A SYSTEMATIC LITERATURE REVIEW ON DIGITAL TRANSFORMATION PROJECTS: DISCOVERING PROJECT GOALS AND PROBLEMS

ADI AZHARI[1], TEGUH RAHARJO[2]

Faculty of Computer Science, Universitas Indonesia, Jakarta, Indonesia[1,2]

E-mail: [1]adi.azhari09@gmail.com, [2]teguhr2000@gmail.com

ABSTRACT

Digital transformation has become a prevalent term in today's business landscape, signifying the adoption of technology to improve existing processes. However, not all digital transformation projects yield successful outcomes. Hence, it is crucial to identify the desired outcomes before implementing such projects. Organizations must prepared to tackle the challenges associated with project implementation. This study utilizes a systematic literature review to gather data on the goals and problems encountered during digital transformation initiatives. This study classifies project goals into different domains, namely operational, customer, social, financial, and strategic domains. Similarly, the problems and solutions are grouped into eight project performance domains: stakeholders, planning, team, project work, development approach and life cycle, uncertainty, delivery, and measurement. This research aims to provide organizations with insights into the necessary preparations for successful project implementation. Moreover, the study bridges the gap between theoretical concepts presented in books and real-world case studies, enhancing understanding in this field.

Keywords—*Digital Transformation, Project Goals, Problems and Solution, Project Management, Technology Adoption*

1. INTRODUCTION

"Digital transformation" is a highly discussed subject in the present times, leading to an increasing number of projects initiated by both private enterprises and government entities. These organizations strive to devise strategies that involve incorporating digital technologies or introducing digital innovations to drive technological advancements [1], [2]. The terminology surrounding digitization, digitalization, and digital transformation distinguishes between different concepts. Digitization involves converting analog information into digital format, while digitalization entails leveraging digital technology [3]. On the other hand, digital transformation involves utilizing technology to modify business processes or generate new business models to enhance performance or improve the overall customer experience [4], [5].

Digital transformation projects are undertaken due to various driving factors. These factors can include the rise of novel technologies or the expansion of technology utilization within that particular field [6]–[8], the presence of business requirements such as fulfilling the fourth industrial revolution concept [9], [10] and the existence of initiatives aimed at gaining a competitive advantage for companies [11], [12]. Regardless of the driving factors, it is crucial to note that every project should aim to achieve the expected value upon completion. Several studies highlight a significant percentage of projects failing to meet the predetermined expected value [11], [13]. Therefore, it becomes essential to understand the project objectives, particularly in the case of digital transformation projects, rather than merely following prevailing trends.

Moreover, project failures can result from hurdles during implementation or post-project phases. The utilization of intricate digital technologies adds to the complexity. Furthermore, organizations must also prioritize aspects such as business process change management and the formulation of new policies to facilitate the transformational process [14], [15].

This research present a comprehensive overview and guidance for companies interested in

undertaking digital transformation projects within their organizations. To ensure alignment and support with an organization's vision, mission, and strategy, it is essential for a project to consider the development of measurable organizational values [16]. The next step is to identify the problem and solution related to the performance domain of the project, which will provide an overview of the preparations required by the organization [17]. This research involves exploratory research, gathering relevant literature, and organizing it based on specific research questions. These questions are carefully constructed to guide the exploration and analysis of the collected information, such as:

RQ1: Which areas are affected, and what are the desired outcomes of digital transformation projects?

RQ2: What factors impact the progress of a project, and the suggested solutions to address these factors?

Prior studies have investigated various aspects of digital transformation, such as project objectives, challenges, and solutions [5], [14], [15], [18]. However, these investigations were conducted fragmentedly, focusing on individual elements rather than completely comprehending the topic. This study, however, applies a new approach by integrating these two components and presenting a unique viewpoint. The research paper classifies empirical case studies according to theoretical frameworks derived from two prominent publications in project management, Information Technology Project Management and PMBOK 7th edition [16], [17]. This study contributes to the academic field by presenting a unique theoretical exploratory framework derived from an authentic case study that distinguishes this study from previous studies. The primary goal is to provide organizations with an overview of strategic goal selection and necessary preparations for implementing digital transformation initiatives. By emphasizing the Measureable Organization Value, this study offers valuable insights and guidance for organizations venturing into digital transformation.

The research is structured as follows: it begins with an introduction, providing an overview of the research content. The subsequent section is the related works, which present the background of the study. Section three describes the systematic literature review methodology and outlines the process of collecting relevant previous studies for the research. Sections four focuses on analyzing the previous studies concerning the predefined research

questions. Sections five and six present the discussion and conclusions derived from the conducted analysis, including any limitations identified. Additionally, the study suggests potential avenues for further research exploration.

2. RELATED WORKS

Multiple prior studies have indicated a noticeable growth in research volume on digital transformation projects [1], [18], leading to its increased prevalence and discussions within organizations recently. However, before embarking on a digital transformation project, organizations must identify their business needs and select suitable technologies that align with their desired goals [4]. Besides that, understanding the problems and their corresponding solutions will contribute valuable insights for the successful execution of digital transformation projects.

Similar to investing, organizations face the challenge of making choices for every project they undertake [16]. With limited resources at their disposal, organizations need to prioritize projects based on a scale of importance, ensuring that the selected projects are impactful and align with their available resources [14], [15], [19]. One way to do selection is to identify the expected outcome of a project. A study by Getrzen et al. divided the project goals into five concept models: Operational efficiency, Customer experience, New business model, Business culture, and Project evaluation criteria. Later, The researcher interviewed the respondents and asked them to discuss their DT strategies and the specific goals that they set [5]. In this study, we used Marchewka's (2015) classification, where five main impacted areas impact: strategic, financial, operational, social, and customer. After main impact classification, organizations can determine the desired value they aim to achieve, whether it is to be "better," "faster," "cheaper," or "do more". The classification behind the prominent books makes it easier our understanding of the project goals.

From a consumer perspective, the focal point of our inquiry pertains to the significant impact of digital transformation on consumer perceptions. The primary focus of our organization's digital transformation strategy revolves around cultivating enhanced customer engagement and prioritizing meeting the customer's needs. Various methods can help achieve the objective, such as increasing customer satisfaction [4], improving the overall customer experience [20], and ensuring service availability to minimize complaints [21].

When considering a financial perspective, our emphasis is on research related to digital transformation that predominantly centers on its core objectives, specifically the attainment of financial advantages, including improved revenue generation [6] and decreased operational costs [22].

Moreover, in the social domain, digital transformation projects aim to achieve goals promoting shared interests, such as facilitating the learning process and knowledge absorption through digital platforms in education [23], [24]. Additionally, digital transformation can extend its benefits to areas such as museum conservation by leveraging IoT technology to aid preservation efforts [25].

"Strategic" pertains to long-term planning, the organization's overall vision, and direction. On the other hand, "operational" is more focused on day-to-day activities that contribute to achieving strategic goals. From an operational standpoint, An illustration of this can be observed in research studies that prioritize the enhancement of performance and the optimization of efficiency [25], [26], [19], [27]. Meanwhile, from a strategic perspective, we have identified research highlighting the utilization of technology to address growing demand [28] and to reshape the competitive landscape among supply chain stakeholders [9], [29].

After identifying the outcomes, it is imperative to analyze the challenges that arise during the implementation or completion of digital transformation projects. The research conducted by [14] aims to investigate the challenges and opportunities that organizations will face, focusing on three fundamental operational areas: labor and social relations, marketing and sales, and technology, where the study grouped due to their predicted influence on company activities resulting from COVID-19. In the study by [15] an iterative process was employed to categorize challenges, issues, barriers, and problems in collected literature. This process involved two separate phases. Initially, the authors independently classified each piece of research. Subsequently, the two lists, each containing 100 items classified by individual authors, were combined in a second pass to achieve a final classification and harmonize the authors' opinions. In this study, we employed categorization using groups derived from prominent project management literature [17]. According to the eight domains of project performance, we can classify the challenges, which include stakeholders, team dynamics, development approach and life cycle,

planning, project work, delivery, measurement, and uncertainty [17]. Grouping facilitates a thorough examination of the challenges encountered throughout the DT project.

The following examples illustrate each project performance domain but are not restricted to these specific instances. In the team domain, one crucial aspect is fostering a sense of shared ownership [12]. The stakeholder domain involves garnering stakeholders' support, opinions, and commitment [13]. The planning domain encompasses budget control and regulatory compliance considerations [25]. The project work domain is associated with limited infrastructure or knowledge, emphasizing the need for continuous learning [30]. The measurement domain involves assessing project performance and taking appropriate actions [31]. The uncertainty domain pertains to factors that are unproven and have a significant impact on the project [32]. The delivery domain is concerned with the scope and quality outcomes of the project [33]. Lastly, the development approach domain focuses on the project's phased development or incremental progress [34].

3. RESEARCH METHOD

This study employed a systematic literature review approach to investigate previous research studies about digital transformation. The purpose of the literature study is to address the research questions formulated. Additionally, a section explains the data collection process and details how the collected data is analyzed.

We used The PRISMA 2020, which involves a multilevel selection process to identify studies that most effectively align with the predefined criteria [35]. The aim is to utilize the findings of this study as a valuable reference to address the research questions. This research use a single database [1]. However, it is not specific to a particular field of work, focusing on a database that contains many journals related to project management, project planning, digital transformation, and information technology. After thorough deliberation, the research has selected the IEEE Explore database as the primary source for retrieving previous research studies. This database will the focal point for collecting relevant scholarly articles and publications pertinent to the research topic. Utilizing the IEEE Explore database, the research study can ensure access to a comprehensive and reputable collection of academic resources.
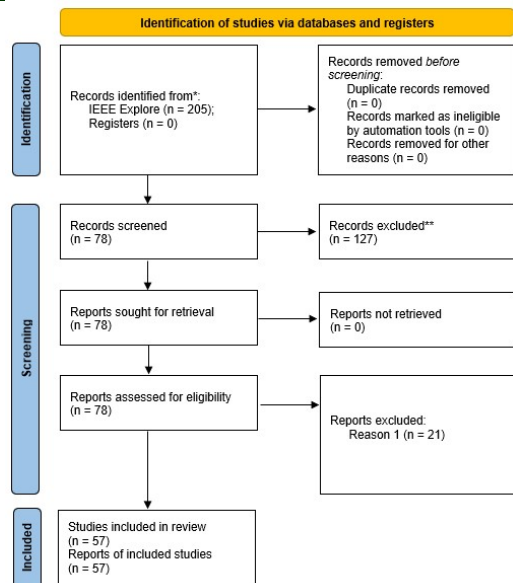
Figure 1: PRISMA 2020 Flow Diagram

Figure 1 illustrates the flow diagram recommended by PRISMA 2020, depicting the sequential steps followed in the systematic literature review process. This study's search for relevant literature was conducted within a specific time frame, covering five years from 2018 to 2023. This time selection considers the type of digital transformation that appears along with the times. However, the search is expanded extensively to determine the annual publication count of articles within the selected database to explore the trend. However, these counts are not included in the analysis process. The search will primarily focus on keywords related to digital transformation, and the emphasis will be on retrieving journal articles written in English. From these initial results, 205 studies were found based on selected criteria.

During the initial screening phase, a more detailed selection process was carried out by carefully reviewing the titles, abstracts, and keywords to identify relevant research. Pay attention to the title, keywords, and abstract to assess the study's relevance. Additionally, it is crucial to determine if the research involves conducting case studies, either at a single location or multiple locations, with a common theme. It should be noted that case studies are carried out at the level of a company or an organization. Including case studies ensures the collection of primary data, which is essential for the study. Following this initial screening, this stage yielded 78 studies that met the criteria and progressed to the next phase.

Next, we reviewed all 78 publications were examined to verify unrestricted access rights, ensuring that we could obtain the complete texts of these studies. Fortunately, we encountered no access-related issues, which enabled us to retrieve the texts fully. Then, we meticulously analyzed the enitre content of the 78 to evaluate how well they aligned with the research questions and the findings of the previous studies. Consequently, we excluded 21 studies and referenced 57 because they aligned with the research questions set for this study.

We manually scrutinized the data from rigorously selected previous studies to address the two formulated research questions. The answers to these questions can be explicitly or implicitly stated as long as they establish the connection between digital transformation technology and existing businesses. We applied a manual deductive coding approach to review the research findings [36]. However, certain studies are excluded from the analysis if their content primarily focuses on technical aspects without adequately addressing business-related aspects such as goals and challenges encountered.

4. FINDINGS

The findings will be categorized into several sections, including analysis results concerning digital transformation trends, project goals, and project performance domains.

4.1 Digital Transformation Trends

The analysis of the IEEE database using the keywords "digital transformation" in all metadata reveals a notable increase in the number of research studies related to this topic over the past five years. The search results indicate a growing trend, with more studies conducted each year. This surge in research activity suggests that "digital transformation" has recently gained significant attention in research. For details on the number of search results can be seen in Figure 2.

Specifically, within the time range of 2018 to 2023, there are 205 search results available. Expanding the temporal range of the inquiry reveals a mere four supplementary investigations, comprising two conducted in 2017, one in 2016, and one from 1995. This observation highlights the recent surge in interest and research on digital transformation in the academic community. It is essential to mention that this analysis was conducted in early June 2023. This timeframe indicates that the research conducted in 2023 has

been running for only full five months. Remarkably, the number of studies found during this period is already close to that conducted in 2022. This observation emphasizes the ongoing and consistent research interest in the field of digital transformation, with the current year showing promising levels of research activity.
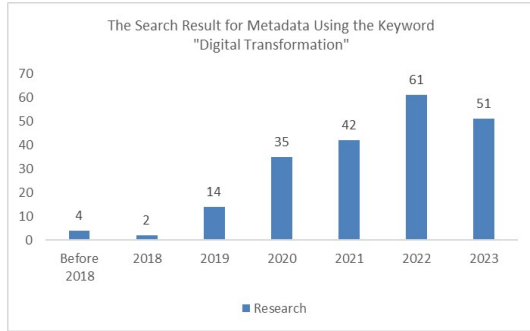

Figure 2 Research Trends Pertaining to Digital Transformation

Furthermore, digital transformation is not limited to a specific industry. The analysis of prior studies indicates that digital transformation is applicable across various fields, as shown in Table 1.

Table 1: Contributing Sector

Category	Article
Manufacturing	14
Healthcare and social assistance	9
Education and researcher	8
Global firm	6
Transportation	6
Energy, oil &gas, and mining	5
Arts, design, and entertaintment	2
Government or public sector organization	2
Banking and insurance	1
Waste management and remediation	1
Administrative and human resource	1
Information and communication technology	1
Retail	1

The manufacturing sector has emerged as the most focus area for case studies examining the implementation of digital transformation projects. The global firm category shows that the case studies are spread across several companies so that they become cross-sectoral. The scope of digital transformation extends to diverse sectors, demonstrating its relevance and potential impact in numerous areas of society.

When considering the driving factors behind digital transformation projects, three broad categories can be identified as the main reasons.

These categories encompass both internal and external factors. Internally, the motivation for digital transformation arises from business needs, including performance issues, changes triggered by the impact of COVID-19, the adoption of Industry 4.0 practices, increasing demands, limited resources, data development, and other organizational factors. Externally, the driving factors involve technology advancements, the widespread adoption of specific technologies, and the influence of technological developments in the respective field. Additionally, competition within the industry plays a significant role, as organizations recognize the necessity of digital transformation to gain a competitive edge. Figure 3 illustrates the distribution of these influencing factors.
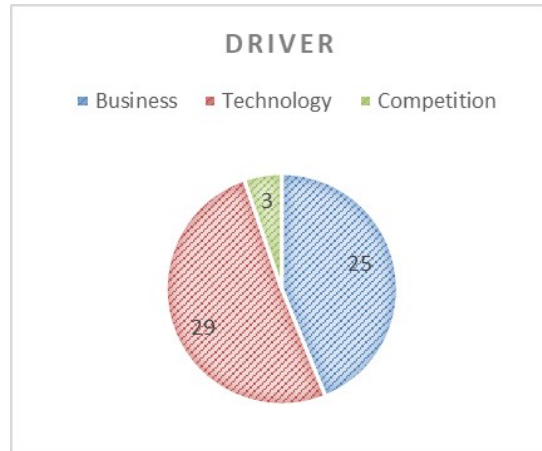

Figure 3: Driver For Digital Transformation

The results of our research support previous studies that have emphasized the increasing prevalence of digital transformation in recent times [1], [18]. Nonetheless, our study strives to provide a comprehensive understanding by illustrating that digital transformation is notably widespread in manufacturing. Furthermore, we observe a significant uptake of these practices in the healthcare and education industries, signifying a growing trend in these sectors. This broader perspective offers a more holistic view of the impact of digital transformation across various domains. It is important to note that digital transformation is not constrained to particular sectors. Additionally, our research highlights the significance of technological factors as the principal catalysts for digital transformation initiatives.

4.2 Project Goals

In this section, the findings of previous studies will be categorized into the five area categories, as shown in Table 2. This categorization is performed to identify the primary goals that projects typically aim to achieve within each specific area. Analyzing and grouping the results makes it becomes possible to gain insights into the common objectives that organizations prioritize when undertaking projects.

4.2.1 Operational

The study by Almeida et al. (2020) categorized project goals related to operations, such as cost reduction and revenue increase. However, placing these objectives within the financial domain is more appropriate. Our research delves into a diverse range of project goals, emphasizing the transformation of daily operational processes. These objectives concentrate on enhancing business processes, improving efficiency, enhancing interconnectivity, automating processes, minimizing downtime, and enhancing monitoring and diagnostic procedures, as shown in Table 2.

Based on a compilation of previous research findings, the operational domain emerges as the most impacted area by digital transformation. The implementation of digital transformation (DT) initiatives has the potential to enhance and optimize operational activities within companies or organizations. Studies such as Ramesh & Delen (2021) and Baslyman (2022) have demonstrated digital transformation to drive improvements in business processes through data-driven optimization and enterprise-level digital platforms.

Conversely, DT can also be leveraged to enhance efficiency and maximize the utility of equipment. For instance, research by Zhao et al. (2021) highlights the utilization of digital platforms to increase the utility of renewable energy sources. Similarly, research by Wang et al. (2022) focuses on employing digital twins to enhance process efficiency in the nuclear power system. Furthermore, research by J. Zhang et al. (2023) demonstrates the use of artificial intelligence (AI) in the design process, while Peng & Member (2022) leverages analytical data to enhance the efficiency of baiju brewing by reducing reliance on human experts.

The implementation of DT is anticipated to enhance organizational performance, as evidenced by research by Satwekar et al. (2022), Karthikeyan et al. (2022), and Song et al. (2022), indicating positive improvements in performance. Additionally, research by R. Zhang et al. (2021) demonstrates that machine learning accelerates the process of container number identification in maritime transport, thereby improving performance. Furthermore, Hajnic and Boshkoska (2021) reveal that using a decision support system expedites decision-making processes. Moreover, the integration of IoT or sensors aids in handling numerous tasks [7].

DT enables companies, particularly in the transportation sector, to enhance interconnectivity [37], [38]. Through the use of data analytics, safety in transportation can be significantly improved. Furthermore, implementing 5G technology offers numerous benefits in the realm of transportation, including enhanced traffic monitoring, safer traffic control, and increased comfort for commuters.

Robotic Process Automation (RPA), the use of sophisticated electronic equipment, and machine learning also help facilitate the automation of repetitive processes, leading to faster operations [45]–[47]. Additionally, using digital twins, which replicate physical assets in a digital form, aids in minimizing downtime by optimizing equipment operating time [34]. The combination of the Industrial Internet of Things (IIoT) and the Digital Twin can also help with the process of monitoring and diagnosing equipment [33], [43], [48]. Collectively, these advancements contribute to enhancing the operational performance of companies.

DT for operational improvement involves the implementation of a wide variety of technologies to enhance and streamline various operational aspects within an organization, including Industrial Internet of Things (IIoT) and Digital Twin, utilization of digital platforms and enterprise-level applications, data-driven optimization through data analytics and machine learning, as well as the implementation of electronic devices such as Robotic Process Automation (RPA) and Optical Character Recognition (OCR) for system automation. The goal is to leverage these technologies to optimize operational processes, increase efficiency, and deliver better outcomes across the board.

Table 2: Impacted Area and Desired Goals

Impacted Area	Project Goals	Literature
Operational	Transform business process (better)	[11]; [4]
	Boosted utilization and efficiency (better)	[39]; [19]; [27]; [40]
	Improve performancec (better / do more / faster)	[25]; [41]; [7]; [42]; [43]; [44]
	Improve interconnectivity (better / do more)	[38]; [37]
	Automate process / reduce process time (faster)	[45]; [46]; [47]
	Avoiding downtime (better)	[34]
	Improve monitoring and diagnosis (better)	[26]; [43]; [48]; [10]
Social	Facilitating learning process (do more)	[24]; [23]; [30]; [49]
	Improve service (better / do more)	[50]; [51]
	Improve quality of life (better)	[52]; [53]
	Helping humans work (better / do more)	[32]; [54]; [55]
	Efficient waste management (better)	[56]
	Help conservation (better)	[57]
	Help sentiment analysis (do more)	[58]
Customer	Enhance customer experience (do more)	[20]; [59]; [60]; [61]; [62]
	Improve customer satisfaction (better)	[63]; [8]
	Reduce complaint (better)	[21]
	Controling usage (cheaper)	[64]
	Quality product (better)	[65]
Strategic	Changing competition / collaboration (better / faster)	[12]; [9] ; [29]
	Increase demand (do more)	[33]; [28]
	New market (do more)	[66]
Financial	Revenue growth (better)	[13]; [6]
	Reduce operational cost (cheaper)	[67]; [68]; [22]

4.2.2 Social

To our knowledge, no previous study has explored the social impacts of digital transformation projects. In the social aspect, DT is extensively employed in facilitating the learning process and information absorption within the social context. It encompasses various approaches to learning through the utilization of digital platforms, as exemplified in research [23] and [24]. DT plays a vital role in enhancing the learning process using digital platforms and improving information organization using OCR, as demonstrated in studies [30] and [49].

DT presents numerous possibilities for improving social services. For example, research by Sarwar et al. (2023) showcases the utilization of digital platforms for E-governance, while Wu et al. (2022) highlight the role of IoT technology in monitoring transportation systems. Furthermore, IoT applications enhance the quality of life through government initiatives [52], as well as tracking the progression of diseases transmitted by Aedes Aegypti mosquitoes [53].

DT also helps in improving various aspects of human life. For instance, the integration of human-robot collaboration aids in supporting human activities [32]. At the same time, monitoring systems assist in overseeing the well-being of the elderly at home, enabling doctors to provide timely assistance [54]. Additionally, the utilization of unmanned aerial vehicles proves beneficial in conducting search and surveillance operations [55].

Last, integrating IoT and digital twins is instrumental in preserving historical buildings and artifacts within museums [57]. Furthermore, video analytics enables sentiment analysis to be conducted effectively [58]. Additionally, the utilization of RFID technology aids in optimizing waste management systems [56].

4.2.3 Customer

Customer adoption of digital transformation is driven by technological advancements rather than solely meeting their needs. This has led to various efforts to provide enhanced user experiences, such as the implementation of digital platforms in banking [20] and healthcare [60], [62]. IoT and

cloud technologies have shown promise in revolutionizing the healthcare industry [59]. Moreover, the concept of technology metaverses, particularly in the realms of gaming and social interaction, has gained prominence during the COVID-19 pandemic. In contrast, metaverse utilization in transportation has seen improvements in areas like traffic information displays, map integration, driving safety enhancements, and autonomous driving control testing [61].

Furthermore, the utilization of IoT and 5G technology has the potential to enhance customer satisfaction through improved service delivery [8], [63]. Implementing Robotic Process Automation (RPA) can also contribute to reducing customer complaints in the power utilities sector by automating information assistance during power distribution issues, such as outages. This approach proves effective in minimizing customer inquiries regarding the state of the electricity service [21]. In addition to RPA, IoT monitors electricity usage, enabling customers to track their consumption patterns and promote energy savings [64]. Lastly, IoT plays a significant role in assisting manufacturers in maintaining or enhancing product quality [65].

Our research distinguishes itself from other studies by identifying two significant factors: the decrease in customer complaints and the enhancement of customer empowerment, enabling them to exert greater control over their usage. This distinct viewpoint offers fresh insights into the potential advantages of digital transformation in these domains.

4.2.4   Strategic

Digital transformation has ushered in significant changes in the strategic landscape of businesses by fundamentally altering competition dynamics and promoting collaboration. One of the key areas where its impact is particularly profound is enhancing the quality of information sharing within the supply chain and logistics management. Findings from research by Rocha et al. (2021) emphasize the significance of collaboration in fostering open innovation, such as the shared utilization of Robotic Process Automation (RPA) and IoT. Moreover, research by Barros et al. (2023) and Hackius & Petersen (2020) highlights the utilization of machine learning and blockchain technology as practical tools for information sharing and enhancing supply chain management.

Furthermore, implementing the metaverse has the potential to create new markets in healthcare and

social assistance industries, such as telemedicine, clinical care, mental health, and physical fitness, as demonstrated in research conducted by Bansal et al. (2022). Additionally, utilizing digital twin technology and automated electronic systems enables organizations to meet growing customer demand [28], [33].

4.2.5   Financial

From a financial standpoint, digital transformation is crucial in helping organizations address cost reduction and revenue generation. According to research [13], the adoption of suitable technologies can serve as a strategic approach to boost company revenue. Additionally, research by Gooneratne et al. (2020) demonstrates how the utilization of IoT and AI addresses industry 4.0 challenges within the drilling sector, resulting in revenue growth. As emphasized in previous research, cloud computing has emerged as a promising solution for reducing operational and maintenance costs [67], [68]. Moreover, research by Dallaora et al. (2022) explores the potential of digital twin, IoT, and SCADA in minimizing energy consumption within production lines, thereby reducing operational and maintenance costs.

This study enhances clarity by clearly delineating the financial impact domain from other areas, specifically operational and strategic. As a result, it offers a well-defined exploration of project objectives within the digital transformation domain.

4.3   Project Problems and Solution

This study's unique contribution lies in categorizing the collected research into the eight domains outlined in the PMBOK 7th edition book, a process distinct from prior research that conducted manual categorization [14], [15]. The research findings will be analyzed and grouped accordingly. Please refer to Table 3 for further clarification or details. Additionally, the solutions proposed by the research studies will be documented and classified based on their respective domains. It is plausible that a problem can span across multiple performance domains. However, in this study, a single performance domain was selected based on its dominant influence in terms of problems and corresponding solutions. By focusing on the most significant domain, the study aims to analyze the challenges and resolutions within that area comprehensively. It is important to acknowledge the interconnected nature of the performance domains and consider their potential

impact on each other when addressing and resolving the identified problems.

4.3.1   Stakeholder performance domain

According to research conducted by Ramesh & Delen (2021), the role of opinion leaders in digital transformation projects is crucial. Effective communication and the capacity to influence opinion leaders play a pivotal role in determining the success of digital transformation initiatives, and their impact surpasses the significance attributed to diffusion strategies or the project's duration. Effective communication of the goals and vision of a digital transformation initiative, along with the ability to win over key stakeholders within an organization, are ultimately more important than the traditional implementation strategy components.

Table 3: Summary of Problems and Solutions

Project Performance Domain	Problems Identified	Suggested Solution
Stakeholder	- Opinion leader	- Leader's commitment supported by internal and external analysis
Planning	- Missing link between technological adoption and organization strategy - Time of implementation - Limited budget - Regulatory compliance	- Invest in technology accordingly and strategi renewal - Analysis of what technologies are currently available and used by competitors - Management framework; cost planning - Management framework
Team	- Identifying customer needs - Deployment issues due to geography	- Cross disciplinary collaboration - Dedicated team
Project Work	- Limited technical knowledge - Limited infrastructure and resource - Limited data storage - Data quality - Change management and people capability - Complex problem	- Conduct pilot project - Management framework (balancing constraint; and techno-economic analysis) - Cloud computing platform - Data governance; machine learning optimization - Training; develop appropriate strategy - Complex analytical solution; adoption from proven method; research and development
Development approach and life cycle	- Future problem - Remaining unresolved issue - Reliability - Accuracy or quality issue - Technology needs human assistance - Limited technology	- Developing machine learning optimization; green computing - Open ecosystem - Management framework; resource management; blockchain resource allocation - Machine learning optimization - Develop with data analytics or ML optimization - Additional device
Uncertainty	- Fast paced problem evolution - Privacy, ethical or fairness issue - Difficult to implement - Unproven technology and long-term uncertainties - Scalability - Ethical, Security, Fairness and regulatory compliance	- Incremental improvement - Management framework / standardization / SOP; blockchain - Developing specific tools; Resource management; research and development - Open ecosystem; future research and development - Open ecosystem; management strategy, combining technology - Management framework; blockchain; risk assessment
Delivery	- Project not deliver	- Management framework
Measure	- Interoperability	- Validation framework (Synchronization)

4.3.2   Planning performance domain

Bughin et al. (2021) highlight the issue of technology adoption incompatibility with company strategy. The study emphasized the importance of investing in complementary assets and competencies and implementing a renewal strategy. The findings suggest that organizations should view digital transformation as a strategic opportunity to create a new one. Furthermore, close integration of digital technology diffusion with strategy functions and processes is crucial to ensure mutual reinforcement and informed decision-making. Furthermore, the timing of implementation plays a critical role, making it essential to stay informed about current technology trends and the technologies utilized by competitors [11].

To address budget constraints and regulatory compliance, companies often find it necessary to proactively establish a management framework and cost planning [10]. Research by Satwekar et al. (2022) introduces a framework known as digital innovation management, which aims to provide guidance and structure for effectively managing digital transformation initiatives in a resource-constrained and compliant manner.

4.3.3   Team performance domain

Within the team domain, a solution to address the challenge of understanding consumer needs and aligning them with suitable technology is establishing a cross-collaboration team [20]. This team brings together members from various departments or disciplines to ensure a comprehensive understanding of consumer requirements and effective technology integration. On the other hand, in the planning domain, deployment-related issues also arise, such as those that arise in problem domain uncertainty. In order to overcome this obstacle, a specialized team solely responsible for implementing the technology might be assembled to ensure a streamlined and effective deployment procedure [6].

4.3.4   Project work performance domain

To address the limited understanding of technology, the team needs to shift its focus from purely technological aspects to the business impact it can deliver. Additionally, conducting a pilot project, as suggested by research [4], can help overcome limited understanding. A pilot project can help gather broader information and insights, allowing them to grasp the technology's potential better. Organizations can leverage cloud computing solutions when faced with limited data available because of limited storage capacity [47]. On the other hand, when limited infrastructure is a challenge, organizations can create specific management framewok, such as management approach that balances constraints and conducts in-depth techno-economic analysis [30], [63]. This approach allows them to make informed decisions considering technological and economic factors.

When conducting data analytics, it is expected to encounter data quality issues. In IoT technology, data quality problems can arise due to the sheer volume and velocity of incoming data, leading to missing values. To address these challenges, Research by Lis et al. (2022) examined the effectiveness of governance data in managing data quality issues. Additionally, Research by Wu et al. (2022) utilized machine learning optimization techniques, while research by Liu et al. (2020) developed a suitable framework for data imputationto enhance data quality in the analysis process.

Training programs can be implemented as a solution to address change management and enhance people's capabilities [23]. Moreover, when applying complex technologies, challenges may arise, such as understanding machine learning and human-machine collaboration in robotic automation processes, which still need to be widely adopted. Conducting trial and error research based on existing literature studies becomes crucial in such cases. By tailoring the approach to the specific needs of the case study, complex problems can be tackled using sophisticated analytical solutions that build upon the advancements documented in literature [9], [21], [42], [54], [57], [58].

4.3.5   Development approach and life-cycle performance domain

Frequently, implemented technologies may require further development as they may only partially address some organizational needs. For example, the effectiveness of implementing digital twins may require enhancements, given its current developmental stage. To address this challenge, a potential solution involves nurturing an open ecosystem that facilitates ongoing testing and advancement [34]. Additionally, future challenges may arise, such as the anticipated increase in network traffic resulting from the use of digital platforms. Machine learning optimization can be employed as a means to tackle this issue [62]. The emerging technology of cloud computing may pose challenges in terms of power consumption efficiency in the future. However, researchers have proposed a solution in the form of hybrid green computing [67].

In the IoT context, challenges are often related to the timeliness and reliability of the absorbed data. Latency issues and the presence of mixed data can hinder the reliability of the data used. Research conducted by T. M. Pham & Nguyen (2020) addresses this challenge by implementing resource management techniques, ensuring that each equipment operates within its capacity. Similarly, research by Groshev et al. (2021) focuses on developing the concept of digital twins as a service, aiming to overcome associated challenges. Alongside reliability challenges, accuracy issues can arise in certain technologies such as optical character recognition (OCR). Inaccuracies in reading text can occur when the quality of the text being scanned is poor. To address this problem, research by Karthikeyan et al. (2022) employs machine learning optimization techniques to enhance the accuracy of text reading processes.

Furthermore, the reliance on human intervention or expertise in operating electronic devices can present a domain of project work that requires attention. The dependence on human expertise may pose challenges and hinder the overall process, which can be addressed with a potential solution to focus on the developing and optimizating data-driven approaches and machine learning techniques [28], [46]. To address the limitation of tool capabilities, organizations can enhance performance by incorporating additional tools that offer improved functionality and features. By integrating complementary tools into their existing infrastructure, they can overcome the constraints of limited tool capabilities and achieve better performance in their operations [55].

4.3.6 Uncertainty performance domain

Projects frequently encounter rapidly evolving problems, as demonstrated in research [24] focused on using digital platforms in the education sector. The educational landscape experiences swift changes in materials, curricula, and requirements, leading to urgent needs. To address this challenge, the research proposes an incremental improvement approach. Additionally, a single digital transformation project may not suffice to address all the complexities and challenges involved.

Furthermore, the implementation of digital transformation projects often encounters challenges related to deployment. For instance, utilizing cloud computing may involve difficulties in migrating data. To address this, optimizing allocation strategies can be employed [68]. Similarly, deploying of 5G technology poses various issues requiring further research and development efforts [37]. The difficulties of implementing and deploying these issues also sometimes require developing new tools to facilitate digital transformation projects [45].

Additionally, certain technologies utilized in digital transformation projects, such as blockchain, may still be unclear or unproven which has not yet achieved widespread adoption. To address this, creating an open ecosystem can facilitate faster and more collaborative development [29]. Furthermore, projects like MosquIoT, which employ IoT in addressing the Aedes aegypti mosquito issue, require continued research and development efforts to enhance their effectiveness [53].

Scalability is a critical challenge in digital transformation projects, and researchers have proposed various approaches to address this issue. One approach is to foster an open ecosystem [12], [56], which allows for collaborative and scalable solutions. Another approach involves developing specific management frameworks, such as the microservice framework for automation systems [43] and the new ID-DTiM [26], which provide guidelines and structures for scalable implementation. Additionally, combining multiple technologies like IoT, blockchain, and cloud computing [59] offers scalable and robust digital transformation initiatives opportunities.

The issue of uncertainty regarding privacy, security, and fairness poses a challenge in digital transformation projects. To address this, several researchers have proposed blockchain as a potential solution [60], [61], [64]. Blockchain technology offers enhanced security and privacy while ensuring data management and transaction fairness. Furthermore, research [7] highlights the significance of risk assessments to mitigate potential threats. Additionally, a Fairness in Design framework has been developed in research [27] to address the issue of fairness in digital transformation initiatives.

4.3.7 Delivery performance domain

When implementing DT projects in a public service organization, particularly for developing e-governance through digital technology, challenges may arise where unresolved issues or project outcomes must align with expectations. A study by Sarwar et al. (2023) emphasizes the significance of establishing a comprehensive framework before project execution. This involves adopting standardized IT Service Management (ITSM) practices to ensure effective project resolution and alignment with desired outcomes.

4.3.8   Measurement performance domain

When implementing IoT for the creation of smart cities, a common challenge is the issue of operability, as each city often adopts different concepts and approaches. This diversity hampers the seamless integration and development of smart city initiatives. To address this, it becomes crucial for all regions to adopt a standardized project concept that enables integration among cities. Developing a standardized validation framework is essential to monitor and synchronize each city's efforts [52]. However, it is essetial to note that establishing such a framework takes time, and timely synchronization with set objectives needs to be measured. In case of any obstacles, appropriate actions can be taken to overcome them and maintain the progress of smart city development.

5.   DISCUSSION

In terms of its contribution to digital transformation projects, this research provides valuable insights into the significance of initiating projects by defining the desired outcomes. This clarity in outcomes helps select and prioritize projects, as projects are essentially investments that are expected to yield positive impacts. Once the outcomes are established, organizations can then examine the challenges associated with project implementation and make necessary preparations to enhance the likelihood of project success. This research offers practical guidance to organizations embarking on digital transformation journeys by emphasizing the importance of outcome-driven project initiation and proactive planning.

In terms of its contribution to research on digital transformation projects, this study establishes a valuable connection between theory and practice by applying practical case studies in conjunction with relevant project management literature. By bridging the gap between theoretical concepts and real-world implementation, this research enhances the understanding and applicability of digital transformation principles. It provides a practical lens through which researchers and practitioners can gain insights into the practical implications of theoretical frameworks, fostering a deeper understanding of how theory translates into successful project outcomes in the dynamic context of digital transformation.

In terms of validity, although the literature sources were limited to a single database, the analysis conducted in this study was comprehensive, ensuring the thorough extraction of research insights, both explicit and implicit. By manually conducting the analysis, potential gaps that automated tools might overlook were effectively addressed. The selected previous research articles were deemed representative as they covered all aspects and categories relevant to the selected references. Thus, the validity of the findings and conclusions drawn from this study is supported by the meticulous approach taken in data collection and analysis.

6.   CONCLUSION AND FUTURE WORKS

The research findings indicate that digital transformation projects have become a widely discussed and prominent topic. These projects are not limited to specific sectors but are being adopted across various industries. The driving factors behind this trend include the emergence of new technologies, the extensive utilization of technology by competitors, the organizational needs, the pursuit of Industry 4.0 concepts, and the urgency created by the pandemic.

The findings section offers valuable insights into the implications of the identified project goals and challenges in digital transformation initiatives. It highlights the interconnectedness of various goals and challenges, underscoring the importance of holistic approach to project planning and implementation. The systematic literature review contributes to understanding of project goals and challenges in digital transformation initiatives. Synthesizing a wide range of research, it provides a comprehensive overview of the common goals pursued and challenges encountered by organizations. This study discovered that DT initiatives primarily focused on goals such as strengthening performance, supporting learning processes, improving customer experience, fostering competition or cooperation, and decreasing operational costs. These objectives were the most often discussed in the literature for the five impacted areas. Furthermore, a detailed analysis of the identified challenges indicated that issues predominantly occurred in uncertainty, development approach, and project work performance domains.

6.1. Limitation of Study

The research is subject to certain limitations such as the process of literature study selection is conducted manually by a single researcher. It is important to acknowledge that this approach may introduce bias, potentially resulting in the omission of certain research papers related to digital transformation from the study's discussion.

Moreover, while the implement of technology and data analytics are relevant topics in the context of digital transformation, many studies primarily focus on techniques and calculations. Consequently, they may not adequately explore the relationship between the technology utilized and its actual business impact. As a result, these types of studies not included in the discussion.

6.2. Future Work

This research can be further enhanced by expanding the existing database by incorporating additional relevant sources and broadening the selection criteria for previous studies. A wealth of research available that delves deep into the utilization of various technologies, and exploring these studies in relation to their impact on business can offer valuable insights. Including a more comprhensive range of databases and incorporating diverse research sources, there is a higher likelihood of obtaining new and valuable information. Moreover, considering the inclusion of books or frameworks in the analysis can provide additional perspectives and contribute to a comprehensive understanding of digital transformation projects. These resources often offer theoretical frameworks, practical guidance, and case studies that can shed light on various aspects of digital transformation. The goal is to equip readers with comprehensive insights and valuable perspectives that can guide their decision-making process, ultimately ensuring the successful implementation of digital transformation project initiatives.

ACKNOWLEDGEMENT

REFERENCES

[1] R. N. Chawla and P. Goyal, "Emerging trends in digital transformation: a bibliometric analysis," *Benchmarking*, vol. 29, no. 4, pp. 1069–1112, 2022, doi: 10.1108/BIJ-01-2021-0009.

[2] G. Vial, "Understanding digital transformation: A review and a research agenda," *J. Strateg. Inf. Syst.*, vol. 28, no. 2, pp. 118–144, Jun. 2019, doi: 10.1016/J.JSIS.2019.01.003.

[3] M. A. M. Gobble, "Digitalization, Digitization, and Innovation," *Res. Technol. Manag.*, vol. 61, no. 4, pp. 56–59, 2018, doi: 10.1080/08956308.2018.1471280.

[4] M. Baslyman, "Digital Transformation from the Industry Perspective: Definitions, Goals, Conceptual Model, and Processes," *IEEE Access*, vol. 10, pp. 42961–42970, 2022, doi: 10.1109/ACCESS.2022.3166937.

[5] W. M. Gertzen, E. van der Lingen, and H. Steyn, "Goals and benefits of digital transformation projects: Insights into project selection criteria," *South African J. Econ. Manag. Sci.*, vol. 25, no. 1, pp. 1–14, 2022, doi: 10.4102/sajems.v25i1.4158.

[6] C. P. Gooneratne *et al.*, "Drilling in the Fourth Industrial Revolution-Vision and Challenges," *IEEE Eng. Manag. Rev.*, vol. 48, no. 4, pp. 144–159, 2020, doi: 10.1109/EMR.2020.2999420.

[7] I. Ashraf *et al.*, "A Survey on Cyber Security Threats in IoT-Enabled Maritime Industry," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 2, pp. 2677–2690, 2023, doi: 10.1109/TITS.2022.3164678.

[8] T. M. Pham and T. T. L. Nguyen, "Optimization of resource management for NFV-enabled IoT systems in edge cloud computing," *IEEE Access*, vol. 8, pp. 178217–178229, 2020, doi: 10.1109/ACCESS.2020.3026711.

[9] J. Barros, F. Cunha, C. Martins, P. Pedrosa, and P. Cortez, "Predicting Weighing Deviations in the Dispatch Workflow Process: A Case Study in a Cement Industry," *IEEE Access*, vol. 11, no. November 2022, pp. 8119–8135, 2023, doi: 10.1109/ACCESS.2022.3232299.

[10] S. Mihai *et al.*, "Digital Twins: A Survey on Enabling Technologies, Challenges, Trends and Future Prospects," *IEEE Commun. Surv. Tutorials*, vol. 24, no. 4, pp. 2255–2291, 2022, doi: 10.1109/COMST.2022.3208773.

[11] N. Ramesh and D. Delen, "Digital Transformation: How to Beat the 90% Failure Rate?," *IEEE Eng. Manag. Rev.*, vol. 49, no. 3, pp. 22–25, 2021, doi: 10.1109/EMR.2021.3070139.

[12] C. Rocha, C. Quandt, F. Deschamps, S. Philbin, and G. Cruzara, "Collaborations for Digital Transformation: Case Studies of Industry 4.0 in Brazil," *IEEE Trans. Eng. Manag.*, vol. 70, no. 7, pp. 2404–2418, 2021, doi: 10.1109/TEM.2021.3061396.

[13] J. Bughin, T. Kretschmer, and N. Van Zeebroeck, "Digital Technology Adoption Drives Strategic Renewal for Successful Digital Transformation," *IEEE Eng. Manag. Rev.*, vol. 49, no. 3, pp. 103–108, 2021, doi: 10.1109/EMR.2021.3098663.

[14] F. Almeida, J. Duarte Santos, and J. Augusto Monteiro, "The Challenges and Opportunities in the Digitalization of Companies in a Post-COVID-19 World," *IEEE Eng. Manag. Rev.*, vol. 48, no. 3, pp. 97–103, 2020, doi: 10.1109/EMR.2020.3013206.

[15] A. Kutnjak and I. Pihir, "Challenges, Issues, Barriers and Problems in Digital Transformation – Systematic Literature Review," *Cent. Eur. Conf. Inf. Intell. Syst.*, pp. 133–140, 2019, [Online]. Available: https://www.proquest.com/conference-papers-proceedings/challenges-issues-barriers-problems-digital/docview/2366660959/se-2?accountid=15909

[16] J. T. Marchewka, *Information technology project management: providing measurable organizational value*, 5th ed. John Wiley & Sons, 2015.

[17] Project Management Institute, *The standard for project management and a guide to the project management body of knowledge (PMBOK guide).*, 7th ed., no. July. Project Management Institute, Inc, 2021.

[18] M. M. Feliciano-Cestero, N. Ameen, M. Kotabe, J. Paul, and M. Signoret, "Is digital transformation threatened? A systematic literature review of the factors influencing firms' digital transformation and internationalization," *J. Bus. Res.*, vol. 157, no. January 2022, 2023, doi: 10.1016/j.jbusres.2022.113546.

[19] W. Wang, M. Liu, and J. Li, "Research and Realization of Virtual-Real Control of Robot System for Off-Heap Detector Assisted Installation Based on Digital Twin," *IEEE J. Radio Freq. Identif.*, vol. 6, pp. 810–814, 2022, doi: 10.1109/JRFID.2022.3209715.

[20] J. Gaurav and E. Kongar, "Value Creation via Accelerated Digital Transformation," *IEEE Eng. Manag. Rev.*, vol. 49, no. 2, pp. 63–72, 2021, doi: 10.1109/EMR.2021.3054813.

[21] B. Vajgel *et al.*, "Development of Intelligent Robotic Process Automation: A Utility Case Study in Brazil," *IEEE Access*, vol. 9, pp. 71222–71235, 2021, doi: 10.1109/ACCESS.2021.3075693.

[22] N. Dallaora, K. Alamin, E. Fraccaroli, M. Poncino, D. Quaglia, and S. Vinco, "Digital Transformation of a Production Line: Network Design, Online Data Collection and Energy Monitoring," *IEEE Trans. Emerg. Top. Comput.*, vol. 10, no. 1, pp. 46–59, 2022, doi: 10.1109/TETC.2021.3132432.

[23] C. G. Demartini, L. Benussi, V. Gatteschi, and F. Renga, "Education and digital transformation: The 'riconnessioni' project," *IEEE Access*, vol. 8, pp. 186233–186256, 2020, doi: 10.1109/ACCESS.2020.3018189.

[24] A. Raza and M. Hasib, "Digital Transformation of Education Toward Successful Internships: A Methodology Developed Over Seven Years and Tested During COVID-19," *IEEE Trans. Educ.*, vol. 66, no. 3, pp. 244–253, 2022, doi: 10.1109/TE.2022.3221842.

[25] A. Satwekar, T. Volpentesta, P. Spagnoletti, and M. Rossi, "An Orchestration Framework for Digital Innovation: Lessons From the Healthcare Industry," *IEEE Trans. Eng. Manag.*, vol. 70, no. 7, pp. 2465–2479, 2022, doi: 10.1109/TEM.2022.3167259.

[26] M. H. Hung *et al.*, "A Novel Implementation Framework of Digital Twins for Intelligent Manufacturing Based on Container Technology and Cloud Manufacturing Services," *IEEE Trans. Autom. Sci. Eng.*, vol. 19, no. 3, pp. 1614–1630, 2022, doi: 10.1109/TASE.2022.3143832.

[27] J. Zhang, Y. Shu, and H. Yu, "Fairness in Design: A Framework for Facilitating Ethical Artificial Intelligence Designs," *Int. J. Crowd Sci.*, vol. 7, no. 1, pp. 32–39, 2023, doi: 10.26599/IJCS.2022.9100033.

[28] J. Wan *et al.*, "Reconfigurable smart factory for drug packing in healthcare industry 4.0," *IEEE Trans. Ind. Informatics*, vol. 15, no. 1, pp. 507–516, 2019, doi: 10.1109/TII.2018.2843811.

[29] N. Hackius and M. Petersen, "Translating High Hopes into Tangible Benefits: How Incumbents in Supply Chain and Logistics Approach Blockchain," *IEEE Access*, vol. 8, pp. 34993–35003, 2020, doi: 10.1109/ACCESS.2020.2974622.

[30] Q. D. Pham, N. N. Dao, T. Nguyen-Thanh, S. Cho, and H. C. Pham, "Detachable Web-Based Learning Framework to Overcome Immature ICT Infrastructure Toward Smart Education," *IEEE Access*, vol. 9, pp. 34951–34961, 2021, doi: 10.1109/ACCESS.2021.3062371.

[31] Project Management Institute, *Process Groups: A Practice Guide*. Project

Management Institute, Inc, 2023.

[32] Y. Tirupachuri *et al.*, "Online Non-Collocated Estimation of Payload and Articular Stress for Real-Time Human Ergonomy Assessment," *IEEE Access*, vol. 9, pp. 123260–123279, 2021, doi: 10.1109/ACCESS.2021.3109238.

[33] M. Groshev, C. Guimaraes, A. De La Oliva, and R. Gazda, "Dissecting the Impact of Information and Communication Technologies on Digital Twins as a Service," *IEEE Access*, vol. 9, pp. 102862–102876, 2021, doi: 10.1109/ACCESS.2021.3098109.

[34] Y. Qamsane *et al.*, "A Methodology to Develop and Implement Digital Twin Solutions for Manufacturing Systems," *IEEE Access*, vol. 9, pp. 44247–44265, 2021, doi: 10.1109/ACCESS.2021.3065971.

[35] M. J. Page *et al.*, "The PRISMA 2020 statement: An updated guideline for reporting systematic reviews," *BMJ*, vol. 372, 2021, doi: 10.1136/bmj.n71.

[36] F. S. Altuwaijri and M. A. Ferrario, "Factors affecting Agile adoption: An industry research study of the mobile app sector in Saudi Arabia," *J. Syst. Softw.*, vol. 190, 2022, doi: 10.1016/j.jss.2022.111347.

[37] D. Corujo *et al.*, "An Empirical Assessment of the Contribution of 5G in Vertical Industries: A Case for the Transportation Sector," *IEEE Access*, vol. 11, no. February, pp. 15348–15363, 2023, doi: 10.1109/ACCESS.2023.3243732.

[38] D. Lis, M. Arbter, M. Spindler, and B. Otto, "An Investigation of Antecedents for Data Governance Adoption in the Rail Industry—Findings From a Case Study at Thales," *IEEE Trans. Eng. Manag.*, vol. 70, no. 7, pp. 2528–2545, 2022, doi: 10.1109/TEM.2022.3166109.

[39] Y. Zhao, S. Xia, J. Zhang, Y. Hu, and M. Wu, "Effect of the Digital Transformation of Power System on Renewable Energy Utilization in China," *IEEE Access*, vol. 9, pp. 96201–96209, 2021, doi: 10.1109/ACCESS.2021.3094317.

[40] L. Peng and S. Member, "Deep Neural Network-Based Sorghum Adulteration Detection in Baijiu Brewing," vol. 1, no. May, 2022.

[41] S. Karthikeyan, A. G. S. De Herrera, F. Doctor, and A. Mirza, "An OCR Post-Correction Approach Using Deep Learning for Processing Medical Reports," *IEEE Trans. Circuits Syst. Video Technol.*, vol. 32, no. 5, pp. 2574–2581, 2022, doi:

10.1109/TCSVT.2021.3087641.

[42] R. Zhang, Z. Bahrami, T. Wang, and Z. Liu, "An Adaptive Deep Learning Framework for Shipping Container Code Localization and Recognition," *IEEE Trans. Instrum. Meas.*, vol. 70, 2021, doi: 10.1109/TIM.2020.3016108.

[43] J. Song, Y. Kang, Q. Song, L. Guo, and A. Jamalipour, "Distributed Resource Optimization With Blockchain Security for Immersive Digital Twin in IIoT," *IEEE Trans. Ind. Informatics*, vol. 19, no. 5, pp. 7258–7267, 2022, doi: 10.1109/TII.2022.3224986.

[44] M. Hajnic and B. M. Boshkoska, "A Disruptive Decision Support Platform for Reengineering the Strategic Transfer of Employees," *IEEE Access*, vol. 9, pp. 29921–29928, 2021, doi: 10.1109/ACCESS.2021.3059895.

[45] D. Choi, H. R'Bigui, and C. Cho, "Enabling the Gab Between RPA and Process Mining: User Interface Interactions Recorder," *IEEE Access*, vol. 10, pp. 39604–39612, 2022, doi: 10.1109/ACCESS.2022.3165797.

[46] F. Fricke *et al.*, "Artificial Intelligence for Mass Spectrometry and Nuclear Magnetic Resonance Spectroscopy Using a Novel Data Augmentation Method," *IEEE Trans. Emerg. Top. Comput.*, vol. 10, no. 1, pp. 87–98, 2022, doi: 10.1109/TETC.2021.3131371.

[47] A. Villalonga, G. Beruvides, F. Castano, and R. E. Haber, "Cloud-Based Industrial Cyber-Physical System for Data-Driven Reasoning: A Review and Use Case on an Industry 4.0 Pilot Line," *IEEE Trans. Ind. Informatics*, vol. 16, no. 9, pp. 5975–5984, 2020, doi: 10.1109/TII.2020.2971057.

[48] Y. Liu, T. Dillon, W. Yu, W. Rahayu, and F. Mostafa, "Missing Value Imputation for Industrial IoT Sensor Data with Large Gaps," *IEEE Internet Things J.*, vol. 7, no. 8, pp. 6855–6867, 2020, doi: 10.1109/JIOT.2020.2970467.

[49] K. Nguyen, T. T. Nguyen, T. Q. Nguyen, A. Nguyen, N. D. Vo, and T. V. Nguyen, "A Benchmark of Parsing Vietnamese Publications," *IEEE Access*, vol. 10, no. June, pp. 65284–65299, 2022, doi: 10.1109/ACCESS.2022.3183193.

[50] M. I. Sarwar, Q. Abbas, T. Alyas, A. Alzahrani, T. Alghamdi, and Y. Alsaawy, "Digital Transformation of Public Sector Governance With IT Service Management-A Pilot Study," *IEEE Access*, vol. 11, no. January, pp. 6490–6512, 2023, doi:

10.1109/ACCESS.2023.3237550.

[51] Y. Wu, H. N. Dai, and H. Tang, "Graph Neural Networks for Anomaly Detection in Industrial Internet of Things," *IEEE Internet Things J.*, vol. 9, no. 12, pp. 9214–9231, 2022, doi: 10.1109/JIOT.2021.3094295.

[52] L. Diez, J. Choque, L. Sanchez, and L. Munoz, "Fostering IoT service replicability in interoperable urban ecosystems," *IEEE Access*, vol. 8, 2020, doi: 10.1109/ACCESS.2020.3046286.

[53] J. Aira, T. Olivares, F. M. Delicado, and D. Vezzani, "MosquIoT: A System Based on IoT and Machine Learning for the Monitoring of Aedes aegypti (Diptera: Culicidae)," *IEEE Trans. Instrum. Meas.*, vol. 72, 2023, doi: 10.1109/TIM.2023.3265119.

[54] M. Fahim, V. Sharma, R. Hunter, and T. Q. Duong, "Healthy Aging: A Deep Meta-Class Sequence Model to Integrate Intelligence in Digital Twin," *IEEE J. Transl. Eng. Heal. Med.*, vol. 11, no. September 2022, pp. 330–340, 2023, doi: 10.1109/JTEHM.2023.3274357.

[55] P. Mursia, F. Devoti, V. Sciancalepore, and X. Costa-Perez, "RISe of Flight: RIS-Empowered UAV Communications for Robust and Reliable Air-to-Ground Networks," *IEEE Open J. Commun. Soc.*, vol. 2, no. June, pp. 1616–1629, 2021, doi: 10.1109/OJCOMS.2021.3092604.

[56] L. Catarinucci, R. Colella, S. I. Consalvo, L. Patrono, C. Rollo, and I. Sergi, "IoT-Aware Waste Management System Based on Cloud Services and Ultra-Low-Power RFID Sensor-Tags," *IEEE Sens. J.*, vol. 20, no. 24, pp. 14873–14881, 2020, doi: 10.1109/JSEN.2020.3010675.

[57] Z. Ni, Y. Liu, M. Karlsson, and S. Gong, "Enabling Preventive Conservation of Historic Buildings Through Cloud-Based Digital Twins: A Case Study in the City Theatre, Norrköping," *IEEE Access*, vol. 10, no. September, pp. 90924–90939, 2022, doi: 10.1109/ACCESS.2022.3202181.

[58] S. Al-Azani and E. S. M. El-Alfy, "Enhanced Video Analytics for Sentiment Analysis Based on Fusing Textual, Auditory and Visual Information," *IEEE Access*, vol. 8, pp. 136843–136857, 2020, doi: 10.1109/ACCESS.2020.3011977.

[59] F. Firouzi *et al.*, "Fusion of IoT, AI, Edge-Fog-Cloud, and Blockchain: Challenges, Solutions, and a Case Study in Healthcare and Medicine," *IEEE Internet Things J.*, vol. 10, no. 5, pp. 3686–3705, 2023, doi: 10.1109/JIOT.2022.3191881.

[60] A. Abugabah, N. Nizamuddin, and A. A. Alzubi, "Decentralized telemedicine framework for a smart healthcare ecosystem," *IEEE Access*, vol. 8, pp. 166575–166588, 2020, doi: 10.1109/ACCESS.2020.3021823.

[61] Y. Fu, C. Li, F. R. Yu, T. H. Luan, P. Zhao, and S. Liu, "A Survey of Blockchain and Intelligent Networking for the Metaverse," *IEEE Internet Things J.*, vol. 10, no. 4, pp. 3587–3610, 2023, doi: 10.1109/JIOT.2022.3222521.

[62] N. Alharbe, M. A. Rakrouki, and A. Aljohani, "An Improved Ant Colony Algorithm for Solving a Virtual Machine Placement Problem in a Cloud Computing Environment," *IEEE Access*, vol. 10, pp. 44869–44880, 2022, doi: 10.1109/ACCESS.2022.3170103.

[63] H. Frank, C. Colman-Meixner, K. D. R. Assis, S. Yan, and D. Simeonidou, "Techno-Economic Analysis of 5G Non-Public Network Architectures," *IEEE Access*, vol. 10, no. June, pp. 70204–70218, 2022, doi: 10.1109/ACCESS.2022.3187727.

[64] T. V. Le, C. L. Hsu, and W. X. Chen, "A Hybrid Blockchain-Based Log Management Scheme with Nonrepudiation for Smart Grids," *IEEE Trans. Ind. Informatics*, vol. 18, no. 9, pp. 5771–5782, 2022, doi: 10.1109/TII.2021.3136580.

[65] L. J. Moukahal, M. A. Elsayed, and M. Zulkernine, "Vehicle Software Engineering (VSE): Research and Practice," *IEEE Internet Things J.*, vol. 7, no. 10, pp. 10137–10149, 2020, doi: 10.1109/JIOT.2020.3001026.

[66] G. Bansal, K. Rajgopal, V. Chamola, Z. Xiong, and D. Niyato, "Healthcare in Metaverse: A Survey on Current Metaverse Applications in Healthcare," *IEEE Access*, vol. 10, no. September, pp. 119914–119946, 2022, doi: 10.1109/ACCESS.2022.3219845.

[67] A. Alarifi *et al.*, "Energy-Efficient Hybrid Framework for Green Cloud Computing," *IEEE Access*, vol. 8, pp. 115356–115369, 2020, doi: 10.1109/ACCESS.2020.3002184.

[68] S. Li, H. Liu, W. Li, and W. Sun, "An Optimization Framework for Migrating and Deploying Multiclass Enterprise Applications into the Cloud," *IEEE Trans. Serv. Comput.*, vol. 16, no. 2, pp. 941–956, 2022, doi: 10.1109/TSC.2022.3174216.