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RESEARCH ARTICLE

A structured taxonomy for effective digital transformation project implementation: Development, validation, and practical insights

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Abstract
The aim of this study was to develop and validate a taxonomy designed to assist organizations in formulating their Digital Transformation Project implementation strategies. In creating this taxonomy, we sought to blend both conceptual frameworks and empirical data. The initial phase involved a scoping review that synthesized existing literature to lay the foundation for the taxonomy. Subsequently, we aimed to validate the taxonomy by gathering feedback from industry experts in Germany using a closed card sorting technique, complemented by case study analysis. This structured compilation of information regarding implementation strategies, presented through the taxonomy, simplifies the process for practitioners. Such a taxonomy enables practitioners to adopt a standardized vocabulary, which supports decision-making, encourages learning from previous successes and challenges, and facilitates the application of these lessons to their projects. Additionally, we have included practical case scenarios within the taxonomy, offering guidance for organizations on leveraging it in the execution of digital transformation projects.

Keywords
digital transformation projects; card sorting technique; case study analysis; implementation strategies; taxonomy development.

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1. Introduction

The noticeable advancements in digital technologies and their increasing prevalence have served as a profound inspiration for organizations to transform their operations and business models (Ardito et al., 2018). This transformation involves modifications in activities, processes, business models, and capabilities, taking into account potential disruptions (Correani et al., 2020). When an organization begins or enhances its use of digital technologies by integrating information technology, innovation, and organizational change to meet customer needs, it is called Digital Transformation (Hafseld et al., 2021; Morakanyane et al., 2017; van Dyk & Van Belle, 2019). A project designed to carry out such digital transformation is referred to as a Digital Transformation (DT) Project (Gertzen et al., 2022).

In the late 20th and early 21st centuries, digital technologies were increasingly integrated into business processes, leading to the adaptation of the DT Project (Barthel & Hess, 2019). Numerous industries have experienced a market shift in recent years, driven by better responsiveness to customer demands (Barthel & Hess, 2019). Consequently, organizations are compelled to engage in DT Projects to stay competitive, as 40% of businesses that do not adapt to new technologies may face extinction within the next decades (Kutzner et al., 2018). Hence, to avoid this great fall and to stay competitive, companies are continually reinventing themselves and pursuing digital transformation (Fuchs et al., 2019; Henriette et al., 2015).

The prospect of undertaking a DT Project in an organization is promising and exciting but poses significant challenges (Setzke et al., 2020). The predominant reason for the majority of failure cases (approximately 70%) is a misunderstanding of the characteristics and definition of DT Projects (Mirkovic et al., 2019; Smith, 2020). Besides, the implementation of DT Projects often fails due to the lack of comprehensive guidelines and widely shared implementation strategies (Setzke et al., 2020).

Digital transformation has gained wide research recognition multiple times. The scholars have investigated its definition (Fuchs et al., 2019), domain (Kutzner et al., 2018), existing barriers (Vogelsang et al., 2019), implementation (Setzke et al., 2020), and influencing factors (Dörr et al., 2023) and organized those in a manner through building a taxonomy. While observing the research related to the DT Project, it came to light that the researchers have analyzed the factors causing complexity in the DT Project (Hafseld et al., 2021) and the framework to analyze the DT Project success (Mahboub & Sadok, 2022). A recent publication by Hermann et al. (2024) created a taxonomy for initiating Digital Innovation Projects in SMEs. These authors used taxonomy to consolidate interpretations from prior research and contribute to future studies (Glass & Vessey, 1995; Sabherwal & King, 1995). Besides, taxonomy is utilized to provide a structured perspective when the field of research has its specific area of interest (Glass & Vessey, 1995).

To date, there are limited scholarly developments that have explored the characteristics contributing to the successful implementation of Digital Transformation Projects (Baier et al., 2022; Morakanyane et al., 2017). Therefore, we will investigate DT Project characteristics to understand their outlook and implementation strategy. Accordingly, a taxonomy will be developed to provide those characteristics with a concrete structure with standard terminology. Such a taxonomy is important because it will foster a better understanding of the dimensions of DT projects, thus aiding efficient implementation. Therefore, the objective of our study is "*to develop and validate a taxonomy aimed at helping organizations shape their implementation strategies for Digital Transformation projects.*"

To fulfill the research objective, we focused on building a taxonomy that includes essential characteristics for implementing DT Projects in organizations. The taxonomy development technique suggested by Nickerson et al. (2013) will be taken as a guideline. The development was done in three iterations. A scoping literature review was carried out to consolidate insights on the definition and characteristics of DT Projects from existing articles. This helped to frame the initial base of the taxonomy. After that, the card sorting technique was applied to incorporate the perspectives of practitioners involved in DT Projects. Thereafter, a case study analysis was conducted to gather instances specifically focusing on DT Projects

from various organizations in Germany. Through the multi-method study of combining scoping review, card sorting technique, and case study analysis, we bring in a new perspective of developing taxonomies, which other studies have not done before. Finally, some relative contextual factors have been presented from the collected case studies, which will help to understand specific situations while implementing DT Projects.

The paper is structured as follows. In section 2, related works have been discussed. Section 3 presents the research methodology. Sections 4, 5, and 6 discuss the analysis regarding taxonomy development. Sections 7, 8, and 9, respectively, include a cross-case analysis, implications of the research, and conclusion, including limitations and future scopes.

2. Related Works

2.1. Digital Transformation Project and its impact

To understand the meaning and impact of a Digital Transformation (DT) Project on an organization, we analyzed the perspectives of various authors on organizational DT efforts. This approach will help us to clarify the need for a taxonomy from an organizational standpoint.

A project can be regarded as a Digital Transformation Project when it integrates information technology, innovation, and organizational change, offering a comprehensive perspective on all involved facets (Hafseld et al., 2021). Considering these facts, the outcome of a DT Project is expected to differ from a Traditional IT Project (Barthel & Hess, 2019; Gertzen et al., 2022). These projects use new technologies to streamline organizational processes, increase efficiency, reduce waste, and enhance data management, aiming to improve decision-making and facilitate the digital transformation of a business (Gertzen et al., 2022). Hence, it can be said that organizational structure, technology, and innovation are the three main focus factors for DT Projects (Hafseld et al., 2021).

Stakeholder mapping significantly impacts DT Projects, focusing on trust, influence, and relationships (Filho et al., 2021; Novelli & Paoloni, 2022). While mapping, it is necessary to ensure stakeholders' influence does not negatively impact the project and that sufficient trust is built among all parties (Filho et al., 2021; Novelli & Paoloni, 2022). Given these considerations, upcoming leaders need robust technical skills, people management, and business knowledge (Urbach et al., 2019).

DT Projects prefer agile methods like SCRUM over the waterfall (Corejova et al., 2020). Such projects often encounter time delays and budget overruns, requiring increased flexibility and adaptability (Baker, 2014). Utilizing agile methodologies overcomes these limitations, prioritizing prompt delivery for enhanced project efficiency (Baker, 2014).

Combined with technological transformation, the DT Project has a bigger impact on the business (Urbach & Ahlemann, 2019). Organizations must leverage digital technologies into strategies, transform work routines and processes, reimagine their business model, and align their value proposition (Legner et al., 2017). While a monthly or quarterly release cycle was once standard, DT Projects now require daily builds due to their structured processes (Urbach et al., 2019).

2.2. Implementation Strategy

Implementation strategy can be noted as a method through which we can boost the versatility, implementation, and sustainability of an innovation (Proctor et al., 2013). It was challenging to identify a suitable implementation strategy to reach our research objective. According to Mazza et al. (2013), when a research area has not been thoroughly reviewed, a scoping review helps establish a foundation for understanding the key aspects of that field. Subsequently, we decided to begin with a scoping review. Additionally, it is crucial to consider the experience and judgment of practitioners and researchers throughout the implementation of any specific strategies (Kirchner et al., 2023). Therefore, we decided to involve practitioners associated with DT Projects to further develop our strategy.

2.3. Taxonomy and its Validation Techniques

Before developing the taxonomy, we concentrated on evaluating its effectiveness in meeting the research objectives. Additionally, we explored the most appropriate validation technique for the taxonomy.

Taxonomy is referred to as an empirical and theoretical exploration of classification, encompassing its foundations, principles, procedures, rules, and identification (Bailey, 1994; Satava et al., 2003). It simplifies things for practitioners by giving them standard terms, consistent categories, and organized frameworks, simplifying understanding in a field (Dörr et al., 2023; Hermann et al., 2024; Setzke et al., 2020). Taxonomy helps focus on key dimensions in decision-making and avoids distractions (Pfister & Lehmann, 2023). Before initiating a project, practitioners can utilize the taxonomy to study past projects, gaining insights into their structures and the factors contributing to their success or failure (Setzke et al., 2020). It aids in structuring thoughts, analysis, and communication (Dickson et al., 2023). These factors highlight the effectiveness of the taxonomy in helping organizations understand key dimensions for implementing a Digital Transformation (DT) Project and facilitating knowledge exchange during and after the process. Developing a taxonomy appears to be a suitable approach to address the lack of a structured DT Project implementation strategy.

After recognizing its effectiveness, we focused on exploring different approaches to validate the taxonomy and identify the most suitable way for our needs. The predominant approach for validating taxonomies has been identified to be Semi-Structured Surveys. For example, some authors have performed interviews with domain experts (Jöhnk et al., 2017; Li et al., 2021), and others have administered surveys to individuals within their respective fields (Ahmed & Kassem, 2018; Almalki et al., 2017; Toda et al., 2019). In some instances, open-ended questionnaires were utilized as the sole method (Toda et al., 2019) or in conjunction with multiple-choice or closed-ended questionnaires (Almalki et al., 2017; Tett et al., 2000). The card sorting technique has also been observed as a method for capturing the perspectives of domain experts and users regarding the taxonomy, subsequently validating it (Haimson et al., 2021; Huber et al., 2023).

2.3.1 Card Sorting Technique

Among multiple approaches of taxonomy validation techniques, the card sorting technique seems suitable to initially collect the perspectives of domain experts (Haimson et al., 2021; Huber et al., 2023). Card sorting is an engaging research method to understand participants' comprehension and organization of concepts (Conrad et al., 2019; Nawaz, 2012). In qualitative analysis, the card sorting technique lets researchers examine conscious and subconscious thoughts but is more effective with fewer participants and limited time (Wood & Wood, 2008). The items in the card sorting method can be presented in two different ways: open and closed (Fincher & Tenenberg, 2005; Wood & Wood, 2008). Open card sorting lets participants freely group cards and name groups, ideal for early research without pre-analysis. Closed card sorting allows participants to organize cards into preset groups, often used for analysis validation (Fincher & Tenenberg, 2005; Wood & Wood, 2008). We opted for closed card sorting as we planned to frame the initial taxonomy beforehand through a scoping review, and the target was validating our already collected information.

2.3.2 Case Study Analysis

Case studies are often used to discover any unknown facts inductively or test any generated analysis deductively (Gammelgaard, 2017). In qualitative analysis, loosely structured case studies can have a greater impact according to the researcher's desire (Maxwell, 2008). When selecting cases, it is advisable to focus on the desired data sets rather than opting for an open approach (Gammelgaard, 2017). Maxwell (2008) identified three different ways to analyze case studies while falling into qualitative analysis. *Categorizing Strategies* involve coding data from case studies into structured categories. *Connecting Strategies* identify relationships among elements in texts. *Memos and Displays* emphasize data visibility and retrieval methods rather than analysis (Maxwell, 2008). The most reliable and legitimate method is the combination of *Categorizing Strategies* and *Connecting Strategies,* as it decreases the chance of missing an important vision (Maxwell, 2008). As a consequence, we went further to validate the taxonomy through this approach.

3. Research Methodology

While developing this taxonomy, we followed the method provided by Nickerson et al. (2013) which is highly acceptable and has been widely applied for the last five years in the domain of digital disruption (Szopinski et al., 2019). The taxonomy development by Jöhnk et al. (2017) and Fuchs et al. (2019) were also utilized.

This research has been designed in six steps. Firstly, we identified the research objective and target group. Our focus was on including practitioners actively engaged in DT Projects to gather their perspectives toward implementing such projects. Table 1 includes participants' roles in the industries. The participants were mostly top and mid-level employees of the respective organizations. Missing organization information is marked with "-". The table also shows their card-sorting session participation and associated cases. For some organizations, either case collection or card sorting was done. This sign "*" indicates that one of the two was not performed. While there was some overlap in data collection methods among organizations, we avoided participant overlap. Specifically, practitioners involved in card sorting were not included in the case study analysis and vice versa to prevent bias.

Table 1. Overview of the Participants

Card Sorting Session	Cases	Participants' role	Industry	Organization established	Number of Employees (2023)	Organizations' Revenue in € (2022)
1	6	a. Chief Operations Officer b. Chief Executive Officer	Educational Technology	2023	2	None
2	*	2 Project Coordinators	Business Consulting and Service	2014	150	~ 5 M
3	8, 9	a. Project Manager b. Deputy Project Manager	Computer Software	1969	4800	228.67M
4a, 4b	10, 11	4 Product Managers	Bank and Financial Service	2014	400	10B
*	1, 3	Managing Director	Consulting Business and Corporate Investment	2012	-	-
*	2	Project Consultant	Financial Service	2002	25	-
*	4	a. Chief Executive Officer b. Chief Technical Officer	Health Care Software Development	2007	22	8M
*	5	Project Manager	Business Consulting and Service	1995	800	1.39B
*	7	Project Coordinator	Digital Business Transformation and Consulting	1990	20000	1.19B

The taxonomy development process was done in three iterations. We began the first iteration through a conceptual-to-empirical approach. Due to a lack of research on DT Project characteristics, we conducted a scoping review to gauge the field's knowledge level. This review has been driven by the guidance of Munn et al. (2022) and Petres et al. (2020). We began the scoping review on June 11, 2022, utilizing Google Scholar. Therefore, only articles published before this date were included. From the review, we extracted the initial set of characteristics and their respective dimensions for taxonomy. After that, in the next iteration, our focus was to gather the feedback of experts on the previously defined dimensions and characteristics. For this purpose, we used a closed card sorting technique as it is commonly suggested to conduct validation of previously done analysis (Wood & Wood, 2008). To execute this approach, the guidance has been adapted from the work of Nurmuliani et al. (2004) and Fincher & Tenenberg (2005). Compiling the results from five groups and considering the common feedback, a few adjustments were made to the initial taxonomy. As the defined objective and subjective ending conditions were not met, we opted for the third iteration. During the third iteration, we performed an explorative, qualitative-empirical research approach by collecting case studies. The research of Jöhnk et al. (2017) and Fuchs et al. (2019) was a great help in analyzing those case studies by applying a categorizing strategy. The data collection took place from June 2023 to October 2023. After the third iteration, the taxonomy was revised again. By the end of this iteration, we were confident enough about meeting the subjective ending conditions and the objective ending conditions that were defined earlier. Therefore, no further analysis was done. To identify the relationship of the dimensions and characteristics among the collected case studies through connecting strategy, a cross-case analysis was also done at the end.

The summary of the steps integrated into the research design of this paper is presented in Table 2.

Table 2. Elaborated Research Design

Phase 1: Setting Research Objective	▪ Research Objective: to develop and validate a taxonomy aimed at helping organizations shape their implementation strategies for DT Projects. ▪ Target group was defined to be the practitioners who are engaged in DT Projects.
Phase 2: Planning	▪ The meta characteristics of this taxonomy are intended to confine the characteristics of DT Projects during the implementation phase and help to define the strategic move in the early stage. Consequently, the meta-characteristic was structured as *"Implementation Strategies of Digital Transformation Project"*. ▪ Objective Ending questions: a) Each characteristic possesses uniqueness within its respective dimension, b) Each dimension and characteristic is distinct and not replicated, c) No characteristic was combined or divided in the final iteration and d) The characteristics in the dimensions need to be mutually exclusive and collectively exhaustive. ▪ Subjective Ending questions: The taxonomy needs to be concise, robust, comprehensive, extendible, and explanatory.
Phase 3: Gathering data from articles through Scoping review	▪ Keyword-based Searching: Digital Transformation Project, Digital Transformation, Digitalization Project, Digitalization, Digitalisation Project, Digitalisation, Digitization Project, Digitization, Digitisation Project, and Digitisation. ▪ 528 articles were included by incorporating all articles found for each keyword up to the 6th page.

	▪ Screening Process: o Five steps screening. o Included only peer-reviewed articles in the English language which were relevant to the research objective. o Ended up sorting with having 29 relative articles. ▪ Quality Assessment: cross-checked the process of screening and went through the selected articles thrice to validate the collected dataset from those articles. ▪ The initial set of characteristics with their dimension was gained from this scoping review.
Phase 4: Validating taxonomy by applying Card-Sorting technique	▪ Intention to gather the thoughts of experts under the defined dimensions and characteristics of the taxonomy. ▪ Participants: Ten participants from four different organizations in Germany. ▪ Platform: Miro. ▪ Card Sorting Sessions' Structure: o 13 fixed cards representing the dimensions and 31 free cards representing the characteristics of the taxonomy. o 45-minute sessions with groups of 2 people. ▪ Combining five different scenarios from the sessions and the feedback from the participants, resulted in modifying the earlier taxonomy.
Phase 5: Validating Taxonomy by Case Study Analysis	▪ Intention: to assess whether the dimensions and characteristics of the taxonomy align with the perspectives of professionals. ▪ Case Criteria: DT Projects which are ongoing or finished from start-ups to established companies to keep variation in industries. ▪ Steps of Case Analysis: o A set of questionnaires based on the characteristics of DT projects was sent out to the participants in the form of a template. o Arranged 30-minute online sessions with each participant to describe the purpose of the research and the case collection along with describing the questionnaires. In case of groups of 2 people, we allocated 45-minute sessions. o At least 1 week time was provided to fill out the template after the sessions. ▪ Collected Case Study Sample: Eleven case studies from eight organizations. ▪ Open coding of the collected cases led to refining the taxonomy.
Phase 6: Cross Case Analysis	▪ Conducting a cross-case analysis in a variable-centred approach. ▪ Observing and identifying the connections among the cases based on the taxonomy.

4. Gathering Data through Scoping Review

In the first iteration of taxonomy development, a scoping review was done to find out the dimensions and their characteristics concerning the implementation of DT Projects. As a consequence, the dimensions and characteristics mentioned here were progressively discovered while conducting the review from the perspective of the selected articles. In Table 3, each dimension of the DT Project will be elaborated along with their characteristics against their literature background.

Table 3. Reflection of scoping review in DT Project dimensions

Dimensions	Results from the scoping review
Project Objective	We aimed to discover why organizations implement DT Projects. *Business Re-invention,* as a reason for implementation was observed in 69 organizations reinventing products, business models, and processes to impact the economic environment (Effah & Nuhu, 2017; Ivančić et al., 2019; Rossato & Castellani, 2020; Zoppelletto et al., 2020). According to 13 articles, organizations aimed to improve their processes' *performance*. The intent behind this, varied from multiple perspectives., e.g., building a new business model (Elg et al., 2021), bringing digital products and services (Almeida et al., 2020), improving process quality (Hagberg et al., 2016) etc.
Project Drivers	In this scoping review, project drivers are identified as primary catalysts essential for project execution. In terms of *organizational/business value*, it encompasses all the values that contribute to the overall vitality and prosperity of the firm in the long run (Effah & Nuhu, 2017; Hagberg & Jonsson, 2022). *Innovation* indicates the urge to create value with new products, processes, or business models (Rachinger et al., 2018; Rossato & Castellani, 2020). In the realm of *digital technology*, the project's fundamental objective is to integrate web technologies into the equation (Björkdahl, 2020; Heberle et al., 2017; Pagán Ruiz, 2014).
Project Initiators	Project initiation refers to the focus on a broader organization or small unit while initiating the project planning (Daradkah et al., 2018). We discovered two distinct parts of process initiation: *top-down* and *bottom-up*. 27.5% of the articles have shared that initiation was done according to one of those approaches. For example, a top-down approach was seen in (Effah & Nuhu, 2017; Elg et al., 2021; Rossato & Castellani, 2020). On the other hand, the bottom-up approach has been noticed by (Hafseld et al., 2021, 2022; Ivanǎćet al., 2019).
Project Triggering Factors	Two distinctive types of project-triggering factors were discovered from the scoping review; one referring to *internal* factors focusing on organizational or business issues (Effah & Nuhu, 2017; Ivanǎćet al., 2019; Rowbottom et al., 2021) and another referring to *external* factors focusing on technology and market-related aspects (Branca et al., 2020; Caputo et al., 2021; Pagán Ruiz, 2014; Ulas, 2019). In some cases, DT projects were driven by both business improvements and evolving customer needs and technological advancements (Kraus et al., 2021; Tung et al., 2020; Zoppelletto et al., 2020).
Organizational View	When adopting a project, a significant consideration is the *temporary organizational view* (Turner & Müller, 2003). In the scoping review, 70.4% of organizations were observed to begin DT projects as temporary organizational views (Hafseld et al., 2021, 2022; Kraus et al., 2021; Tung et al., 2020).
Nature of Project Novelty	After scrutinizing the articles used in this scoping review on DT Project initiation or transformation, two clear groups were identified. One of these refers to enhancing or modifying organizational processes, termed *novel to the organization* (Cijan et al., 2019; Legner et al., 2017; Ulas, 2019; Verhoef et al., 2021). Another one refers to the target market indicated as *novel to market* (Almeida et al., 2020; Branca et al., 2020; Jovanović et al., 2018; Mergel et al., 2019). Additionally, 24.1% of the articles concentrated on

Dimensions	Results from the scoping review
	meeting the needs of both the target market and the organization simultaneously (Hagberg & Jonsson, 2022; Kuusisto, 2017; Zoppelletto et al., 2020).
Innovation Area	When initiating a project, it is typical to pinpoint a specific area of focus known as the 'Innovation Area,' categorized into *product, process, service, and business model* dimensions. (Barthel & Hess, 2019). From the scoping review, we found that organizations mainly prioritize process as their chosen innovation area, with six articles exclusively using DT Projects to introduce diversity into their processes. (Effah & Nuhu, 2017; Rossato & Castellani, 2020; Tung et al., 2020). Service is the second most favored area, as indicated by three articles that specifically selected it (Hafseld et al., 2021, 2022; Holley, 2004). Fourteen articles notably combined services with one or two other innovation areas (Almeida et al., 2020; Hagberg et al., 2016; Hagberg & Jonsson, 2022).
Team Autonomy	Building a successful team involves strategically aligning autonomy and structure with the project's requirements (Zainal et al., 2020). The teams mentioned in the selected articles were seen to have two significant types. Most of the articles from the scoping review discussing team autonomy have highlighted having *low autonomy* during their project (Elg et al., 2021; Heberle et al., 2017; Rowbottom et al., 2021). Only one article (Hafseld et al., 2021) indicated the importance of maintaining a fully autonomous team with *high autonomy*.
Team Formation	Regarding team formation, the goal was to determine whether project teams adhere to interdisciplinary patterns including technical and business departments, or only members from a single department. Consequently, the characteristics of this dimension were named *interdisciplinary team* and *team with only specific discipline people*. The study indicates that the initial formation style is more commonly preferred in assembling a project team (Elg et al., 2021; Hagberg & Jonsson, 2022; Ivanǎćet al., 2019; Zoppelletto et al., 2020).
Leader of DT	A diverse range of leadership styles were discussed in the scoping review. Some articles uttered of having *specific leaders for DT* (Hafseld et al., 2021; Heberle et al., 2017; Riedl et al., 2017; Ulas, 2019). It was observed that in Hafseld et al. (2022) and Hafseld et al. (2021) researchers discovered that despite assigning a designated leader, there was a tendency to follow the guidance of the *project manager* in executing DT projects.
Expertise of Project Members	In establishing a proficient team, incorporating expertise related to the subject matter is a key necessity (Guinan et al., 2019). Having only *external* expertise was not a familiar aspect of the articles as combining internal expertise from different areas is typically easier due to their familiarity with each other and the organizational culture (Effah & Nuhu, 2017; Legner et al., 2017; Rachinger et al., 2018; Rowbottom et al., 2021). Exceptionally, Ivanǎć et al., (2019) have portrayed a project team including only *internal* experts.
Project Management Method	Choosing a suitable project management methodology works as a crucial element in the way to ensure project success by avoiding project risk (Salameh, 2014). Therefore, the reflections of this element were expected to be more visible in the data set. Surprisingly, only two articles have directly addressed this aspect. Those were focused on the design thinking process (Hafseld et al., 2021, 2022) which is widely known as an *agile* iterative process (Panke, 2019).
Project Acceptance	When considering the adoption of a new project structure, it becomes crucial to assess the team's and market acceptance percentage and implement measures to reinforce acceptance. A significant majority (72.4%) of the chosen articles have placed a strong emphasis on enhancing project acceptance within organizations (Ivanǎćet al., 2019; Kraus et al., 2021; Tung et al., 2020). This highlights the significance attributed to this critical success factor in the initiation or transformation of DT Projects.

5. Validating Taxonomy by applying Closed Card Sorting

This iteration continued with the card sorting technique. Five sessions with 10 people from various organizations resulted in five different taxonomy views. We used a Google Sheet to analyze how practitioners' views look compared to the previously built taxonomy. The result of this iteration is demonstrated in Figure 1. If all 10 practitioners chose a characteristic under the same dimension, it shows 100%. If six chose it, it shows 60%. These percentages indicated how practitioners' thoughts match the initial taxonomy.

Implementation Strategies	Project Dimensions												
	Project Objective	Project Driver	Project Initiators	Project Triggering Factors	Organizational View	Nature of Project Novelty	Innovation Area	Team Autonomy	Team Formation	Leader of DT	Expertise of Project Members	Project Management Method	Project Acceptance
Performance Improvement	60.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%
Business Re-invention	80.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Business Value	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%
Innovation	80.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Digital Technilogy	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Top-down	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bottom-up	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hybrid	0.00%	0.00%	0.00%	40.00%	20.00%	0.00%	20.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Internal	0.00%	0.00%	0.00%	60.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%
External	0.00%	0.00%	0.00%	60.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	40.00%	0.00%	0.00%
Non-temporary	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Temporary	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Towards Market	0.00%	0.00%	0.00%	20.00%	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Towards Organization	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%
Product	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Process	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Business Model	0.00%	20.00%	0.00%	20.00%	0.00%	0.00%	60.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Service	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
High Autonomy	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Low Autonomy	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Interdisciplinary Team	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Team with only specific discipline people	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Specific Leader for DT	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Project Manager	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	80.00%	0.00%	0.00%	0.00%
Full Internally sourced	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	80.00%	0.00%	0.00%
Mixed with internal and external personnal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	40.00%	0.00%	60.00%	0.00%	0.00%
Agile	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Traditional	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Hybrid	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	80.00%	0.00%
Inside Organization	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	60.00%
End Customer	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%

Fig. 1. Result of Card Sorting Sessions

With 10 participants, the place for a characteristic was considered final if its cell number showed 60% or above, indicating a vote from at least half the participants. In this way, we intended to determine the degree of alignment among the dimensions and the characteristics (Righi et al., 2013). Figure 1 shows the final destinations for characteristics in green cells. We adjusted the initial taxonomy based on this iteration.

First, 80% of the participants thought that the characteristic *Innovation* is suitable to be in the dimension of the “Project Objective”. In the previous iteration, a similar characteristic named *Business Re-invention* existed in the same dimension. During feedback, practitioners were asked why they chose *Innovation* for "Project Objective" instead of *Business Re-invention*. The consensus was that *Innovation* was more easily understood than the latter term and seemed suitable. On the contrary, the terminology *Business Reinvention* was not easy to understand and confusing. Due to clarity and practitioners’ preference, *Innovation* was reclassified from "Project Driver" to "Project Objective". Secondly, 80% of practitioners agreed on the characteristics of the "Project Acceptance" dimension. However, they collectively suggested consolidating both *internal* and *external* customers into a single characteristic named *End User* to better reflect project scenarios. As a result, the "Project Acceptance" dimension now includes only the *End User* characteristic in this iteration.

6. Validating Taxonomy by Case Study Analysis

Using a pre-defined template and individual sessions, insights were gathered from each case through open coding. Table 4 demonstrates the application of the developed taxonomy in each case.

Table 4. Collected Cases' Descriptions

Case No	Industries	Case Descriptions
1	*Consulting Business and Corporate Investment*	This was a digital business case that demanded new competencies. The *goal* of this project was to implement a new *business model* that complements existing plant products with a data-driven monitoring system. Through this project, they planned to build a *digital* extension in the form of a digital data model without which *the organization* can face a high level of disruption in the future. With time the transparency and acceptance of the new business model were significantly increased by the *employees*. The starting point for *initiating* this project was in the company's lean management where they wanted to add some *business value* to the company. They followed *classical project management* to design a target action plan and the distribution of roles and responsibilities. The project team was *formed* with three project managers from lean management and one human resource manager. They also took three consultants from *external parties* in their team to help in moderation and process management.
2	*Financial Service*	Like Case 1, this project was also driven by *business value* and *digital technology*. This specific case relates to developing a new technology/tool that will fit into the company's digital transformation strategy. The main *objective* of the project is the generation of a new analytical tool with additional intelligence (AI) on the data generated in the monitoring of web traffic through artificial intelligence. The project has a direct *impact* on the company by increasing competency and being a source of higher turnover when the final product is developed. The *employees' motivation* was necessary to accept the change coming with the project to ensure a stable workspace. The project was run by eight people including the *internal* and *outsourced* team. The organizational structure of the project followed the *balanced matrix organization structure* adapted for this. Thus, obtaining optimum coordination between agents and better dissemination of horizontal and vertical information was easy to handle. In this way, the final decision-making also does not fall exclusively into the hands of the *project manager*. Seeking to ensure fast project implementation they have applied *agile* project methodology which involves constant collaboration with the project partners.
3	*Consulting Business and Corporate Investment*	In this case, the organization planned to run the specific project to make their "discovering hidden talent" task more organized and *digitalized*. Through this project, they targeted to take competence management *inside the organization* to the next level by making training measures more efficient; digitally uncovering hidden talents, and documenting those qualifications comprehensively to make them easily searchable. They also aimed to increase *employee attractiveness* and staff retention rate. They opted to initiate this project to keep pace with the rapidly changing world, enhance their *customer service,* and increase the turnover consequently. At the beginning of this project, the idea and goal of this project were briefly discussed with the training provider, in the presence of the business consultant and the supervisor of the software. Through this phase, the *management* agreed on developing the competencies jointly and paving a single way for those through a competence management software system. To fulfill the mentioned goal above, they formed an *agile* project *team* including a business consultant, a person from human resources who is a part of the training providing program, and a supervisor from IT support who knows software. They decided to have a *non-hierarchical team* to provide

Case No	Industries	Case Descriptions
		the *maximum degree of opportunity* to manage work. This decision worked very well for them to act more quickly to reach the desired common goal.
4	*Health Care Software Development*	During the pandemic due to COVID-19, many companies went for remote working to keep up their business. This project was initiated in one of those companies. The *goal* of this project was to help create a working environment in the *employees'* homes and overcome the data security challenges on the part of the organization at the same time. Dedicated resources as well as the IT *team*, supported by the *management*, was the efficient combination for the digital transformation in this project. The readiness to accept the change both from the *employee and the organizational side*, was the main consideration in the way of the project's success. They implemented new practices to achieve *business* growth and meet *customer* needs. The organization chose to drive the project according to the *Scrum* method. The project team was formed with *internal expertise*, all holding the same role as the process owner. It was a cross-functional team where all the members worked collaboratively to reach a common goal. The team was kept as a self-managed team by providing the *highest autonomy* while keeping a good connection among all.
5	*Business Consulting and Service*	This is the first case that seems to have been an objective towards *innovation* driven by *business value* and *digital technology*. The goal was to align IT more closely with *customer needs* and create end-to-end responsibility for IT while ensuring operational stability during the transformation phase. They wanted to *improve their performa*nce by implementing a *new operating model* considering there could be challenges and complexities. Given the complexity and scope of the project, the team was formed with decision-ready participants from IT, business, HR, and finance and they followed an *iterative approach*. Different *internal* employees led the project occasionally to make them adjust with the targeted customer. Help from *external* consultants was also taken when needed. The first level of *leadership* in IT has been the core team. The project had seen to have a direct impact on both *inside and outside* the organization and improving their customer service. They expected to improve consistency in *business development* and better alignment with customer needs.
6	*Educational Technology*	This DT Project was aimed at relaunching their AI companion with three *new* primary features. The idea was not to merely *digitalize* the already existing career guidance, but rather to *reimagine* the way Gen Zs imagine careers. They are combining human efficiency with Artificial Intelligence to power up this disruption. This project is fully intended to fill up the *desire of the market*. The project was initiated through a *bottom-up* approach. As a small company, they kept the project *team* small with 4 people maintaining a *non-hierarchical* structure to avoid complexity. One backend developer, one frontend developer, one product owner, and one designer were involved, and they changed roles if needed. Though the team did not follow any methodology strictly, some part of *Agile* was adopted.
7	*Digital Business Transformation and Consultancy*	This project has a partial intention to improve their website, which is their *product*, through their shared DT project. The goal of this DT project was to *update* the layout of their website so that *people* can directly order cars online. Utilizing the project, they targeted to catch the attention of *potential customer* groups and increase their online sales. This project was initiated through a top-down approach. The project team involved nearly 40 people including creative, social media, copywriting, and product managers. The team followed *agile methodology* to carry on their task though they had *mid* autonomy. To them, the most important things were fast delivery and keeping in a continuous feedback loop with clients. This project had the intention to serve the *organizational work structure* by rearranging their team setup according to the different workstreams of their products.

Case No	Industries	Case Descriptions
8	*Computer Software*	This case is collected from a German multinational software organization. The main *aim* of this DT Project was to *enhance* and streamline the procurement *processes* within *their organization*. During the annual health check, the *audit team* noticed that the cost of the procurement department was going higher. Consequently, the organization needed to control the process and decrease the cost. To accomplish the project, a *team* was formed with 9 people from 2 different departments. Of them, four were *external* people. The team was a combination of project manager, project portfolio reviewer, and business analyst with 2 stakeholders from other business units. It was a fully *autonomous* team *led* by a defined *project manager*. According to the company's normal structure, the project started its journey through *traditional or waterfall methods*.
9	*Computer Software*	This case has been collected from the same organization as Case 8. The ultimate *objective* of this DT project was to *automate* every step of deployments from the hardened operating system to the application including all necessary configurations. With this, the organization wanted to ensure *business continuity* and save valuable IT resources. Together with that, they wanted to implement a collaboration approach between *information technology* and business units to enable valuable contributions towards their other project. The project *team* was created with 5 people from *multiple* departments. They did not have a *specific leader* as a result whenever anyone needed guidance the other members had reached out to help. This indicates practicing *shared leadership*. Like the previous case, this was also maintained by the *traditional or waterfall project* management method. The initiation of this case was on purpose to bring some changes in the set-up of the *GitHub tooling process*. It will eventually help to migrate repositories to GitHub, implement monitoring dashboards to observe those, and set alerts in case any hamper goes on.
10	*Financial Technology*	The project was meant to serve the *internal customer*, which means the employees of the organization. They wanted to provide a user-friendly platform for booking desks and rooms in the office, where users could also see where the booked resource is in the office. The plan was to make the booking *process* easier and *comfortable*. The project *team* has been formed including three Software Engineers, a Software Developer, a Product Manager, and two Designers. The idea for this project was generated by one of the *software engineers*. Hence, the engineer and the product manager were *leading* the project. They had quite a lot of *autonomy* since this was an internal project. The team followed the *agile methodology*, especially the reflex of the scrum, to run this project. They had been doing their work through sprints. This is an ongoing project where the team is making new additions to their web *service* according to the demand.
11	*Financial Technology*	The *objective* of this DT project is to reach a broader *target group* and leverage a large customer base of *their partner*. They want to improve both their *product* and *process* to reach the goal. To enhance the product, their strategy involves constructing a new, integrated interface, incorporating new features that are frequently requested by *customers,* and leveraging business growth. To conduct the project, a *team* was formed with 10 people from the *product department* and 20 from *the engineering* from *internal* and *partner* organizations. This project was *led* by the product people and C-level by practicing the *shared leadership* method. The idea of *initiating* the project and the direction to run the project comes from company leadership, founders, and C-level executives. Therefore, it has a *mid-level* of autonomy. The team chose to follow the path guided by *agile* methodology.

After the open coding, we adjusted the taxonomy according to the analysis. Firstly, none of the cases mentioned the "Organizational View" dimension. Therefore, we opted to exclude this dimension from the taxonomy. Secondly, we removed the characteristic *Team with only specific discipline people* from the "Team Formation" dimension as it did not appear in any of the cases. Thirdly, we considered excluding *Hybrid* from the "Project Initiators" and "Project Management Method" dimensions, as it was not mentioned in any of the reviewed cases. Fourthly, a new characteristic *Shared Leadership* has been added to the dimension "Leaders of DT" as nearly 36% of the cases mentioned it. Lastly, *Mid Autonomy* was added to the "Team Autonomy" dimension, reflecting its presence in nearly 20% of the cases. Considering all those adjustments, we finally came up with the taxonomy demonstrated in Figure 2.

Dimensions	***Implementation Strategies***			
Project Objective	Innovation		Performance Improvement	
Project Driver	Business Value		Digital Technology	
Project Initiators	Top-down		Bottom-up	
Project Triggering Factors	Internal		External	
Nature of Project Novelty	Towards Market		Towards Organization	
Innovation Area	Product	Process	Business Model	Service
Team Autonomy	High Autonomy	Mid Autonomy	Low Autonomy	
Team Formation	Interdisciplinary Team			
Leader of DT	Specific Leaders for DT	Project Manager	Shared Leadership	
Experise of Project Members	Full internally sourced		Mixed with internal and external personnel	
Project Management Method	Traditional		Agile	
Project Acceptance	End Users			

Fig. 2. The Final Taxonomy for DT Projects Implementation Strategy

Considering the dimensions and characteristics of the third iteration in Figure 2, we can say that the taxonomy is concise, distinctive, extendible, self-explanatory and comprehensive. The dimensions are mutually exclusive and collectively exhaustive, and the characteristics are unique. None of the dimensions was merged or split during the third iteration. As the taxonomy from the third iteration met all the defined conditions guided by Nickerson et al. (2013), we concluded the taxonomy development process and articulated it finally. Figure 3 shows the adjustments made in each iteration.

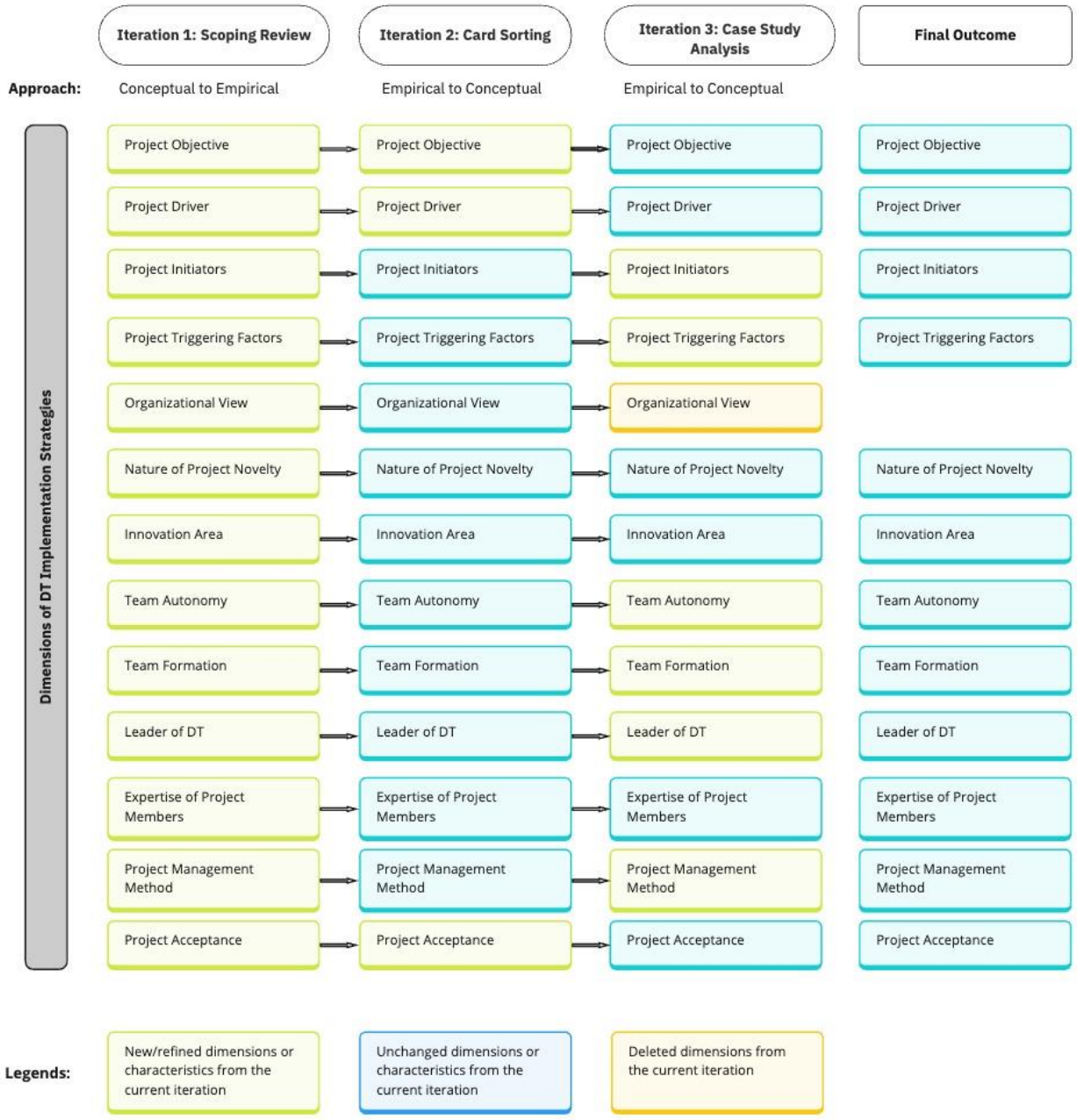

Fig. 3. Taxonomy Development Flow (diagram is inspired by (Hermann et al., 2024; Remane et al., 2016))

7. Cross Case Analysis

7.1. Project Objective with their innovation focus area

The primary objective of all cases is seen to be improving organizational performance from various product, process, service, or business model perspectives. While cases 1, 2, 6, 7, and 11 focus on product enhancement and innovation, cases 3, 4, 7, and 9 aim to improve the work environment through digitalization. Besides, cases 5, 8, 10, and 11 emphasize process improvement via new business models, automation, or new functionalities. Only a few (i.e., cases 6 and 10) seek product innovation alongside performance improvement.

The cases are seen to be creating novelty either towards the organization or market or both. In the case of organization novelty, the cases wanted to either optimize their work processes (cases 2, 8), ensure business growth continuity (case 4), or ease employees' lives (case 10). Nearly half of the collected cases (i.e., cases 1, 3, 5, 7, 11) have aimed to influence both the organization and the market through their DT Projects, enhancing product, process, and business model, while attracting and retaining customers.

7.2. Project Origin

Originating projects indicate three dimensions described in this taxonomy. For steering DT projects, all cases except case 10 considered both business value and digital technology. Case 10 focused solely on simplifying employees' daily activities. In other cases, the organizations initiated to elevate their business value by integrating digital technology into business models (cases 1, 5), products (cases 2, 6, 7, 11), work structures (cases 3, 4), or processes (cases 8, 9).

Project initiation can flow from general to specific aspects or vice versa. Among eleven cases, four DT Projects followed a bottom-up approach, initiated by lean management (case 1), project team members (cases 6, 10), and procurement management (case 8). In contrast, cases 3, 4, and 11 indicate project initiation from the top management level, later branching into specific sector-focused enhancements.

Concerning the origin of the projects, the cases differ in considering from which sector the project was triggered; internal or external. Five cases were triggered solely by organizational internal issues: improving business value (cases 1, 2), enhancing processes (cases 8, 9), and improving work-life balance (case 10). Cases 5-7 have solely focused on bringing value to external factors through their DT Projects being triggered by the target market. Conversely, DT Projects in three instances (cases 3, 4, 11) have been instigated by a combination of internal and external factors, considering business operations and expansion; and customer satisfaction.

7.3. Project Resource Planning

Project team resources or expertise were mixed with internal and external (i.e., consultants, support engineers, students) personnel in cases 1, 2, 3, 8, and 11; and fully internally sourced in the rest of the cases. Incorporating internal resources into the project team, organizations in ten cases have opted to construct an interdisciplinary team. The personnel related to information technology (IT) has been commonly included in each case. Software developers, software designers, software engineers, business analysts, product managers, and project managers were commonly included in those cases. Along with them people from other departments, such as human resources (cases 1, 3, and 5), creative, social media, and copywriting (case 7), were noticed to be included occasionally.

Team autonomy has not been discussed in two cases. In the remaining cases, seven teams were highly autonomous, with only two having a mid-level of autonomy differing from the majority. Subsequently, selecting leaders for those project teams diverge significantly. Project Managers have been seen to be in the leading role for cases 2 and 8. Cases 5 and 10 indicate having multiple specific leaders throughout their projects, each fulfilling specific roles as needed. Surprisingly, four cases (3, 6, 9, and 11) have uttered of having no specific leaders during their project life duration.

7.4. Project Management and Acceptance

While implementing DT Projects, the cases have considered either traditional waterfall project management or agile project management. The projects explored in cases 2-7, 10, and 11 extensively focused on the adoption of agile methodology. Only three cases (cases 1, 8, and 9) emphasized the projects based on traditional project management. No traces of hybrid project management, combining traditional and agile methods, were observed in these cases.

Project acceptance has been considered a factor in all the cases while implementing DT projects. In most cases, employee acceptance was crucial for ensuring project stability (cases 1, 2, 4, 6, 8-10), maintaining motivation and support (case 3), retaining employees (case 5), and improving partner relations (case 11). Alongside gaining employee approval, cases 4, 6, 7, and 11 also considered customer acceptance of the project.

A summary of this cross-case analysis can be found in Figure 4.

Dimension	**Case 1**	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**	**Case 9**	**Case 10**	**Case 11**
Project Objective	Performance Improvement	Performance Improvement	Performance Improvement	Performance Improvement	Performance Improvement	Performance Improvement, Innovation	Performance Improvement	Performance Improvement	Performance Improvement	Performance Improvement, Innovation	Performance Improvement
Project Driver	Business Value, Digital Technology	Business Value, Digital Technology	Business Value, Digital Technology	Business Value, Digital Technology	Business Value, Digital Technology	Business Value, Digital Technology	Business Value, Digital Technology	Business Value	Business Value, Digital Technology	Digital Technology	Business Value, Digital Technology
Project Initiators	Bottom-up	-	Top-down	Top-down	-	Bottom-up	-	Bottom-up	-	Bottom-up	Top-down
Project Triggering Factors	Internal	Internal	Internal, External	Internal, External	External	External	External	Internal	Internal	Internal	Internal, External
Organizational View	-	-	-	-	-	-	-	-	-	-	-
Nature of Project Novelty	Towards Market, Towards Organization	Towards Organization	Towards Market, Towards Organization	Towards Organization	Towards Market, Towards Organization	Towards Market	Towards Market, Towards Organization	Towards Organization	Towards Organization	Towards Organization	Towards Market, Towards Organization
Innovation Area	Product Business Model	Product	Process	Process, Service	Process, Service, Business Model	Product, Service	Product, Process, Service	Process, Service	Process, Service	Process, Service	Product, Process, Service
Team Autonomy	-	High	High	High	-	High	Mid	High	High	High	Mid
Team Formation	Interdisciplinary Team	-	Interdisciplinary Team	Interdisciplinary Team	Interdisciplinary Team	Interdisciplinary Team	Interdisciplinary Team	Interdisciplinary Team	Interdisciplinary Team	Interdisciplinary Team	Interdisciplinary Team
Leader of DT	-	Project Manager	Shared Leadership	-	Specific Leaders for DT	Shared Leadership	-	Project Manager	Shared Leadership	Specific Leaders for DT	Shared Leadership
Expertise of Project Members	Mixed with Internal and External Personnel	Mixed with Internal and External Personnel	Mixed with Internal and External Personnel	Fully Internally Sourced	Fully Internally Sourced	Fully Internally Sourced	Fully Internally Sourced	Mixed with Internal and External Personnel	-	Fully Internally Sourced	Mixed with Internal and External Personnel
Project Management Method	Traditional	Agile	Agile	Agile	Agile	Agile	Agile	Traditional	Traditional	Agile	Agile
Project Acceptance	End User	End User	End User	End User	End User	End User	End User	End User	End User	End User	End User

Fig. 4. Cross Case Analysis

8. Implications

This study focuses on defining key dimensions for implementing DT projects, resulting in a taxonomy shown in Figure 2. It has exclusively concentrated on capturing the attributes of DT projects and the organizational perspective related to this particular project type. Consequently, The taxonomy reflects this focus, omitting aspects like complexity, uncertainty, expertise level, and project duration typically found in conventional project management models (Abdulhafedh, 2021).

In this section, potential contextual factors will be discussed based on the analysis conducted in each step of taxonomy development and cross-case analysis. Given the limited number of cases in this study, definitive empirical statements are not possible, so the discussion will focus on speculative insights into these contextual factors.

8.1. Guidance to Implement DT Projects

Individual DT Projects have seen to gain success with their defined organizational goal though they differed from each other from some perspective. Thus, it can be assumed that there is no certain frame that can make a DT project successful. It varies from project to project. Accordingly, it can be difficult to have one way to describe the way to implement such projects. Using classification i.e. taxonomy can be a better approach which leads us to develop one.

8.2. Dimensions and Characteristics for DT Project Implementation Clustering

Practitioners' participation in the card sorting technique shows familiarity with the dimensions and characteristics included in this taxonomy. Despite lacking a defined structure for implementing DT Projects, they continuously apply these concepts and achieve success with their methods. This highlights the relevance of the taxonomy's dimensions and characteristics for successful DT Project implementation.

8.3. Understanding the situation to implement DT Projects

It was observed that DT Projects are predominantly executed to achieve performance improvement in the organization's products, processes, services, or business models. Mature companies emphasize innovation less, while start-ups and growing companies embrace risk for stability (Lippitt & Schmidt, 1967). This factor creates opportunities to introduce innovation through their initiated projects. Business value is found to be the most defined catalyst for DT Projects. This indicates companies implement DT projects for long-term financial growth and better project performance. Digital technology is also a commonly recognized motivator though the project's drive isn't always solely from technological advancement. On another note, DT projects are initiated equally through top-down and bottom-up approaches, indicating both are viable depending on project needs.

8.4. Independence of Targeted Domains in DT Project Implementation

The project objective involves enhancing or innovating products, processes, services, or business models within an organization. Strategically, during the implementation of the DT project, this dimension remains fully independent. By defining project goals, companies choose areas for innovation or improvement, thus delineating the project's innovation domain.

8.5. The environment-oriented with DT project implementation

The project's initiators and its intended beneficiaries are closely connected. Projects initiated by internal needs aim for organizational novelty, while external triggers focus on the target market. Nevertheless, it is observed that in some instances, the project goal may be oriented to meet both the organization's and the customer's requirements, irrespective of whether the trigger point is internal or external. The dimension of project acceptance is seen to be highly related to the dimension of project novelty. It indicates that the project's acceptance often hinges on those for whom the goal is intended).

8.6. Formation of teams for DT Projects

DT project discussions often focus on team characteristics, with organizations typically preferring interdisciplinary teams of internal and external employees Interdisciplinary team helps to have cross-functional knowledge which serves as a reasonable cause to have one. Including internal and external expertise enhances the opportunity to gather valuable knowledge, regardless of its availability within the organization. Considering team autonomy, most analyzed cases favor high team autonomy and a non-hierarchical structure. To sustain collaboration and ensure collective output, projects are mostly led by managers or designated leaders. On the contrary, DT Projects are also seen to be operated without a designated leader, with team members assuming leadership roles based on their expertise and project needs.

8.7. Preferred Project Management method in implementing DT Projects

Companies often opt for variations of agile methodologies when implementing DT projects. However, companies that have consistently used the traditional or waterfall approach tend to stick with it and succeed in their DT projects. This implies that while agile is preferred for DT projects, alternative approaches do not pose obstacles for organizations.

In summary, implementing DT projects varies based on internal and external contextual factors such as organizational structure, culture, target market, available competence, maturity level, and so on.

9. Conclusion and Contributions

In this research, we uncovered and classified DT Project implementation strategies into twelve distinct dimensions within the taxonomy based on insights from scholars and professionals. These dimensions encapsulate the key dimensions of DT Projects, including:

1. Project objective: The goals intended to be achieved.
2. Project driver: The primary force propelling the project forward.
3. Project initiators: The origins of project ideation.
4. Project triggering factors: The motivations for undertaking the project.
5. Nature of project novelty: The intended beneficiaries of the project.
6. Innovation area: The specific focus areas targeted for innovation.
7. Team autonomy: The degree of independence granted to the project team.
8. Team formation: The strategy for organizing the project team.
9. Leader of DT: The appointed project leadership.
10. Expertise of project members: The composition and skill set of the project team.
11. Project management method: The optimal methodology for managing the project.
12. Project acceptance: The critical stakeholders for project approval.

By adopting a standardized classification, this taxonomy seeks to enhance clarity and precision in discussing DT Project implementation strategies among DT Project practitioners and academic researchers. For instance, terms like "agile implementation," "shared leadership," or "innovation areas" may be interpreted differently. What exactly does adopting an "agile implementation" strategy mean? By referring to this taxonomy, stakeholders can understand these terms, facilitating enhancing communication about project strategies.

Moreover, this structured approach aims to improve information exchange about DT strategies. Often, communication fails due to vague terminology. It's anticipated that this taxonomy will enable meaningful exchanges about digital transformation projects, strategies, and lessons learned, fostering coherence and productivity.

The taxonomy's dimensions are mutually exclusive and collectively exhaustive, meaning they are distinct yet comprehensive. A combination of characteristics from each dimension can guide the implementation of a Digital Transformation (DT) project. These dimensions serve as a starting point for considering key elements, such as the project's objective or driver. By answering questions like *"What is the intended goal to achieve in this DT Project?"* or *"What is the motivation of undertaking the project?"*, organizations can select relevant characteristics from the taxonomy to form an initial set of strategies, helping to guide the next steps in the DT project's implementation.

The taxonomy was validated through a rigorous three-iteration process, engaging practitioners from a variety of organizations. Our case studies confirmed the dimensions' presence and importance, validating the taxonomy and its role in successful DT projects.

In the cross-case analysis, we found that organizations mostly initiate a DT Project to improve and digitalize their existing products, processes, services, or business models and add business value for the organization, target market, or both.

DT Project teams are highly autonomous and agile, comprising both external and internal personnel from various departments. Besides, the outlined contextual factors offer a roadmap for understanding and implementing DT projects. Reviewing the shared cases will provide insights into potential implementation challenges and study implications.

9.1. Limitations

While conducting this study, we faced some limitations. For the scoping review, we only used Google Scholar, potentially missing relevant articles from other search engines. However, the initial inclusion had many articles, minimizing the limitation. In the empirical study, we focused on German organizations, which may differ from those outside Germany due to contextual factors. Another limitation is the sample size of 11 cases, which may affect the final stage of taxonomy development. Increasing the sample size can strengthen research results (Dolnicar et al., 2014), providing a focus for future studies.

9.2. Future Research Suggestions

The developed taxonomy can aid DT Projects in various industries, whether startup or established, as demonstrated in the third iteration. Future research could focus on a specific genre to test the taxonomy's effectiveness. Concrete guidelines can be developed using this taxonomy, benefiting practitioners. However, the taxonomy does not guarantee DT Projects' success as it does not include KPIs but facilitates a deeper understanding of DT Projects' characteristics to enable the development of concrete guidelines for success. Future research could explore which KPIs, based on the taxonomy, can be used to evaluate DT Project success.

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