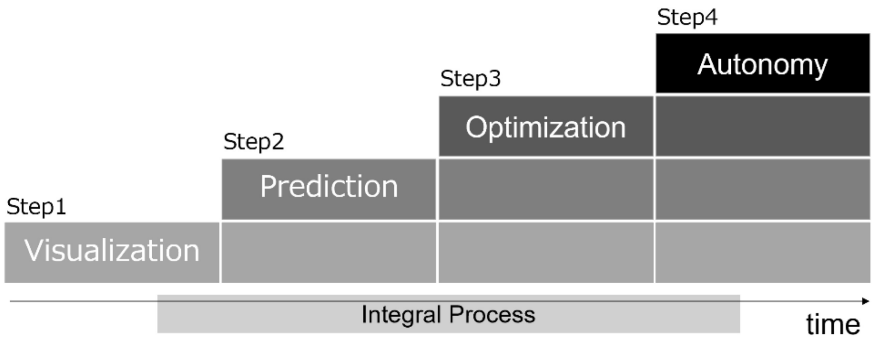

Figure 2: Exploitation patterns for machine learning systems.

Table 1. Interviewee information.

Interviewees ID	Projects	Industry	Role of interviewee
Interviewees 1	Inventory allocation optimization system	e-Commerce	CDxO
Interviewees 2	Sales planning system	Advertising	CEO/IT strategy Dept.
Interviewees 3	Disaster prevention system	Disaster prevention	CEO
Interviewees 4	Web application firewall system	SaaS provider	CXO
Interviewees 5	Rent yield calculation system	Real estate	CEO, CTO
Interviewees 6	Driving assistant system	Mobility	CXO
Interviewees 7	Parking inventory management system	Real estate	CXO
Interviewees 8	Health care service	Manufacturing	R&D Manger

Figure 3: Research flow.

the authors led three types of digital transformation. Transcripts were proceeded by qualitative data analysis. The software used was MAXQDA (version 22.1). Using a software which allow for changing the relationship between Codes and analyzing the correlation.

Digital Transformation Classification Types

Digital transformation can be classified into the following three types (see Figure 4). DX1.0 Institutional optimization, which consists of optimizing the data in the company. DX2.0 Value chain optimization is strengthening the model by involving outside parties DX3.0 new business value creation refers to building a new business model.

DX1.0: Institutional Optimization

According to the interview, DX1.0 involves the digitization and accumulation of data through business operations. (see Figure 1). Intervening in the process and gathering data is a significant undertaking that should be disseminated throughout the company. To ensure success, it is advisable to proceed in stages, starting with local optimization and gradually scaling it throughout the organization. Pay attention to the fact that the company is systematized by digitization. These were manifested in various ways, such as improved speed, accuracy, and predictive accuracy of business processes. Data acquisition at this stage is essential for DX2.0 value chain optimization and DX3.0 new business value creation. Large companies face many barriers when expanding

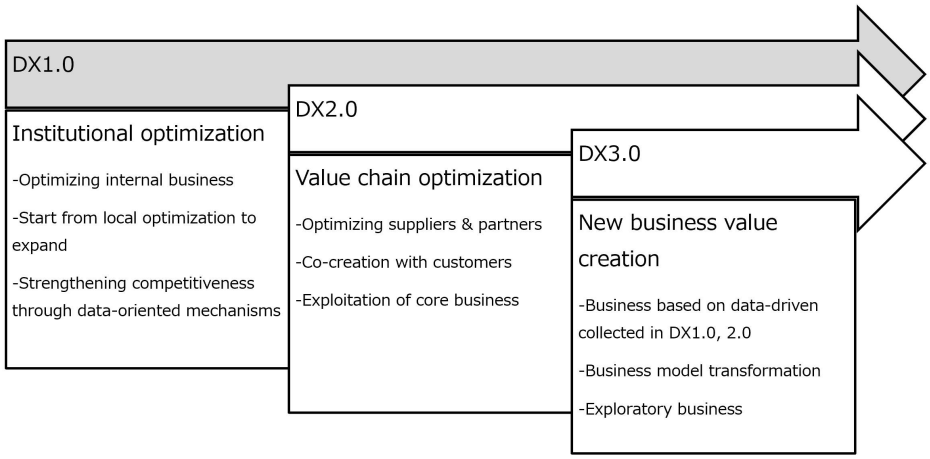

Figure 4: Digital transformation classification types.

from local optimization to other departments, and one of the challenges is creating data silos between departments. Data definition, data pre-processing, and unifying processes requires significant resources and investments. DX1.0 is often promoted based on marketing and sales. In recent years, with the advent of CDP (customer data platforms), there has been a trend to integrate customer data, and along with this, data linkage between departments is promoted. In this research, the authors can recognize that much data is integrated based on points of contact with customers.

Interviewee 2: Dispatching sales staff to stores.
"It was about 18 years ago when I was a manager of a convenience store, and since that time, I have had a strong sense of the problem that the work in the field is a treasure trove of information, but it is being neglected.
-omission (of the middle part of the interview) -
We started our company with the business of undercover research. From the beginning, we built a system called "System M(Provisional)" to create a database of retail store information, believing that if data is accumulated, it should become valuable. This system has finally been recognized as valuable over the past two to three years."

Interviewee3: Disaster prevention SaaS.
"When the Great East Japan Earthquake struck, detailed information by region was not being conveyed through the traditional mass media, so I looked at Twitter and saw that there were quite lots of tweets saying things like, "There is a shortage of supplies here," or "We are looking for volunteers here. At the time, there were not many Twitter users, but organizing this information on SNS and putting it together by region would be useful. This was the starting point of the business. Currently, the company is not only working with SNS, but also with weather data, driving data from car navigation systems, human flow data, and satellite data, and combining data for analysis."

DX2.0: Value Chain Optimization

One of the features of DX2.0 is to involve suppliers and partners in the institutional optimization system built in DX1.0. Realizing in-house optimization with DX1.0, and expand the scope of optimization by involving suppliers and partners in these mechanisms. Here, suppliers and customers are involved, and with an appropriate value to customers, it is possible to collect data through co-creation with them. These activities do not allow changes in the business model, and the company is at the stage of exploiting the existing business model. The premise of DX2.0 is that DX1.0 has built a mechanism that allows suppliers, partners, and sometimes customers to be included in the optimization process.

Interviewee 1: Major e-commerce for office supplies.
"We consist of our business model as data-driven oriented from the start-up stage. Therefore, silo problems between departments have not occurred compared to old companies. We have achieved data-driven optimization in many processes, such as purchasing logistics, inventory management, and shipping logistics. DX1.0 started smoothly from the above background. By integrating suppliers' inventory information, it is possible to prevent shortages and achieve improved user benefits and increased sales. Appropriate inventory allocation and shipping logistics optimization require a large amount of data, and they are operated autonomously by a machine-learning application system. We are optimizing logistics and sales in a data-driven manner, but we classified it as DX2.0 because it does not meet the requirements of DX3.0."

Interviewee 8: Shoe manufacturer.
"The problem was that it was difficult to obtain user information. Because we sell the shoes through retail sales, we cannot know how the users use the products. We made a path to the runner community by acquiring the runner app. We are promoting the business with the vision of creating a runner ecosystem, including its applications."

Since this is an apparel manufacturer, there are still many issues in the transition to services, so the authors classified interviewee eight as DX2.0.

DX3.0: New Business Value Creation

DX3.0 has two essential requirements. The first involves a transformation of the business model, and the second to provide data-driven value. The first business model change is the change in the value provided from the customer's point of view between DX1.0 and DX2.0, which often changes the charging system for customers. As for the second data-driven value, the new value is created by data-driven based on the data generated by DX1.0 or DX2.0. DX3.0 can be classified as an exploratory business and is a business that is distinct from conventional businesses.

Interviewee 2: Dispatching sales staff to stores.
"We compile data on how many products were sold at which store through the sales staff. As a result, we shifted from a sales staff dispatch type to a

promotion using digital signage, partly because of the COVID-19 response. The strength is that we can predict from past data which sales floors will lead to results by digital signage. We can say that prediction by the data made it possible to launch the DX3.0 digital signage business quickly."

Interviewee 6: Taxi business.
"*Due to the business characteristics of the taxi business, the difference in sales between veteran drivers and new drivers is remarkable. Also, how to run a taxi was accumulated by veteran drivers' tacit knowledge, and it could not be easily conveyed to newcomers. The company stored the movement information of taxis in a database, investigated the characteristics of high-selling drivers, and provided them as a navigation system for new drivers. This contributed to a 1.6% increase in sales for using the area search function and a 1.9% increase in sales for viewing detailed demand information compared to new drivers who relied on conventional experience and intuition. We are currently providing this to other companies as well.*"

Features of Digital Transformation Classification Types

The authors classified the digital transformation into DX1.0: Institutional optimization, DX2.0: Value chain optimization, and DX3.0: New business value creation. The authors summarized these features according to the features provided in Table 2. Features of DX classification types. See Table 3 where DX classification types by interviewees show the arrangement of DX types and features for interviewees.

DX starts with value chain optimization. Promoting data integration across departments makes it possible to optimize internal business processes. Data-driven companies from the outset have an advantage in that they can avoid the issue of data silos between departments. Usually, while performing local optimization from a specific department, data-based optimization is carried out for related departments. Doing this will result in faster business processes, better accuracy, and better forecasting accuracy.

DX 2.0 and DX 3.0 have different characteristics, such as exploring and exploit types. In DX 2.0, by incorporating suppliers and partners into the system built in DX 1.0, the benefits can be enjoyed in a broader range. As

Table 2. Features of digital transformation classification types.

No.	DX types	Features
1-1	DX1.0	Optimizing internal business
1-2	DX1.0	Start from local optimization to expand
1-3	DX1.0	Strengthening competitiveness through data-oriented mechanisms
2-1	DX2.0	Optimizing suppliers & partners
2-2	DX2.0	Co-creation with customers
2-3	DX2.0	Exploitation of core business
3-1	DX3.0	Business based on data-driven collected in DX1.0, 2.0
3-2	DX3.0	Business model transformation
3-3	DX3.0	Exploratory business

Table 3. DX classification types and features by interviewees.

Interviewees ID	Pjt ID	Projects	DX types	1-1	1-2	1-3	2-1	2-2	2-3	3-1	3-2	3-3
Interviewees 1	Pjt 1	Inventory allocation optimization system	DX2.0	Y	Y	Y	Y	N	Y	N	N	N
Interviewees 2	Pjt 2	Sales planning system	DX3.0	Y	Y	Y	Y	N	Y	Y	Y	Y
Interviewees 3	Pjt 3	Disaster prevention system	DX3.0	Y	Y	Y	Y	Y	Y	Y	Y	Y
Interviewees 4	Pjt 4	Web application firewall system	DX3.0	Y	Y	Y	Y	Y	Y	Y	Y	Y
Interviewees 5	Pjt 5	Rent yield calculation system	DX3.0	Y	Y	Y	Y	N	Y	Y	Y	Y
Interviewees 6	Pjt 6	Driving assistant system	DX3.0	Y	Y	Y	Y	Y	Y	Y	Y	Y
Interviewees 7	Pjt 7	Parking inventory management system	DX3.0	Y	Y	Y	Y	Y	Y	Y	Y	Y
Interviewees 8	Pjt 8	Health care service	DX2.0	Y	Y	Y	Y	Y	Y	N	Y	Y

shown in Interviewees 3, 6, 7, and 8 provided in Table 3, we can find the co-creation processes with customers. However, these are not essential, and whether or not they can be adopted depends on the business characteristics of the company. Since DX 2.0 is the orthodox evolution of DX 1.0, it will shift to DX 2.0 once the company completes the DX 1.0 requirements.

DX 3.0 needs to proceed with a much clear intention compared above. A process different from DX 1.0 and DX 2.0 is required, such as exploring the direction while experimentally acquiring data, preparing for utilization, and providing new value to customers. Sebastian et al. (2017) suggested that agility and rapid innovation are required to manage in-house data and gather new information, such as user purchase data and social media information. They use agile and DevOps methods in DX3.0, familiar with new business creation methods (Rise 2011, Osterwalder 2004, Blank & Dorf 2020).

Digital Transformation Evolution Process

The evolution process starts with DX 1.0 and progressing to DX2.0 and DX3.0 (see Table 4). However, the six cases that led to DX3.0 had the following characteristics. First, for the two cases of Interviewees 2 and 5, the DX2.0 step was skipped, and DX3.0 was performed first. The authors suggest that to realize DX3.0 is information fully prepared with the data accumulated in the company. From the value chain perspective, it is not necessarily practical to cooperate with suppliers to obtain information, and they have done everything independently.

Second, interviewees 3, 4, and 6 proceed with DX3.0 and DX2.0 in parallel. These characteristics were seen in new industries with fewer industry ties and in SaaS-type businesses that have completed data collection. This type of business often starts in the SaaS (software as a service) business models to utilize user data to enhance service levels. Interviewee 7 is progressing smoothly with DX1.0, DX2.0, and DX3.0. This case is characteristic of a mature business model with many external collaborations. This is the case for the Operation Excellence type business, which requires time for partner collaboration due to national regulations and the need to keep pace with the industry.

Table 4. Digital transformation evolution process.

Pjt ID	DX1.0 Institutional optimization	DX2.0 Value chain optimization	DX3.0 New business value creation type	Customer value
Pjt 1	Optimize internal distribution system	Linking manufacturer inventory and EC inventory	-	Prevent out-of-stock
Pjt 2	Data accumulation by staff	-	Digital signage business #A	Co-creation of retail promotion plans
Pjt 3	Open data collection *	User participation	Disaster prevention SaaS #B	Early flood simulation
Pjt 4	Open data collection *	SaaS (user data collection)	Web application FireWall SaaS #B	Web application Firewall service
Pjt 5	Open data collection *	-	Real Estate Income Simulation SaaS #A	Real estate profit simulation
Pjt 6	Accumulation of in-house driver data	User participation	Driver assistance system for companies within the industry #B	Taxi driver assistance navigation
Pjt 7	In-house data collection	Data registration by the supplier	Parking Lot Brokerage Business	Real-time visualization of parking lot
Pjt 8	Business acquisition	Product sales through user contact points	-	Health service platform

DISCUSSION AND CONCLUSION

There has been much research on digital transformation in recent years. There are many discussions on utilizing digital transformation in corporate management, such as digital innovation and business model innovation, which is close to digital transformation research. Areas such as innovation management and digital platforms, since research areas cover technology management and ecosystem areas, which are closely related but different from this research area. This paper clarified the classification of digital transformation from the viewpoint of business model innovation and its exploitation. Creating new business value is essential when realizing digital transformation, however the new business theory also comes into play in this context. Furr & Shipilov (2019) and Mcgrath & Mcmanus (2020), featured in this article, are also prominent researchers in the new business fields. In terms of utilizing digital technology in management, it is necessary to examine it from a multifaceted perspective, such as management and new business creation aspects. The authors hope that this paper will help in clarifying this relationship.

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