The Nature of Digital Transformation Project Failures: Impeding Factors to Stakeholder Collaborations

Naoshi Uchihira, *JAIST* and Tatsuya Eimura, *JAIST*

Abstract—**For successfully executing digital transformation (DX) projects in a company, collaboration among various internal and external stakeholders is intrinsically crucial and key to success. However, there are various factors that can impede such collaborations, six of which were identified in this paper based on interviews with DX project stakeholders. Six impeding factors include information gap, experience gap, incompatible evaluation criteria, conflict of interest, perception gap of the future, and lack of mutual trust. Although previous studies have discussed superficial factors which directly explain the success or failure of such projects, this paper isolates and explores them in greater depth than the traditional ones. These essential impeding factors are helpful to find solutions to eliminate them and lead DX projects to success.**

Index Terms— *digital transformation, stakeholder collaboration, project management, impediments.*

I. INTRODUCTION

WITH rapidly evolving digital technologies such as artificial intelligence (AI), the Internet of Things (IoT), and cloud computing, the need for and potential of digital transformation (DX) projects in various companies and organizations has been widely recognized. However, while some advanced companies have done well with DX, others are left struggling. Although the details are unclear, it has been reported that 84% of DX projects fail [1]. According to the "DX Promotion Index Self-Diagnosis Results Analysis Report (2020 Edition)" of the IPA (Information Technology Promotion Agency, Japan), approximately 70% of companies stay at the level where the company-wide strategy is unclear and DX is only sporadically implemented [2]. In particular, unlike KAIZEN (also called "defensive DX") that uses digital technology with a clear objective, DX that creates new and unconventional values (called "offensive DX") faces various difficulties in achieving success, which should be overcome by collaborations among the various stakeholders involved. However, various factors impede such collaborations, which are major causes of unsuccessful DX projects. Since the DX vision, which creates new and unconventional value, is not always clear or shared among the stakeholders. Then, the unclear vision and future create various gaps among the stakeholders. Based on interviews with DX project stakeholders, we have identified six factors that impede these collaborations and examined their characteristics while suggesting possible solutions to eliminate them.

II. LITERATURE REVIEW

In recent years, DX research has received wide recognition with several studies identifying its challenges and the factors that contribute to its success or failure. Davenport and Westerman discussed why many high-profile companies, such as General Electric, have struggled with DX, by pointing out that transformation in the pioneering period is not easy, as with past cases of e-commerce [3].

As for the factors that make DX projects successful, many studies from a macro perspective have been conducted. Osmundsen et al. mentioned DX drivers, objectives, and success factors based on a literature review by identifying the latter as following: supportive and agile organizational culture, well managed transformation activities, leveraging knowledge, engaging managers and employees, growing information system (IS) capabilities, developing dynamic capabilities, developing a digital business strategy, and the alignment of business and IS [4]. The authors point out that the key success factors include trust and cooperation among organizations and the utilization of knowledge inside and outside the organizations. Through a Delphi study of experts, Hartl and Hess investigated the organizational culture necessary for DX, and found that the clan, adhocracy, and cultural values of Cameron and Quinn's organizational cultural typology are effective for DX success [5]. Mhlungu et al. identified four success factors as customer centricity, governance, innovation, and resource attainment, based on a questionnaire survey, and showed that information technology (IT) managers and non-IT managers that are in a position to promote DX have a common understanding of these factors [6]. Based on a literature review, Saltz and Shamshurin examined success factors of big data analytics projects from six perspectives, data, governance, process, objectives, team, and tools, and mentioned a need to refine the process methodology to carry out the project [7].

On the flip side, factors causing failures have been extensively studied as well. Saldanha cited a lack of discipline in defining and executing the right steps for DX projects to take off and stay ahead as a reason for failure, then proposed five stages—foundation, siloed, partially synchronized, fully synchronized, and living DNA—that lead to the final DX stage, as well as the important disciplines and checklists for each stage [8]. For example, digital reorganization and staying up-dated are important disciplines in Stage 4, i.e., fully synchronized. Stief et al. analyzed DX's success and failure factors by interviewing 23 DX experts, and classified the opportunities and challenges of DX into the five categories of market-orientation, process-orientation, technology-orientation, company-orientation, and product-orientation [9]. DX experts suggested counteracting the

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currently insufficient knowledge regarding the application of digital technologies to achieve growth and establish a competitive advantage. They all agreed on the importance of digitization within companies, but pinpointed the lack of collaboration between IT and general management.

The reasons for such a lack of progress have been previously charted across studies, but the impediments to stakeholder cooperation are seldom discussed. Ikegami and Iijima interviewed managers and heads of DX promotion divisions across eight Japanese companies and identified seven challenges in DX promotion, which include the siloed nature of DX and lack of an overall strategy, complexity of existing systems and difficulty of integrating them with new systems, inability to invest in the development of the data necessary for DX, and the lack of DX-savvy personnel [10]. Bilgeri et al. also mentioned the difficulty of collaboration between business units in large manufacturing companies, with internal pricing conflicts as a major factor [11].

According to the aforementioned studies, difficulty of stakeholder collaborations is one of the main reasons for DX failure. However, its root cause has not been comprehensively analyzed. This paper focuses on and analyzes the essential factors impeding stakeholder collaborations.

III. RESEARCH METHOD

In this study, we classified and analyzed the impediments of DX projects, particularly those related to stakeholder collaboration difficulties, through interviews. These stakeholders included executives, DX promotional divisions, IS divisions, DX-related technology divisions (research and development (R&D) divisions), business operations divisions (factory, administrative divisions, etc.), and IT solution vendors (software development companies).

We adopted semi-structured 1-2 hour online interviews for six experts involved in DX projects at six Japanese companies (Table I), where the interviewees were asked about their perception of DX, their current usage (especially the use of big data and AI), and the difficulties that existed among themselves. The audio was recorded and converted to text, which was then coded and analyzed using the qualitative data analysis tool, MAXQDA. The qualitative data analysis consists of two steps (initial (open) coding and categorization). Additional confirmation and supplementary questions about the interview content were collated via e-mail.

TABLE I
PROFILES OF THE SIX INTERVIEWEES

	Company attribute and sector	Responsibilities
A	Electric appliance manufacturer, DX promotion division	Collaboration between DX promotion division and business operations division.
B	Electric appliance manufacturer, R&D division	Research and development of supply chain systems and their deployment inside and outside of the company.
C	Materials manufacturer, DX promotion division	Collaboration between DX promotion division and business operations division.
D	E-commerce company, In-house systems development division	Data scientist to solve internal technical problems.
E	AI systems development company, Executive	Defining customer requirements and managing systems development projects.
F	Medical outsourcing company, IS division	Development and maintenance of internal information systems.

Although the six interviews are not enough, we have been able to extract typical DX promotion difficulties in large-scale Japanese companies.

IV. RESULTS

A. Characteristic difficulty patterns

The number of Japanese characters in all text data was 47,372. As a result of the initial coding, 224 segments were retracted from the interview text data. Then, 224 segments could be grouped into 15 major categories (Figure 1) and subsequently classified into organization-wide issues (n = 9), stakeholder and inter-stakeholder issues (n = 5), and others (n = 1).
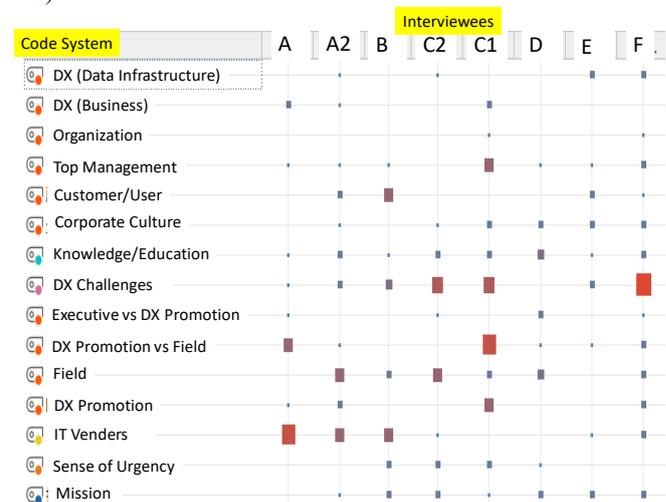

Fig. 1. Code matrix (MAXQDA). The size of the rectangle indicates the number of segments belonging to the category.

The following is a list of typical difficulty patterns based on the second issue (stakeholder and inter-stakeholder issues):

1) Current business takes priority and there is no time for DX. (Business operations division and DX promotion division)

"If you're an IT engineer, you're probably aware of AI. However, I have the impression that the section of the information system division I belong to has its hands full with the work, rather than thinking about how to utilize AI. They have an awareness of AI, but the word AI is almost never mentioned in their work routine." (Interviewee F)

2) Return on investment cannot be explained. (Business operations division and DX promotion division)

"Another issue is that it is unclear to what extent we can rigorously estimate the cost-effectiveness of AI to persuade those in the field (business operation)." (Interviewee C)

3) The business operations division is not aware of the intentions of top management and the DX promotion division. (Executives, DX promotion division, and business operations division)

  "Although the DX is being envisioned by the top management and the DX promoters, it is not being communicated well to the field (business operations division). Also, there is an atmosphere in the field that says why don't we just introduce it anyway?" (Interviewee A)

  "Since the benefits of AI automation are difficult to convey to people in the field (business operations division) in the first place, there is a tendency for people to perceive it as something troublesome. This also affects support for AI projects in the field. This is not only a problem for the field, but also a problem for the middle managers. The middle managers need to communicate well with the field." (Interviewee E)

4) Data scientists do not know what is going on in business operations. (DX-related technology division and business operations division)

  "The problem is that there is still a gap in awareness and knowledge between data scientists who do data analysis and employees who are actually work in the field and have knowledge about the business operation." (Interviewee A)

5) Customers do not want to give their data to IT vendors. (IT vendor and business operations division)

  "It is the customer's work to manage the data and operate the system, so if they disclose it to a manufacturer like us, the know-how may leak out and the customer's own work may be lost, so that is where there is business interference between the customer and the manufacturer." (Interviewee A)

6) The business operations division is satisfied with the current process. (DX promotion division and business operations division)

  "The people who are closer to the actual business don't think it's crazy that there's a lot of manual work, that there's no way to do it automatically, that they're not trying to find a way to do it other than manual process, much less using technology to solve it." (Interviewee D)

7) Unclear purpose of AI implementation triggered by the AI boom. (IT vendor and business operations division)

  "In the midst of the AI boom, there are many cases where people in the business operation division come to us for getting advices after receiving a top-down order to do something using AI." (Interviewee B)

  In addition to the above, there are a variety of difficulty patterns. However, we believe that they are superficial. Classifications based on the stakeholder's relationships are possible, but it may not reveal essential factors.

B. Impeding factors in stakeholder collaborations

  By examining the difficulties recognized from these interviews, we were able to inductively isolate six essential factors (see Table II) after the researcher's discussion. These six essential factors are MECE (Mutually Exclusive and Collectively Exhaustive) in the scope of the interview data. The difficulty pattern consists of several essential factors. The relationships between these factors and the aforementioned difficulty patterns are shown in Figure 2.

  These six impeding factors can be classified into three groups as shown below:
Group1: Knowledge Gap
(1) information gap (explicit knowledge) and (2) experience gap (tacit knowledge)
Group2: Profit-loss Gap
(3) incompatible evaluation criteria and (4) conflict of interest
Group3: Perception Gap
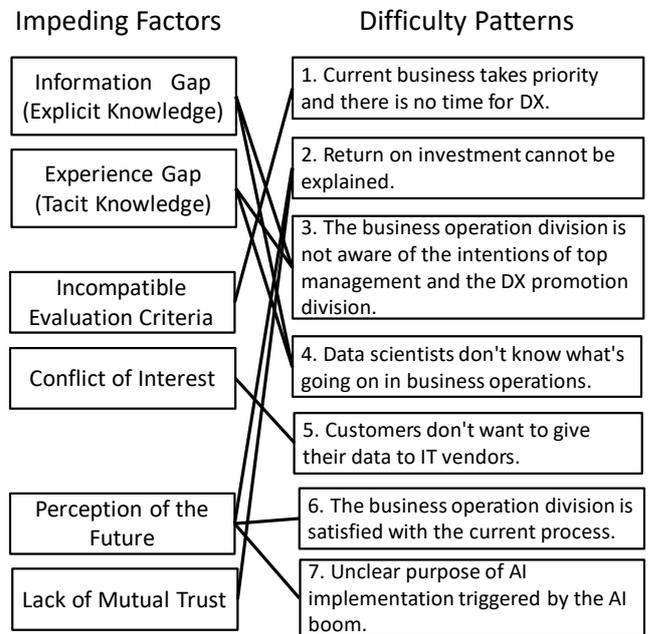(5) perception of the future and (6) lack of mutual trust

Fig. 2. Relationship between the impeding factors and difficulty patterns.

V. DISCUSSION

  In this section, we relate the six essential impeding factors that were identified and the existing theories to discuss solutions for their elimination.

1) *Information (Explicit Knowledge) Gap*
  Explicit knowledge can be obtained to some extent through documents (textbooks, manuals, et al.), but in reality, it is difficult to completely grasp it. For example, it is unrealistic for people in the business operations division to keep abreast of the latest trends in machine learning technologies. The problem of asymmetric information about state-of-the-art technical knowledge is a common case. The poor absorptive capacity of the information receiver is one of the causes of this gap [12]. To bridge it, it is necessary to translate the information appropriately, taking into account the absorptive capacity.

Improving the information literacy of people in the business operations division is also an important measure.

2) *Experience (Tacit Knowledge) Gap*

The empirical knowledge cultivated in the business operations division or in the DX promotion division is not necessarily formalized in documents or other forms of knowledge that have a high degree of information stickiness [13], and it is necessary to bridge this gap through close interaction and mutual empathy. Specifically, it is effective to have veterans from the business operations division serve concurrently in the DX promotion division. Business ethnography in the field (ex. manufacturing shop floors) could also be an effective method [14].

3) *Incompatible Evaluation Criteria*

If an organization's existing evaluation criteria are not compatible with DX promotion, the organization cannot actively cooperate in it based on rational judgment. For example, keeping QCD (Quality, Cost, and Delivery) is the most important, and supporting DX is a low priority in the business operations division. In this case, the evaluation criteria should be changed so that they are compatible with DX promotion. This can be incentivized in bonus evaluations by computing the degree of contribution made to DX.

4) *Conflict of Interest*

If there are conflicting interests between stakeholders, collaborations between them will not be possible. It is important to have a mechanism or contract that adjusts the interests and makes the promotion of DX beneficial for both parties. Theoretically, cooperation games and negotiation games can be used to break out of the prisoner's dilemma of non-cooperation games in game theory. Specifically, DX can be promoted by obtaining a firm contractual agreement on data and model handling created by AI, i.e., machine learning. A guideline authorized by the government about a contract about data and AI model is helpful.

5) *Perception Gap of the Future*

DX will not progress if the business operations division thinks that the status quo is acceptable. It is critically important to share opportunities and risks for the company of the future, and to develop and share a digital vision [15]. Digital leadership is required for its steady implementation. Roadmapping is also an effective dialog tool for filling recognition gaps among the stakeholders [16].

6) *Lack of Mutual Trust*

One of the major challenges in promoting DX is that its effects are not known until it is actually implemented. For such an uncertain task, it is important to have a relationship of trust between the business operations division and the key persons of the DX promotion division, based on past achievements and relationships. To achieve this, it is effective to assign people who can be trusted as leaders and key personnel. It is also important to implement "NEMAWASHI" [17] and stealth storm [18] to gain trust of stakeholders.

The key to promoting DX is to understand the essential impeding factors that exist among the stakeholders, rather than the superficial difficulty patterns, and take appropriate solutions to eliminate them. Figure 3 shows a structural relation among difficulty patterns, impeding factors, and solutions. For example, there are many cases in which the proof of concept (PoC) does not proceed to the next phase, because it is conducted blindly without identifying and eliminating the target impeding factors.

VI. CONCLUSION AND FUTURE WORKS

Based on interviews with DX project stakeholders, this paper identifies six essential factors that impede collaboration, clarifies their characteristics, and discusses possible solutions to eliminate them. Although many previous studies have discussed the superficial factors directly explaining the success or failure of DX, this paper is unique in giving a new perspective on impeding factors to stakeholder collaboration, which lay the groundwork for future research on DX project management.

A limitation of this study is that the impediments are not necessarily comprehensive because there were only six interviewees in Japanese large companies. For example, the difference among the stakeholders' execution pace may be an additional impediment that was not considered in this paper. In the future, we hope to increase the number of interviews and expand the target companies (small and medium-sized enterprises, companies in Europe, the U.S. and Asia) to aid comprehensiveness.

In addition, the solutions to eliminate essential impeding factors need to be systematized and made concrete in Figure 3, while this paper mentioned only partial solutions and the related theories.

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TABLE II
ESSENTIAL IMPEDING FACTORS TO STAKEHOLDER COLLABORATION

Impediments	Explanation	Example
Information Gap (Explicit Knowledge)	Gap due to information asymmetry, where information is defined as communicable formal knowledge.	The business operations division is not aware of the latest information on AI technology held by the DX promotion division.
Experience Gap (Tacit Knowledge)	Gaps in knowledge based on the past experiences of the people involved. Tacit knowledge that is difficult to transfer.	DX promotion division and IT vendors try to promote DX with idealism without knowing the actual business operation.
Incompatible Evaluation Criteria	Differences in the evaluation criteria and priorities of each division.	The DX promotion division wants to promote DX, but the front line prioritizes the steady execution of the current work.
Conflict of Interest	Conflicts of interest between stakeholders.	IT vendors want all of their customers' data, but the customers do not want to provide their know-how to IT vendors.
Perception Gap of the Future	Differences in the perceptions of the purpose, direction, and path of DX (what DX will achieve in the future).	The top management thinks that the future of the company is in jeopardy if DX is not promoted, but the front line thinks that the current extension is sufficient.
Lack of Mutual Trust	Lack of interorganizational trust and negative thinking about an uncertain future.	Members may wonder if DX is really going to work, but they can go along with it if they trust a leader in the DX project.

Superficial Difficulty Patterns of Stakeholder Collaboration

| Difficulty Pattern | Difficulty Pattern | Difficulty Pattern |

| Difficulty Pattern | Difficulty Pattern | Difficulty Pattern | Difficulty Pattern |

| Difficulty Pattern | Difficulty Pattern | Difficulty Pattern |

Essential Impeding Factors

| Information Gap (Explicit Knowledge) | Experience Gap (Tacit Knowledge) | Perception of the Future |

| Incompatible Evaluation Criteria | Conflict of Interest | Lack of Mutual Trust |

Measures and tools to remove impediments

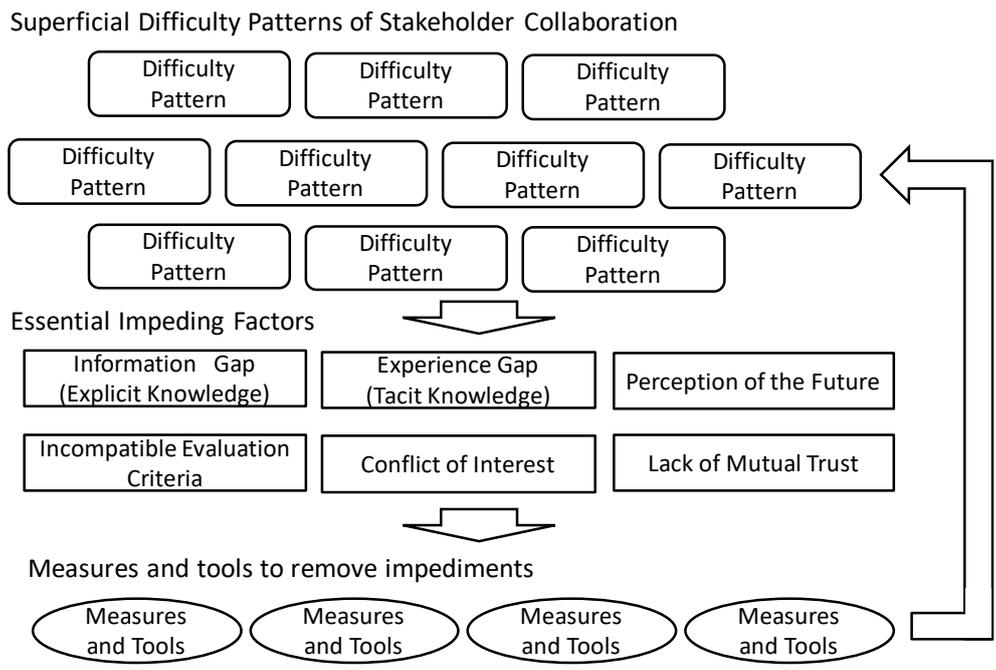| Measures and Tools | Measures and Tools | Measures and Tools | Measures and Tools |

Fig. 3. Identification of the essential impeding factors for resolving superficial difficulties.