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Building an Integrated Digital Transformation System Framework: A Design Science Research, the Case of FedUni

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Abstract: The purpose of this paper is to propose an integrated digital transformation system framework (IDTSF) to help support business leaders and teams in making their products, services, and operations more streamlined and competitive. The framework will help organizations to best meet user/customer needs with minimum waste and time and enables businesses to achieve efficiency compared with island and traditional sequential approaches. The proposed framework can also provide insights to help organizations to avoid common failures when deploying digital transformation initiatives. The paper follows the design science research (DSR) and the information systems design science research (ISDSR) methodologies to develop the IDTSF model and a practical design artifact. The main problems were the initiation, execution, and governance challenges associated with digital transformation. After identifying the problems and the objectives, a relevant IDTSF model was synthesized and tested as a design artifact. The results of the test of the proposed artifact showed its effectiveness and efficiency in facilitating the components of the model in creating a cohesive framework.

Keywords: agile; change management; design thinking; design science research; digital transformation; digital; digital technologies; digital strategy; integrated framework; system development life cycle



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1. Introduction

In recent years, Digital Transformation has attracted increasing attention from researchers and practitioners [1–6]. The transformation affects every aspect of a company's business in its entirety and leads to changes in the way of conducting business [2,7,8], and even in its business process models [6]. Emerging technologies, such as artificial intelligence, blockchain, robotic process automation (RPA), IoT, big data, cloud, and mobile, are disrupting the marketplace [9]. Enterprises are facing a substantial threat from startups, modern IT solutions, and other enterprises who are integrating these technologies into their enterprises in agile processes. Therefore, it is essential to understand the technological options as well as the impact of adopting these technologies in enterprises. Digital transformation is a highly complex, enterprise-wide endeavor [3]. Bonnet et al. [4] reported that nearly 90% of executives in the U.S. and U.K. are expecting information and digital technologies to make an increasing strategic impact on their overall business in the coming decade. It has become a high priority on the c-level executives' strategic agendas [4]. In the current COVID-19 scenario, digitalization is having an impact on the wellbeing of customers [10]. Digital transformation received a fast push due to the pandemic. For instance, the teleworking system in Romania was implemented during the pandemic [11]. Subsequently, adopting and integrating new digital technologies into the enterprise infrastructure is one of the biggest challenges that companies are currently facing [12].

Digital transformation is the profound transformation of business and organizational activities, processes, competencies, and models to fully leverage the changes and oppor-

tunities of a mix of digital technologies and their accelerating impact across societies in a strategic and prioritized way, with present and future shifts in mind. For instance, an attempt was made to evaluate the present and future research trends in the digitalization of business model innovation [13]. It has an influence on the organization's structure from the interaction of the organization with stakeholders to internal processes and each product of the organization [14]. The digital transformation of the innovation ecosystem is conducted when there are modifications made at two levels of the organization. One is at innovation activities, and the other is at innovation organization [15]. New firms are being set up to bring business models relating to digital innovation and digital transformation to the market and add value [16]. They show high intensity towards optimization, customer interaction, and the utilization of digital technologies. Digital competencies and skills are essential for digital transformation [17], and such skills make a major contribution to digital transformation [18].

Digital transformations depend on several factors, including the nature of the industry in which the company competes, the age and size of the company, the number of legacy tools and processes that must be transformed, and the motivation of company owners and leaders to impact change in their businesses. Several challenges have been identified that are associated with digital transformations, including initiation challenges ('Blind' Challenge, Short-Term View Challenge, omnichannel adaptation, and failing or poor analytics), execution challenges (Technology Integration Challenge, the changing customer experience, and employee pushback), and governance challenges (Aligning Business and IT Challenge, Culture Challenge, lagging, and legacy business models) [5,8,12,19,20].

Current digital transformation approaches are not well-defined or well-established, and the potential has not yet been realized [21–23]. To take advantage of digital transformations and unlock new business opportunities and remain competitive, enterprises must create a practical roadmap based on a series of milestones. Such development processes should be transdisciplinary using a balanced mix of traditional system development approaches (such as Agile SDLC and Waterfall SDLC) and creatively designed approaches (such as design thinking) [21,24]. It has been realized that technology alone cannot result in organizational transformation. Strategic use, involvement, and engagement of stakeholders are essential to convert the potential of technology into practice. Therefore, organizations need to adopt long-term, holistic, systems-thinking approaches, including Design Thinking, SDLC, change management, and quality management frameworks, to design and deliver digital innovation, [25]. The effective use of best practices can help to avoid re-inventing wheels, optimize the use of scarce IT resources, and reduce the occurrence of major IT risks, such as project failures, wasted investments, intellectual property theft, data loss and data breaches, system disruptions, failure by service providers to understand and meet customer requirements, and compliance penalties [26].

Accordingly, this research aims to build a complete integrated digital transformation system framework by aligning well-known structured processes, such as Design Thinking, Agile SDLC, and Waterfall SDLC, into five domains (business need, problem, solution, operational, and change management) to address the challenges posed by Digital Transformations. This research intends to deliver a better integrated system framework to produce a product or a service that best meets user/customer needs with minimum waste and time and enables the business to achieve efficiency compared with island and traditional sequential approaches. Moreover, the proposed framework can also provide insights to help organizations avoid common failures when deploying digital transformation initiatives. According to the Everest Group [27], 78% of enterprises today fail to scale their digital transformation initiatives. Considering these endeavors and limitations, this work puts forward two research objectives:

- ✓ (Obj1) How should experience-centered digital transformation deployment systems be designed?
- ✓ (Obj2) Which aspects of the organizational systems theory can be used to support efficient, sustainable, and smart digital transformation systems?

The rest of the paper is organized as follows. Following the introduction, Section 2 provides a briefing about digital transformation, while Section 3 provides an overview of the theoretical foundation. Section 4 presents the research methodology and Section 5 provides a background to the study and identifies the problem that is being investigated. Section 6 presents the analysis, the results of the study, and the proposed framework. Finally, the limitations of this research and future work are addressed after the conclusion.

2. Digital Transformation

Digital Transformation is a current, evolving field and it challenges almost all business sectors. It is severely under-researched and more research in the area should be conducted as it is expected to impact all business sectors. Many researchers and practitioners have defined Digital Transformation in different ways. Even businesses define it differently in the same industry. It has a different meaning in various businesses, and even companies in the same business having a unified definition is difficult to achieve [28]. As such, currently, no commonly accepted definition for the term DT exists. For example, i-scoop [29] defines digital transformation as “the profound transformation of business and organizational activities, processes, competencies, and models to fully leverage the changes and opportunities of a mix of digital technologies and their accelerating impact across society in a strategic and prioritized way, with present and future shifts in mind”. Congdon [30] defines digital transformation as “the integration of digital technology into all areas of a business, fundamentally changing how you operate and deliver value to customers”. Westerman et al. [28] defines DT as “the use of technology to radically improve the performance or reach of enterprises—is becoming a hot topic for companies across the globe. Executives in all industries are using digital advances such as analytics, mobility, social media, and smart embedded devices—and improving their use of traditional technologies such as ERP—to change customer relationships, internal processes, and value propositions”. Mazzone [31] defines DT as “the deliberate and ongoing digital evolution of a company, business model, idea process, or methodology, both strategically and tactically”.

As such, digital transformation is about integrating digital technology into all of the functional areas of the enterprise (finance, marketing, production, human resources management, etc.). This requires a fundamental change to how enterprises run their business and how they deliver value to their customers/users. Moreover, digital transformation requires acceptance by the enterprise’s employees since it frequently causes a major change in the operations and responsibilities of employees [32]. This brings up the importance of planning and implementing digital transformation in a bottom-up manner. Bottom-up innovation, used by organizations, has proven beneficial [33,34].

In recent years, enterprises have conducted several initiatives to explore new digital technologies and exploit their benefits. Enterprises need to establish management practices to govern these complex transformations [35]. This requires the formulation of a digital transformation strategy that serves as a central concept to integrate the entire coordination, prioritization, and implementation of digital transformations within the enterprise [35]. The exploitation and integration of digital technologies often affect large parts of enterprises and even go beyond their borders by impacting products, services, business processes, sales channels, and supply chains. The potential benefits of digitization are manifold and include increases in sales or productivity.

We drew our inspiration for the proposed framework from the keywords associated with the definitions of digital transformation, such as “digital disruption, fundamentally changing, faster deployment, digital transformation strategy, integration, stages, and ongoing journey”.

3. Theoretical Foundation

With the advancement of technology and exponential development in the field of software, digital innovation seems to improve an organization’s performance in terms of making the processes efficient. It is not only meant for IT organizations, but can also be

applied to almost any organization in today's world [36]. Digital innovation [37] has an impact on small and medium-sized enterprises, depending on how well an organization is ready to use it [38]. There have been some attempts to conduct digital transformation at universities in the past. While one of these studies emphasizes the importance of data governance and management for effective digital transformation [39], another similar study [40] reported higher educational institutes facing multiple challenges in terms of IT skills and redundant systems, with less focus on digital transformation.

Structured processes, such as Business-Need, Design Thinking, Agile, and Change Management, are applied and familiar in many enterprises. The application of the structured processes is often localized to specific business units (departments), specific phases of the product/service lifecycle [1], and specific domains. For example, design thinking is applied in the problem space during the initial phases of the problem discovery stage, while agile methods are being used in the solution space during the product execution stage.

The conceptual framework for the study was developed based on system theory [41]. The proposed framework integrates these structured processes into a value-centric system framework to remove many obstacles to the digital transformation challenges. The word "system" can broadly be defined as an "integrated set of elements that accomplish a defined objective" [42–44]. Bertalanffy [41] wrote that a system is "a complex set of interacting elements and that they are open to and interact with their environments", and they are self-regulating (they self-correct through feedback). These elements are independent, each with its own specific functions and interrelated responsibilities. Simply put, "a system is a whole consisting of parts and being more than the sum of its parts" [45].

When systems are applied to organizations, viable system models focus on conceptual tools for understanding the organization of systems to redesign them through (i) change management; (ii) understanding the organization as an integrated whole; (iii) evaluating the essential functions of implementation, coordination, control, intelligence, and policy [8,46,47].

Digital transformation maturity has several levels that denote the extensions of digital transformation in an organization [48,49]. There are different levels ranging, from very basic, intermediate, to advanced. There are some changes that are required to move from a particular level to the advanced one. The stage of maturity varies from 1 to 6 [50]. Many organizations are handling digital transformation projects as common IT activities. Business–IT alignment is centered around the idea that the integration of new technologies within the organization should fit to its business need, strategy, and objectives. The failure to grasp the magnitude of the mission has led many organizations to fail in their digital transformation projects, in common, more than 80% of organizations are failing in their digital transformation efforts [48].

This paper presents a coordination-centric system framework by integrating structured processes from their respective domains to develop a holistic sustainable framework. This will reshape the management role into a more strategic paradigm, consistently integrating iterative models of business needs, problem-solving, and change, to the deployment of new products/services or updates. The framework that we present in this paper supports the need for a holistic approach to a need-driven process. The framework is based on aligning the structured processes with the five domains to ensure consistency and the complete development of the lifecycle.

Let us briefly examine the structured processes and the five domains.

3.1. Business Needs Space

Accurately identifying the business needs is key to ensuring not only that the appropriate digital technology solution is chosen but that it can potentially deliver significant business value. The goal of digitization should not be primarily to increase business efficiency and effectiveness, but also to establish new business models and change the way of thinking for the benefit of users and/or customers. As such, a stage-by-stage IS/IT/business plan is essential to build a bridge between business and IS/IT, and to

align IS/IT strategies with business strategies. The user requirements, user requests, and the existing systems and data need to be fully analyzed for smooth integration of new digital technologies.

Understanding the customer requests and requirements and identifying the business needs early in the process gives a clear understanding of why the change is being initiated. Any digitalized solution option that does not satisfy the business needs and the business goals should be eliminated from consideration because it serves no purpose.

Digital transformation embraces the realignment of technology and new business models to engage digital customers more effectively at every touchpoint in the customer experience lifecycle. Therefore, successful digital transformation begins with an understanding of consumer behavior, preference requirements, and choices. It then leads to major consumer-centric changes within the organization that address these requirements. Such a consumer-centric process has significant consequences for enterprises. Enterprises will need to continue managing existing products and services while developing strategies to manage the shift in the business model.

3.2. Problem Space: Design Thinking

The problem space is the current state of the enterprise, where the users/customers and their requirements live. The current state must be understood so that the enterprise can leverage its resources' creativity and innovation to define a new state and a map between the two.

Disruptive technologies, changing customer requirements, a rapidly changing world and markets, and shifting economic and political landscapes have led to complex challenges requiring innovative solutions. To discover these new opportunities and reshape toward digital transformation, many enterprises have turned away from traditional analytical thinking toward design thinking, a method that does not immediately consider a solution upfront, but examines both present and future conditions and parameters of the problem, ultimately exploring alternative solutions.

In recent years, Design Thinking has attracted increasing attention from researchers [27,51,52], companies [53], and the media [43] as a novel problem-solving structured process. Design Thinking focuses on developing innovative products, processes, systems, and solutions by applying design principles to the way people work [53–55]. Potential solutions are identified through a creative and iterative process, which helps users better manage complexity. In this article, Stanford's Design Thinking Process [54,55] will be used. It consists of the following five stages: Empathize (Connect with and understand the users); Define (Identify (reframe?) the core problems); Ideate (Brainstorm lots of ideas); Prototype (Narrow down the ideas and build prototypes); and Test (Use the results to support decision-making).

In the last few years, Design Thinking has gained increasing attention from researchers and practitioners [43,51–53,56–58] as a structured process to solve ambiguous problems [59]. Design Thinking focuses on developing innovative products, processes, systems, services, and solutions by applying design principles to the way people work [53]. Design thinking is a user-centric structured process, given its propensity to connect both enterprises and users in the local context [60]. Design thinking primarily adds value to the problem space.

It is suggested that, typically, the larger a company, the less likely they are to consider design thinking methods as an approach to solving problems due to pressure from stakeholders who value reliability over validity. More recently, however, Kolko [53] identified that a shift is occurring towards utilizing design thinking within larger organizations. This shift is focused on applying the principles of design to how people work to create a design-centric culture within an organization, which removes design from historical associations with aesthetics and craft, and instead elevates the role of design towards imparting a set of principles to all in order to help bring ideas to life [53].

In the early stages of development, the Design Thinking approaches were circular approaches, whereas later ones were sequential [61]. More recently, design thinking has

been put forward as a step-by-step method that anyone can follow and has become widely popular and used. The rapid acceptance of design thinking as a technique has, however, become a cause for concern for researchers and practitioners. To prevent design thinking from being applied superficially, advocates argue that design thinking should be seen as a series of overlapping domains, as opposed to a sequence of orderly phases [43]. Kolko [53] indicated that design thinking “works extremely well for imagining the future. But it’s not the right set of tools for optimizing, streamlining, or otherwise operating a stable business”. He added that design thinking “helps people and organizations cut through complexity. It’s great for innovation”.

3.3. Solution Space

The solution space is where products, services, processes, maintenance, and experiences fulfilling users/customers live. The solution can only be as good as the problem if discovered and understood. The solution is determined by producing new ideas, models, and prototypes that potentially solve the problem.

The challenge for managers lies in deciding when to move from the problem space to the solution space. As a rule, a certain amount of validation about the problem must be considered before commencing with SDLC. Moving from the problem space to the solution space should carefully consider the strategic fit and the portfolio fit. The project’s fit with the portfolio’s markets and technologies is tied to the overall business strategy [62]. Moving from the problem space to the solution space should be considered a Go/No-Go decision.

Several methods and techniques are used for the system-development life-cycle (SDLC), such as the waterfall and agile approaches. The goal of the SDLC is to bring the problem space to the solution space. The SDLC lives entirely in the solution space, along with other solution structured processes such as agile.

Agile is an approach and scrum of building a product or service based on a process of continuous iteration. Iteration allows cycling within a phase and between phases. Therefore, there is always a way to move back and forth between the problem and solution space [57]. With each iteration, the design thinker’s knowledge will increase in both the problem and the solution space, until an acceptable state of the solution has been found [61].

3.4. Operational Space

The operational space is where things are conducted within an organization. In the operational space, organizations continuously monitor the consumer/user requirements and competitor landscape, confirming strategic direction and tracking the progress against the market performance to ensure continuous improvements. This continuous monitoring process should be used as an input (feedback) to the business needs space.

We draw on international best practice standards, such as the Information Technology Infrastructure Library (ITIL) (Axelos (2019-02-18). “ITIL® Foundation, ITIL 4 edition”. Axelos), to pragmatically tailor approaches providing “good practice, culture, scale, and a right-fit/optimal” result better suited to the proposed system framework. This is more appropriate, achievable, and affordable.

ITIL is a set of detailed practices for IT service management (ITSM) that focuses on aligning IT services with the needs of the business. It helps to drive the organization in an instrumental, visionary, and unified direction. ITIL v4 is grouped into five major components: service value chain, guiding principles, practices, governance, and constant growth [63]. ITIL 4 provides “the guidance organizations need to address new service management challenges and utilize the potential of modern technology in an era of cloud, Agile, DevOps and transformation” [64].

There are many operational challenges across industries that the c-suites face on a daily basis, such as Optimizing Service Delivery, Rising Operational Costs, Shortage of the Papers’ Forms, Communication Barriers with On-Field Professionals, Difficulty in Tracking and Third-Party Billing, Inefficiency in Meeting Customers’ Demand, Failing to Capture Accurate Information from the Field, Unprepared Field Personnel, the Business Shows No

Signs of Improvement, and Dealing with Unsatisfied Customers [65]. These challenges and many others need to be monitored and controlled by business leaders to align business services and IT services with business needs. This will help in linking the five domains of the proposed system framework.

3.5. Change Management

The business environment in today's competitive climate is very complex and needs a deep study. As such, change management has been widely investigated. Change management is defined by Moran and Brightman [66] as "the process of continually renewing an organization's direction, structure, and capabilities to serve the ever-changing needs of the marketplace, customers and employees".

Change management must be an essential piece of the general improvement strategy of any organization. Most organizations perform change tasks just toward the end of the improvement initiative. This is an incapable strategy, since it does not give adequate opportunity to individuals to adapt to evolving conditions. Change management tasks ought to start related to the beginning of an improvement initiative. Further change management arrangements ought to agree with the various periods of the improvement initiative.

Change is a recurring process. To implement change effectively, one needs to be doing several things at the same time. Change management cycles repeatedly go through the following phases (Figure 1):

1. Assess for change (understand the current situation);
2. Prepare for change (determine the desired state);
3. Plan for change (develop a change plan);
4. Implement the change;
5. Sustain the change (track and stabilize the results);

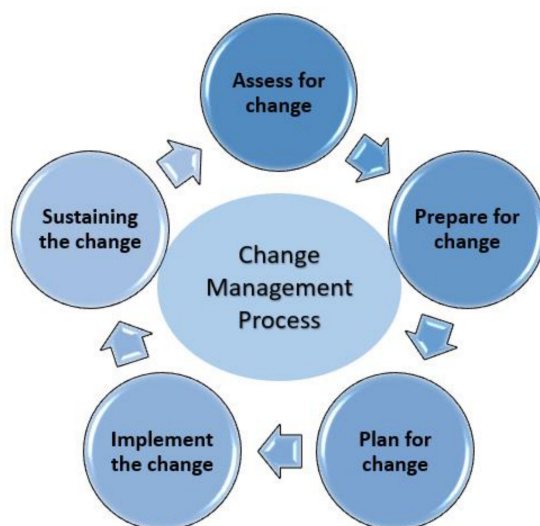


Figure 1. Change management cycle. Source (<https://www.innerworkcompany.com/change-management-process/>, accessed on 6 April 2020).

Change management activities must operate at a high level today, since the rate of change is greater than ever [33]. Change must be viewed as an integrated, dynamic, and continuous process of organizational improvement. It is not a matter of "adding on" or "adding in" new or missing functionality of capability to the current environment.

In the era of digital transformation, there are several brutal consequences if organizations fail to build the capacity to change quickly and efficiently [67]:

- Organizations cannot keep up with their competitors (where the marketplace has been disrupted by new entrants);
- Recovery is tough (after a decline);

- The engagement of employees becomes far more difficult (engaged workers);
- Employees suffer from change fatigue;
- Business performance deteriorates rapidly (profit and market share).

In the era of digital transformation, there is an urgent need to replace the contingent style of change management with the need to accommodate emergent change, in which there is a need to establish the capability to process change on an as-needed and more ‘immediate’ basis and not wait until the pressure for change builds up to the point that urgent and significant step changes are required.

Having a holistic and progressive approach to change management helps to define and characterize an organization and contributes positively to the need to present a positive image to the organization’s stakeholders, such as users, customers, suppliers, potential employees, and the ‘competition’.

4. Methodology

In this study, we draw upon the Design Science Research (DSR) process [68] and the Design Science in Information Systems Research [69] as a primary research approach. DSR is one of the two important main research paradigms accepted in the IS discipline, which highlights the artificial/synthetic approach to science. According to Peffers et al. [68], the DSR process consists of the following processes: problem identification, defining the objective of the solution, design and development, demonstration and evaluation, and communication.

4.1. Problem Identification (Relevance Cycle)

To develop a better understanding of the digital transformation problems and objectives of the solution, general and specific to the case study, two rounds were iterated—the first round was to review the literature to understand the nature of the problem in general, and the second round was to explore the problems faced by the organization that drive the development of our framework. In the first round, the project started with two general design inquiries:

1. What drives the digital transformation?
2. What are the challenges associated with digital transformation?

The background section of the paper reviews the literature to understand the state of the problems that motivate the need for and drive the development of the IDTSF model.

To explore the challenges associated with digital transformations within organizations, we investigated a large federal university in the United Arab Emirates (UAE) (referred to as FedUni in this paper), representing digital transformation initiatives in the education sector. The second round started with more specific design inquiries, related to the FedUni case study, as follows:

1. Who are the main stakeholders of the digital transformation operation at FedUni?
2. What are the drivers of the digital transformation project at FedUni?
3. What are the objectives of the solution, in terms of the five domains?

Digital transformation is still a new phenomenon, still developing [70], and no company has yet reached the end state [14]. Consequently, exploratory research is deemed appropriate, as it builds on secondary research and employs formal approaches through in-depth interviews, focus groups, projective methods, case studies, or pilot studies [67]. While qualitative research via interviews has been used in similar studies [37,71] and in similar geographic environments [72] to collect qualitative data, its use has been suggested to appraise the company’s digital maturity [73].

Researchers Benneworth, Paul, and Ben W. Jongbloed [74] identified governing entities, administration, employees, clientele, competitors, government, and non-governmental regulators as some of the typical higher education institution stakeholder categories. These stakeholders can influence the digital transformation decisions in the case of a federal institution, such as FedUni. Accordingly, this research decided to interview eight key

stakeholders consisting of top-level management (administration), faculty and support staff (employees), and students (clienteles), who are either directly involved or have been impacted by the digital transformation process at FedUni.

4.2. Objective of the Solution (Implicit in “Relevance”)

Research, as well as the empirical study, presents a demand for clear, specified guidelines on the transformational steps to overcome digital transformation issues and challenges to successfully achieve the business goals and objectives. Consequently, to resolve transition, development, implementation, deployment, and operational challenges, and to reduce the deployment risk, we identified two objectives of this study:

- ✓ (Obj1) How should experience-centered digital transformation deployment systems be designed?
- ✓ (Obj2) Which aspects of the organizational systems theory can be used to support efficient, sustainable, and smart digital transformation systems?

4.3. Design and Development (Iterative Search Process)

To explicate the design of the solution that fulfills the objectives, we carried out an extensive literature review that proposed that, currently, no sufficient and holistic digital transformation conceptual framework solution exists. Hence, the IDTSF model was proposed through several iterations to ensure a complete and sound solution.

4.4. Evaluation (Evaluate)

Case studies are used by similar studies for the evaluation of their models [72] and are considered the best method when the data acquired from the research needs are presented through descriptive and explanatory methods. We used the FedUni case study to propose and evaluate our solution, trusting that our proposed conceptual model will add value to the Information System’s body of knowledge of literature and practice. We deliberately focused on this federal university for our evaluation, since its business model differs significantly from private universities, and it is considered a regional leader in educational innovation and a market leader in federal education. We adopted face-to-face, semi-structured interviews with open-ended questions for capturing the independent point of view of each of the interview respondents. While case research can be used with any philosophical perspective, we opted for the positivist philosophy as it can explicitly test as well as build theory [75]. In our study, the positivist philosophy is used to evaluate our framework. Semi-structured interviews were conducted to examine the functionality and effectiveness of the initial artifact and explore the potential problems for further improvements. The researchers had a list of pre-determined key questions (derived from the literature review) to be covered during the interviews, which were obtained through deductive research. These research questions were open-ended and divided into five categories (mapping to five domains of the framework). While interviews with top-level managers (decision-makers) and the faculty lasted for an average of 1 h each, it took around 20–30 min to interview each student. Interviews were conducted on the site, face-to-face, and recorded with the respondent’s permission. For analysis purposes, the audio files were transcribed verbatim using ‘O-Transcribe’ and loaded into the qualitative data analysis software NVIVO 12. To analyze and interpret the qualitative data, we followed the five-step guideline given by LeCompte [76], namely “tidying up”, “findings items”, “creating stable sets of items”, “creating patterns”, and “assembling structures”. The collected data were subjected to constant comparison analysis [77] to deductively code data into the pre-determined (five) categories. The results reinforced our views on the importance of using integrating structured processes, such as Business Need, Design Thinking, Agile SDLC, ITIL, and change management, within the five domains of digital transformation projects.

4.5. Communication

In this last step, the primary objective is to communicate the problem and the designed artifact to the researchers and the relevant audience. By conducting this step, researchers can contribute to both practice (i.e., propagating the problem–solution) and design theory (i.e., adding an instantiation of the design model and theory) and attain feedback and suggestions for further artifact improvement.

As part of the “Communication” phase of the DSR paradigm, the initial description of this project was presented at a well-known academic conference [26]. Based on the feedback from the audience, the authors made major revisions to the paper, including the structure of the paper, title, abstract, methodologies, testing the model with FedUni, enhancing the analysis, the conclusion, and adding one more test round with faculty and staff from FedUni’s different units and departments. We plan to share the findings of this research with fellow project members and the public.

5. Background

5.1. Case Background

The UAE government’s strategy to provide intelligent and interactive government services has been the driving force for FedUni’s digital transformation process. Information Technology (IT) is a vital part of FedUni’s business model, and it is considered an enabling as well as a supporting function. To facilitate the UAE’s ‘smart city’ vision, to remain at the forefront of technological progress, and to optimize the organization’s interaction with its stakeholders, FedUni watches new trends and technologies very closely. While, in most cases, FedUni is an early adopter of technologies, in some cases, however, it has taken an innovative role in the region, such as in utilizing blockchain in the education industry. FedUni’s strategic agenda of digital transformation in 2016 resulted in structural changes, with FedUni establishing a new ‘Academic Quality and Strategic Initiatives’ department and bringing on board the ‘Provost Advisor for Academic Quality and Strategic Initiatives’ for the coordination of the university’s digital initiatives. This academic technology unit, within the office of the provost, works as a technology enabler for software services, thereby aligning IT services to FedUni’s business goals. It develops strategies to leverage its resources’ creativity and innovation to define a new state.

FedUni’s digital transformation process was executed in three phases. The first phase focused mainly on quality issues that needed immediate attention to run the organization in an optimized way. Their focus in this phase was on efficiency, seamlessness, transparency, and the personalization of services to its stakeholders. The national-level mandate from the Prime Minister’s Office in the UAE necessitates 80% of government services to be on digital platforms. Being a federal university, compliance with such directives is essential. Accordingly, in the second phase, compliance with national and international requirements became the driving force. Automating program-related data and services made it easier to adhere to international and national accreditation requirements. Finally, the third phase focused on bringing innovation to streamline the business processes. This process resulted in automating services for students, faculty, management, and outreach services for the community.

Some crucial steps in this direction of technological innovation were the development of a business analytics dashboard providing detailed analytics, which helps management in its readiness to deliver in terms of the future needs of the organization, as well as to obtain a direct measure of the program’s effectiveness. Besides being an innovator, FedUni is also an early adopter of some of the technologies in the region. In this effort, FedUni monitors and controls challenges, such as optimizing service delivery, unsatisfied stakeholders, and rising operational costs, by utilizing current technologies, such as Artificial Intelligence in their processes. Using technologies such as blockchain and big data, FedUni developed systems that have streamlined and improved services helping in making informed and evidence-based decisions. To cater to customer requirements, FedUni has plans to offer online tracking services for procurement departments to track the progress of purchase requests.

5.2. FedUni's Digital Transformation Initiatives

Inquiries into the digital transformation initiatives at FedUni are divided into five domains as follows:

5.2.1. Business Needs Space

FedUni's digital transformation emphasizes the quality of systems, focusing on efficiency, seamlessness, transparency, and personalization of services to its stakeholders. Compliance with accreditation and government regulations also serves as a driver of the digital transformation initiative at FedUni. It is further fueled by the desire to streamline and reduce or eliminate internal problems in terms of tracking the information, data flaws in the system, and under-utilization of the existing information systems resources. However, some of the transformations brought into the systems are conducted under pressure to respond to the requirements of various entities without going through a proper understanding of the consumer behavior preferences.

5.2.2. Problem Space

As discussed, one vital reason for FedUni to initiate digital transformations was to address the problems related to poor systems. Through digital transformation initiatives, FedUni has been successful, not only in fixing these problems, but also in increasing the efficiency and effectiveness of the academic, administrative, and decision-making processes, and in establishing new models, such as shifting to online teaching, online assessments, and using blockchain for the verification of degrees, to name a few. In general, this has proven to be cost and time-effective and satisfied stakeholders; however, it has led to dissatisfaction among a few stakeholders, who raised concerns of the system complicating already time-strained faculty work, rather than easing it.

5.2.3. Solution Space

The Academic Quality and Strategic Initiatives department engages in digital transformation projects that are aligned with the business goals. Using Agile SDLC-structured processes, the majority of the system development is conducted in-house, with integration being the key target. To acquire the required competencies, FedUni relied on three approaches. Firstly, FedUni realized the importance of developing existing staff through training and workshops. This was conducted to retain the knowledge in-house so that FedUni was better positioned to gain a competitive advantage for future digital transformation initiatives. Secondly, FedUni also found it necessary to hire some experienced competencies. Thirdly, FedUni also partnered with other companies that already had the specific knowledge to facilitate integration processes. Digital transformation at FedUni resulted in the development of solutions, some of which were conducted in-house, while others required partnership with third parties. However, apart from the risk of losing a required competency and becoming dependent on a third party, FedUni fell short of validating the newly established digital solutions.

5.2.4. Operational Space

FedUni is engaging itself in the process of continually renewing an organization's direction, structure, and capabilities to serve the ever-changing needs of the marketplace. All of the digital solutions are first planned and evaluated for technical, financial, and operational feasibility. After obtaining approval from senior management, systems are built, and feedback and approvals are obtained from department heads. This has resulted in significant time savings for the faculty, students, and admin staff, in addition to an increase in satisfaction and return on investment.

5.2.5. Change Management

FedUni uses a top-down approach to manage the change, ignoring the ideas of all except those in the executive suites. Since the faculty or any of its representatives were not

directly involved in the design of solutions, they remained skeptical about the benefits of the new systems. Solutions imposed on employees, without any awareness of the objective of the change, cause dissatisfaction and resistance to change by some stakeholders.

Based on the aforementioned problems, we identified two main objectives of this study: (obj1) build an integrated digital transformation system framework (IDTSF) based on predefined principles; and (obj2) give organizations insight into how the proposed framework helps organizations avoid common failures when deploying digital transformation initiatives.

6. Results

To answer our first research question (obj1), we present an enhanced integrated digital transformation framework by mapping well-known structured processes, such as Design Thinking, Agile SDLC, ITIL, and Change Management, to five identified domains (business need, problem, solution, operational, and change management).

An extensive review of literature proposed that, currently, no sufficient holistic conceptual framework solution exists. Hence, an Integrated Digital Transformation System Framework (IDTSF) was proposed through several iterations to ensure that we have a complete and sound solution.

6.1. Proposed Integrated Digital Transformation System Framework (IDTSF)

Recent research has been largely concerned with guiding certain aspects of digital transformation; it has not addressed a holistic approach to the development and implementation of an enterprise's digital transformation strategy [78]. Some researchers argue for a digital business strategy that combines IT and business strategy [79].

Though a digital business strategy may indicate a company's wide digital business vision, it typically lacks a clearly specified guideline on certain transformational steps and how to approach digital transformation and implement a well-defined digital transformation strategy [3,80].

Capgemini and MIT [5] discuss how to overcome digital transformation issues and challenges to successfully achieve the business goals and objectives. Organizations need to do more to gain value from their IT investments, while also envisioning more radical, new ways of running their business. Capgemini and MIT [5] state that successful digital transformation comes from "reshaping the organization to take advantage of valuable existing strategic assets in new ways". The risk-taking in digital transformation is becoming "a cultural norm as more digitally advanced companies seek new levels of competitive advantage" [81].

To resolve transition issues, development, implementation, deployment, and operational challenges, and to reduce the deployment risk, we propose an Integrated Digital Transformation System Framework (IDTSF). The IDTSF integrates the five domains that, in concert, are essential for the formulation and implementation of a digital transformation deployment: business needs space, problem space, solution space, operational space, and change management space.

To address these objectives, the conceptual model was developed using a system theory approach as a modeling technique to map the workflow of an identified structured processes product. System theory is deemed useful for this research, because it allows the development of process models from a multi-level perspective [82], which is necessary for considering all five types of structured processes. Furthermore, system theory usually includes the specification of system or system elements' boundaries to delimit the object of interest from everything else [83]. Such boundaries are required to model inputs and outputs of information flows. Moreover, the proposed model can integrate other data and processes [84], such as process parameters or information flows. Therefore, the visual concept of the new generic reference model will be developed based on system theory by the observation and analysis of the structured processes that help the organization to avoid common failures when deploying digital transformation initiatives.

As shown in Figure 2, the joint framework is to have one integrated framework drawing from the five identified domains and the identified structured processes. Integrating the joint framework with the other organizational activities will guarantee the seamlessness of the deployment and the integration of digital technologies into the enterprise. The joint framework allows enterprises to (1) implement a single and integrated method that delivers value to the customers/users; (2) set priorities to accomplish their strategic goals and objectives; (3) keep up with digital trends to stay effective and relevant to the customers/users; (4) seamlessly and rapidly integrate emerging technologies into their infrastructure; and (5) lower costs through the whole value chain.

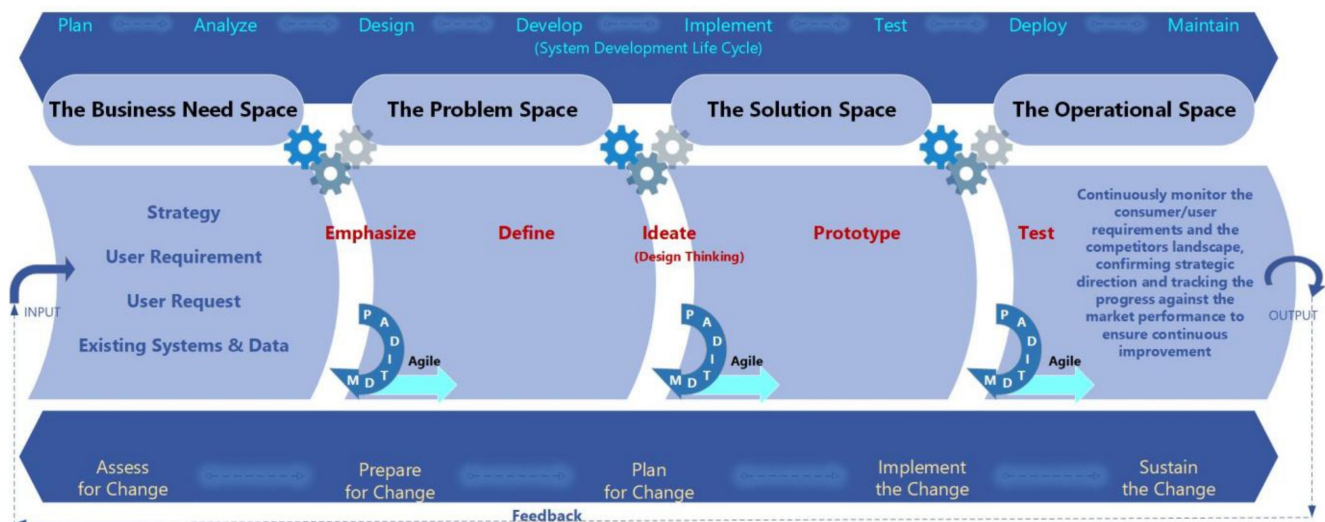


Figure 2. Integrated Digital Transformation System Framework.

As seen in Figure 3, the five domains of the IDTSF fit together like the cog wheels of a perfect machine—moving one cog influences and activates all other cogs.

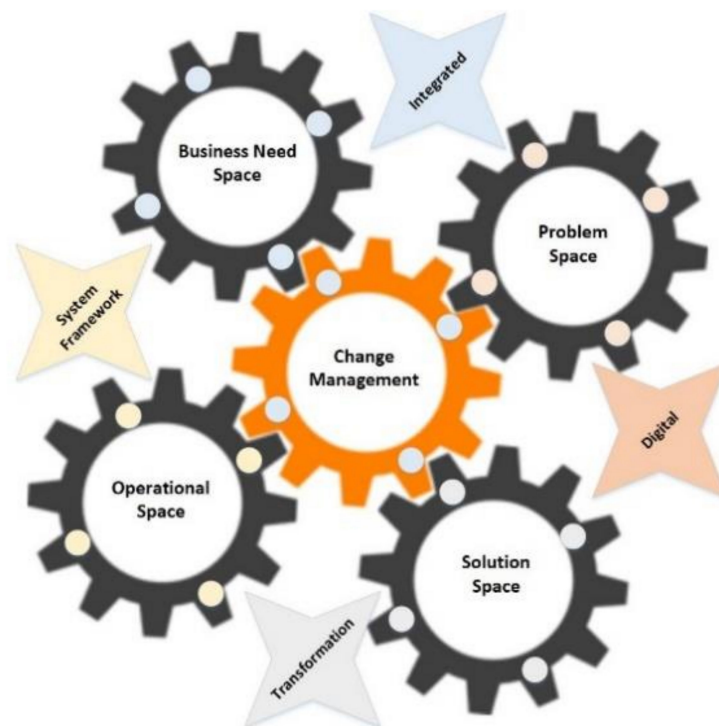


Figure 3. IDTSF components.

In response to the first research question, we utilized the DSR and the ISDSR methodologies using the FedUni case study to design the experience-centric IDTSF model. We followed the five steps (problem identification, design, and development, demonstration, evaluation, and communication) of the DSR process to develop the IDTSF model. Figure 4 below displays an overview of our study results mapped in the design science research structure.

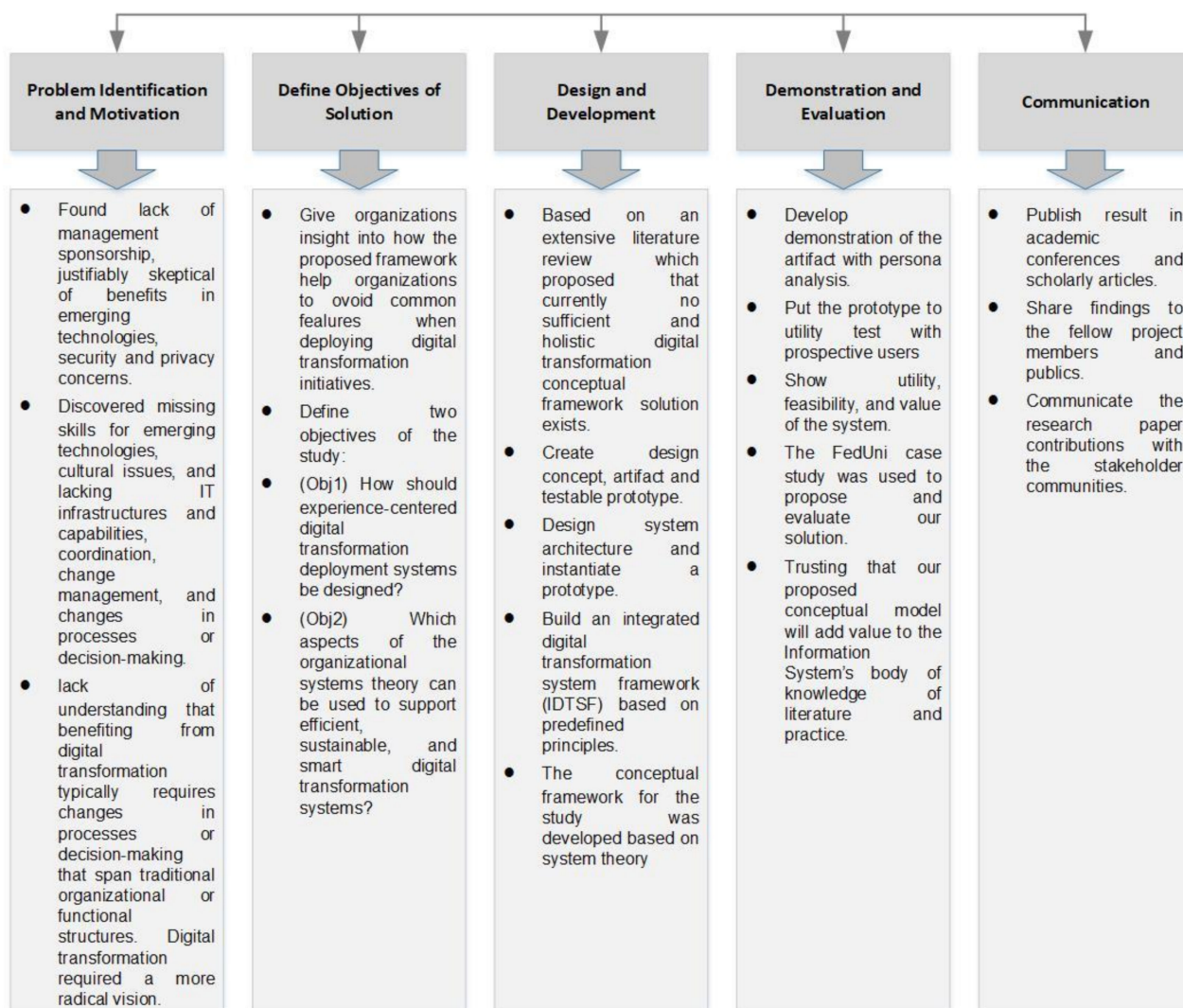


Figure 4. Integrated Digital Transformation System Framework by using the Design Science Research Methodology.

6.2. Organizational Insights

Our analysis of the literature identified three main categories of challenges associated with digital transformation—initiation, execution, and governance. The empirical study attested to these challenges. Based on our study, we addressed obj2 by presenting the guidelines below for organizations to overcome these challenges and to avoid common failures when deploying digital transformation initiatives.

The initiation challenges faced by organizations relate to ‘blind’ and ‘short-term view’ issues. Digital transformations may be brought into the enterprise because of the senior management with an overarching transformative vision of the future. Organizations can overcome ‘blind’ and ‘short-term view’ initiation challenges by avoiding approaching digital transformations with blind rushes. They need to develop strategies and establish quality

initiatives to understand the current state of the enterprise, and then leverage its resources' creativity and innovation to define a new state for a long-term sustainable business.

Digital transformation processes must have the involvement of all stakeholders to develop systems that ease the work of employees, rather than introducing new cumbersome work-related policies. While streamlining its business processes and continually renewing its business model, the focus should be on innovation in establishing new models, and increasing the efficiency and effectiveness of its processes, transparency, and compliance with standards.

In this era of disruptive technologies and rapidly changing opportunities, there is a need to use an innovative structured process, such as Design Thinking, that involves the active participation of users in idea generation, prototyping, or concept evaluation activities. Design Thinking examines both present and future conditions and parameters of the problem, ultimately exploring alternative solutions and processes that fulfill users' expectations.

Organizations face various execution challenges in terms of a shortage of skills and infrastructure and integration issues. To overcome these challenges, organizations can resort to mechanisms of training their employees, hiring new capabilities, or/and partnering with third-party companies that already have the specific knowledge to facilitate integration processes. Adopting third-party digital solutions may lead to the risk of losing their own competencies, over-dependence on external entities, and lack of evaluation of newly established solutions. To steer digital transformation in the right direction, creative solutions need to be developed through an iterative process, whereby the problem and potential solutions 'co-evolve' over time, with the developer exploring two conceptual spaces, a 'problem space' and a 'solution space', with each space informing the other [85]. This iterative, co-evolution view of development helps in potential solutions receiving consideration in the context of the requirements that define the problem. Extracting requirements and transforming them into viable solutions are still intricate tasks. Structured processes, such as Agile SDLC and Design Thinking, can be extremely useful in tackling such intricate tasks by systematically applying these human-centered techniques to solve problems in a creative and innovative way. An agile-structured process can help the team to adapt to the dynamic changes in the user requirements. Moreover, using this process, the solution is frequently evaluated, minimizing the risk of major faults in the future. Design thinking can be particularly useful in tackling problems such as a lack of user involvement by using brainstorming sessions and adopting a hands-on approach in prototyping and testing. User validation of the solution should be of paramount importance in this case.

Other execution challenges faced by organizations include employee pushback and change management issues. Organizations may lean towards a top-down approach involving senior-level executives to manage change. Ignoring the input from all users and imposing solutions on them without any awareness of the objective of the change may cause dissatisfaction and resistance to change by some stakeholders. The acceptance of new digital tools by the employees is often critical for its success. Therefore, early involvement of employees in the road-mapping process and the adoption of bottom-up innovation to keep employees engaged during the onboarding process will help in overcoming employee pushback challenges. In this era of digital transformation, there is a need to establish the capability to process change on an 'as needed' and more 'immediate' basis and not to wait until the pressure for change builds up to the point that urgent steps are required.

Digital transformations should be based on some industry best practices, such as ITIL, whereby IT services are aligned to the business needs, involving concerned stakeholders and linking the five domains. In addition, to implement change effectively, organizations must follow a complete change management cycle of assessing, preparing, planning, implementing, and sustaining the change.

To overcome governance challenges, organizations must be proactive in setting up structures that work as enablers of technology services. Moreover, it is crucial to identify

business needs early in the process, thereby giving a clear understanding of why the change is being initiated to the users.

Overall, this research has shown that the main difficulties and obstacles to digital transformation are not technologies, but human factors, employees' resistance to change, testing and validation of the solutions, and not making the maximum benefits of integrating structured processes, such as business need, design thinking, change management, Agile SDLC, and ITIL. Increased participation of employees, especially the users of the system, is very important in organizational decision-making.

7. Conclusions

Digital transformation approaches have been proposed by many researchers [21,24]; however, none have presented a holistic framework, making the maximum benefits of integrating structured processes based on best practices. This research aims to deliver a better integrated framework that integrates stand-alone structured processes, such as Business needs, Design thinking, and Agile SDLC, applied in the five domains of the digital transformation projects. Our paper has important practical implications. Many organizations struggle to make the best of digital transformation [86]. This framework will guide managers to implement sustainable digital transformation practices/principles for achieving effective and efficient operation. Our results may prove valuable for them by increasing awareness about the importance of change management in digital transformation.

This paper also contributes to the body of knowledge on digital transformation research. This research has identified initiation, execution, and governance challenges faced by digital transformation projects. Some initiation challenges include blind challenge, short-term view issues, issues related to the top-down approach, management skepticism of the benefits of emerging technologies, and security and privacy concerns. Developing strategies, establishing quality initiatives, and streamlining business processes to leverage their resources' creativity for a long-term sustainable business with a focus on innovation, efficiency, transparency, and quality are suggested. Managers need to consider the strategic fit and the portfolio fit of digital transformation in the business needs space and avoid jumping into a solution space too quickly. Moving into a solution space should be considered only after there is sufficient validation of the problem.

Execution challenges include missing skills for emerging technologies, employee push-back, integration issues, cultural issues, lack of IT infrastructures, change management, and changes in processes or decision-making. Governance challenges, such as a lack of understanding of the benefits of digital transformation, typically require changes in processes or decision-making that span traditional organizational or functional structures. Digital transformation requires a more radical vision, and senior executives need to establish an overarching transformative vision of the future, since managers in the rest of the firm will often tend to locally optimize within their own spheres of authority.

Structured processes, such as Agile SDLC and Design Thinking, can be extremely useful in tackling execution and governance issues by systematically applying these human-centered techniques to solve problems in a dynamic, creative, and innovative way. Moreover, using this process, the solution is frequently evaluated, minimizing the risk of major faults in the future. Digital transformations based on industry best practices, such as ITIL, can help in aligning IT services to the business needs, involving concerned stakeholders, and linking the five domains. In addition, to implement change effectively, organizations must follow a complete change management cycle of assessing, preparing, planning, implementing, and sustaining the change.

8. Limitations and Future Work

As in all qualitative studies, absolute completeness is hard to achieve; one might question whether our results cover all processes that can be useful in a digital transformation project, but we have captured key structured processes that can be utilized in the five domains (stages) of digital transformation projects.

Despite our paper's valuable contributions, it also has the limitation of having samples from one case study and one industry only. In the future, we need to synthesize, explore, improve, and extend the ITDSF by replicating our study with more case studies and spanning wider industries. We plan to achieve this by conducting in-depth interviews, followed by recursive discussions and brainstorming, based on reviews from the unstructured interview and secondary data.

To show the utility feasibility and value of the system, we plan to evaluate the framework further by developing a demonstration of the artifact with persona analysis, and by putting the prototype to utility test with prospective users.

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