

Identifying and Documenting Best Practices in Digital Transformation

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ABSTRACT

Digital transformation allows organizations to maintain sustainable development and address ongoing challenges. The current digital transformation and advanced technology mega-trend significantly impact society and organizations, making digital technology crucial for public and private organizations, universities, and daily life. Despite the rising demand, there is often a lack of standard policies governing the use of digital technology. Practical experience and literature reveal key challenges in transitioning from traditional to digital systems, including limited public awareness, mindset, ICT skills, government support, and collaboration between organizations and software engineering societies. Governments must establish digital transformation policies and offer software development guidelines for public organizations to digitalize their systems. Additionally, they should provide or support research projects funded by governmental and nongovernmental organizations to identify infrastructure and regulatory issues within Afghanistan's digital transformation context. This study documents six organizational patterns observed during the transformation of traditional systems into digital systems, illustrating their sequence and explaining the development of a pattern language from these patterns.

CCS CONCEPTS

• **Software and its engineering** → **Patterns**.

KEYWORDS

patterns, software engineering, organizational patterns, digital transformation

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1 INTRODUCTION

Digitalization, achieved through technology, facilitates the transition of a business into a digital form, which is a process commonly known as digital transformation [7]. It is not just about technology or organizational changes; digital transformation impacts the entire process (workflows, tasks, methods, and constraints), people (culture, skills, capacity), and the organization's infrastructure. Regardless of the enterprise or firm, digital transformation contains four essential dimensions: changes in value creation, structural changes, technology use, and financial factors [16].

In today's interconnected world, where technology is transforming every aspect of life, developing countries face unique opportunities and challenges in embracing digital transformation. Information technology (IT) is revolutionizing all aspects of life worldwide, including technology, education, and business. However, developing countries have not fully experienced the potential of this global revolution. They encounter numerous challenges in transferring and adopting digital transformation, encompassing government policies, inadequate infrastructure, training, business processes, lack of expertise, insufficient capacity building, and cultural differences. Despite these obstacles, developing countries possess the potential to leverage the power of digital transformation, pushing themselves into a new era of growth and prosperity [11].

Firms and other organizations need to provide services effectively and efficiently through digital transformation. They should be appropriately managed and monitored at each stage of the transformation to ensure the practical application of sound practices and avoid mismanagement of resources due to recurring problems. Organizations need to innovate and embrace technologies to stay ahead of the competition in the digital revolution that transforms every business sector into digitalization. Andreessen [3] famously noted: "Software is eating the world." The world is now ruled by digitalization powered by data and technology more than ever before. Digitalization and digital technologies have managed to capture every part of our life. The three significant implications of digitalization in organizations can be described as: organizing people, administration of business processes, and IT infrastructure and tools. Unless employees' mindsets and existing organizational practices are not ready for the change, digital transformation has no meaning for an organization. Leveraging insiders, digital transformation requires daily operations skills during and after the transformation. We need people to have skills to use digital technologies and tools

effectively, organizing people based on their existing technological capabilities and capacity to adapt newly acquired skills.

The core of digital transformation is to design digital services that simplify traditional and classical business methods. However, transforming traditional documents and processes into digital forms using technology solutions can be complex and not always feasible. Digital transformation requires a robust process of designing digital services that add value to the organization. The IT infrastructure and tools used in digital transformation today form an ecosystem of interdependent digital technologies that will continue to drive economic and societal growth in the future. Blockchain, big data, cloud computing, grid computing, Internet of Things, and artificial intelligence are typically involved in digitalization.

In this paper, we aim at identifying the recurring challenges of digital transformation and explore the organizational aspects of digital transformation, covering the best practices derived from practical experience, literature, and lessons learned from digital transformation frameworks. We present them in the form of organizational patterns. Figure 1 illustrates the transition from traditional or manual operations to digital processes. The traditional approach often encounters various issues, whereas digitalization enables faster and more accurate processes, effectively addressing those problems. The depicted process unfolds from left to right, illustrating the transition from traditional operations to digital processes.

The rest of this paper is structured as follows. Section 2 explains the challenges and best practices in digital transformation. Section 3 provides the story behind the patterns and pattern format we used. Sections 4–9 present the patterns. Section 10 discusses our results. Section 11 relates our results to what others have achieved. Section 12 concludes the paper.

2 CHALLENGES AND BEST PRACTICES IN DIGITAL TRANSFORMATION

For nearly a decade, we have engaged with and observed numerous organizations, including HELMIS (Higher Education Learning Management Information System), HEMIS (Higher Education Management Information System), CMIS (Certificate Management Information System), and various public institutions. We have encountered challenges and best practices throughout the digital transformation implementation process. Particularly, when working with public organizations seeking to digitalize their traditional systems, we found that implementing digital transformation can be especially challenging, with a less assured success rate. We encountered various challenges during these transformations. As part of the operational teams in organizations transitioning from traditional to digital systems, we have firsthand experience with these challenges and have observed effective and efficient practices.

Organizations leverage digital transformation for various purposes, including streamlining processes, creating new business opportunities, innovating products, reducing costs, and establishing new business models. To maintain its competitive edge, implementing digital transformation must be strategic. However, employees may face certain challenges from their perspective. Some may resist replacing traditional systems with digital ones despite recognizing the innovative approach as a way to address future challenges and enhance business operations. Common challenges encountered

during digital transformation initiatives include communication gaps, a lack of necessary expertise, limited IT resources, low awareness, insufficient commitment, transparency issues, time wastage, concerns about employee integrity, trust issues, digital maturity gaps, mindset challenges, and a lack of transparency, among others. These challenges are frequently observed in digital transformation initiatives and, in some cases, have led to project failures [14].

The analysis reveals that digital transformation is being implemented across various industries. Companies utilize digital technologies for a range of purposes, including business process integration, creating new business opportunities, product innovation, cost reduction, and the development of novel business models. Nevertheless, companies must adopt a strategic approach to digital transformation to enhance their market position and maintain competitiveness. The paper concludes that digital transformation can assist businesses in making improvements and addressing future challenges [14].

During our work, we observed a number of public projects: E-NID Afghanistan, ASAN KHIDMAT Afghanistan, HELMIS (Higher Education Learning Management Information System), Certificate Management Information System (CMIS) at MoE, E-ELECTION SYSTEM, HEMIS Project at MoHE, and E-Passport System. After observing numerous organizations, we identified several areas of concern. Our goal was to emphasize some of the challenges and best practices, documenting in the form of patterns.

3 THE STORY BEHIND THE PATTERNS

We will tell a short story about a real public organization in Afghanistan, which we will refer to as KTH (not its real name for privacy reasons). The story behind the patterns is authentic and practical. The discovered patterns are presented in the order they were observed. In the story, we mention the corresponding organizational patterns in italics in parentheses.

KTH required additional IT resources, skilled personnel, and software developers. Furthermore, there was a demand for software and hardware equipment, as well as maintenance and support. KTH was unable to undertake these tasks independently. Nangarhar University's Computer Science Faculty (CSF) was enlisted to digitalize the entire KTH system with the aim of improving transparency, facilities, and operational efficiency.

Various KTH's branches aimed to implement digitalization with the appropriate resources, timelines, and budget. To ensure accuracy, speed, security, and efficiency for all processes and communication, moving from manual operations to digital processes is needed (*Embrace Digitalization*, Section 4).

CSF has analyzed and re-engineered all the processes at KTH and developed a prototype for the same department. (Build Prototype [9]).

The CSF development team was responsible for understanding the requirements and business process, and reviewing the required system's structure (Developer Controls Process [9]). It was also responsible for developing and simplifying the business processes of the system. Both organizations needed to make sure they are on the right path toward development (*Engage Quality Assurance* [9]), which is dependent on prototyping.

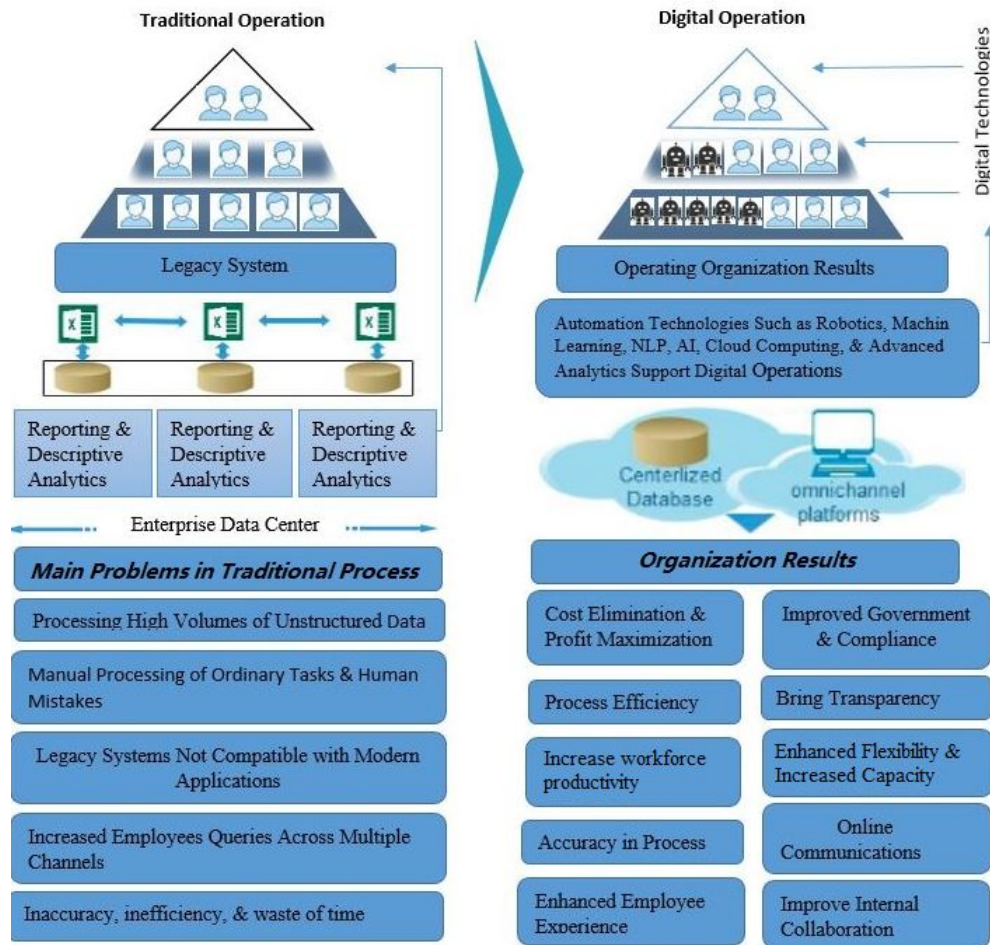


Figure 1: Moving from traditional operations to a digital process.

In most countries, organizations wish to digitalize their systems but don't have skilled employees. In addition, already recruited employees have poor awareness of technology usage and business processes. Furthermore, in developing countries such as Afghanistan, employees often do not know about the advantages of digital transformation. Thus, they need to become aware of the technology and digital transformation ((*Digital Awareness*, Section 5).

Most organizations are working through a digitalization process and incorporating cutting-edge technologies. They will have to overcome many barriers through digital transformation. As a result, they will support the digital transformation process and improve their mindset. The capacity of employees is low. Most of them are not used to IT. Some of them are even IT illiterate.

Within public organizations, a mindset refers to a "typical" manner of thinking, behaving, solving, relating, approaching, and stabilizing [15]. It could also be related to organizational culture. This implies that a mindset is a mental scheme. To enhance employees' performance and the execution of digital transformation, a growth mindset among employees regarding technology should be fostered. ((*Digitalization Mindset*, Section 6).

Due to various obstacles, the public sector, including KTH, has faced challenges in adopting digitalization for the past decade. For instance, employees must possess technical skills when they hold a technical role within an organization. Conducting a digital maturity assessment is advisable to measure the organization's interest in leveraging digital transformation to create value. This assessment involves using a digital maturity model to evaluate the organization's current level of digital maturity 7).

During the last decade, CSF has witnessed a massive change in the public and private sectors regarding the digitalization of many organizations. In developing countries, such as Afghanistan, there is a culture of nepotism, lack of trust, and technical expertise. These issues result in delays in deliverables, corruption, and even project failure. Often corrupt practices like bribery and nepotism occur in manual systems. It is the only way to reduce or eliminate the above mentioned problems. In order to implement transparency and efficiency within the organization, the current manual system must be converted into a digital format to bring transparency ((*Digital Transparency*, Section 8).

There is a complex and complicated workflow in the traditional system. Since paperwork has influenced them for years, employees

are not well prepared for digital transformation. In addition, they are afraid of losing their employment opportunities. There was no trust and mutual understanding between staff to share information. Comprehensive awareness and a trust-building program are required to switch the current employees to the digitalized system ((*Trust Building*, Section 9).

It is essential that team members believe in each other. Otherwise, it is difficult to get things done. In order for any team to work smoothly, members must communicate in order to coordinate their efforts. If individuals do not trust each other, communication will not be smooth. As a result, team members need to trust each other (Community of Trust [9]).

If there are some problems that still remain after the digitalization process has been accomplished. The organization can recruit a few domain experts for certain roles, and build a small expert team. Teams and groups tend to form around common interests and focus. Employees should take responsibility for their roles. Hiring domain experts is vital to the success of an organization (*Domain Expertise In Roles* [9]).

Although some parts of KTH are digitalized, and successful results are achieved, KTH can still recruit competent employees across all departments where they are needed. On the other hand, it's important to note that KTH faces challenges in finding the right talent. While they have succeeded in digitalization, they need help hiring competent employees. This way, KTH can meet the organization's requirements, but the recruitment process is challenging. Nonetheless, they can replace unprofessional employees with experts. (*Phasing It In* [9]). The pattern diagram of digital transformation, specifically designed for KTH, is depicted in Figure 2. The diagram illustrates a comprehensive set of interconnected patterns to drive the organization's successful digital transformation.

We present our pattern language of digital transformation and we document six patterns we observed in real projects of digital transformation in Afghanistan (highlighted blue in Figure 2), in which the first author of this paper was personally engaged.

We expressed the patterns in Coplien and Harrison's pattern format [10] with the conflict of the most prominent contradicting forces expressed in the *but* form proposed by Vranić and Vranić [18]. This is the format:

<Pattern Name>

...The context in which the pattern occurs.



The text in bold describes the actual problem as a conflict of the two most prominent contradicting forces.

Therefore

Here, the text in bold describes the solution.

❖❖❖ – An optional part with resulting consequences upon applying the given pattern. **Description** optional description to explain the pattern.

4 EMBRACE DIGITALIZATION

...In a rapidly evolving landscape, organizations face societal expectations, resource constraints, and the need for transparency. Embracing digitalization becomes crucial for

modernizing operations, improving service quality, and enabling data-driven decision-making to serve communities effectively.



Organizations struggle to embrace digitalization and undergo successful transformation due to challenges like resistance to change, outdated processes, legacy systems, a lack of technical staff with expertise in new technologies, and the need to meet evolving community needs. These issues lead to decreased service quality and diminished public trust.

Adopting new technologies with consideration for the well-being and engagement of employees is necessary for the success of digitalization, but employees express concerns about job losses and fear disruption to established processes. This fear creates resistance and poses obstacles to the smooth implementation of digitalization efforts.

Organizations realize the significance of modernizing operations and leveraging digital technologies for better decision-making, but they face challenges such as a shortage of experts, limited budgets, and resource constraints.

Therefore:

To address employees' concerns and ensure a successful digital transformation, organizations should create a clear digital transformation plan aligned with goals and objectives. They should implement comprehensive training programs to address employee concerns and promote acceptance of new systems, while also ensuring job security and fostering a culture of innovation to encourage employee support. Adopting a phased implementation strategy that balances integrating new technologies with existing systems can minimize disruption and facilitate a smoother transition, mitigating resistance and obstacles. The Ministry of Finance has successfully implemented this pattern at the Afghanistan Revenue Department with the support of the World Bank to improve tax services through the E-filing system.

5 DIGITAL AWARENESS

...As organizations shift from traditional systems to digital platforms, employee digital awareness becomes crucial for a successful digital transformation. Without fostering strong digital awareness among the workforce, the transition is neither feasible nor efficient, and employees need to learn and embrace digital tools and processes.



Organizations often struggle to equip their workforce with the skills needed to use new digital technologies and processes during digital transformation effectively, but inadequate digital awareness can delay adaptation and limit the benefits of the transformation and implementation.

Additionally, digital technologies can potentially improve productivity and efficiency for public organizations, but the lack of employee digital awareness and proficiency can delay adoption and limit the advantages of digital transformation. Effective communication and collaboration through modern technology can enhance

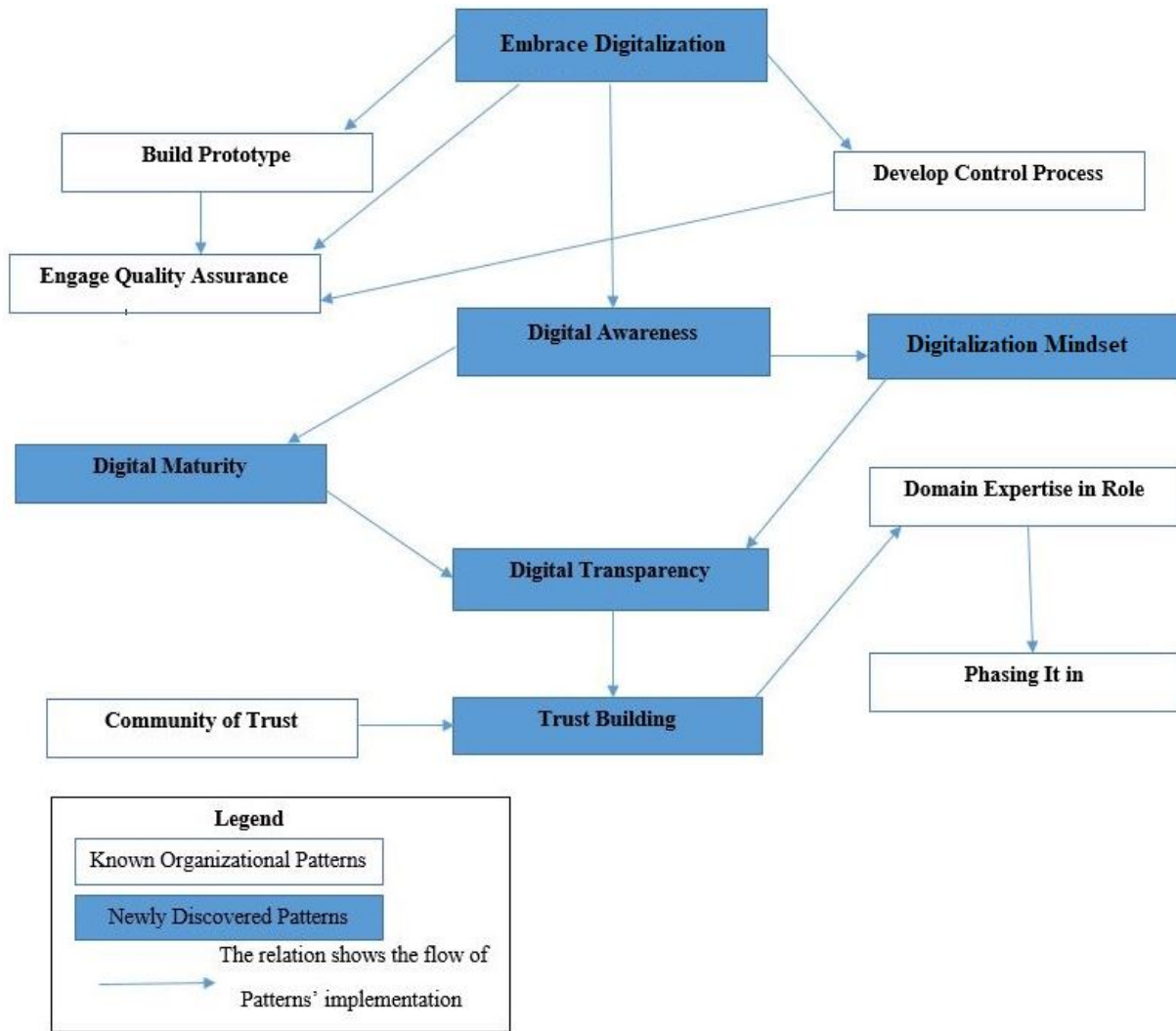


Figure 2: Pattern diagram of the KTH's digital transformation.

public services, but a disconnect between employees and digital advancements due to inadequate training and support can prevent organizations from fully realizing the potential of digital transformation.

Therefore:

Governments and IT-focused organizations should collaborate to create and implement comprehensive public awareness initiatives to address digital awareness gaps among management and employees in public organizations. These programs should be led by experts and utilize a variety of approaches, such as digital skills development, e-learning, in-person instruction, mentorship, coaching, continuing education opportunities, hands-on activities, workshops, symposiums, and seminars. Additionally, mass and social media

promotion can increase awareness and encourage the adoption of digital technologies, leading to improved efficiency and productivity for public organizations. The Ministry of Finance effectively applied this pattern at the Afghanistan Revenue Department with support from the World Bank to enhance tax services using the E-filing system.

6 DIGITALIZATION MINDSET

... Public organizations are shifting to digital platforms to enhance services for citizens and adapt to technological updates. However, this transformation is accompanied by challenges such as employee resistance, skill gaps, and a limited mindset toward digitalization. Addressing these obstacles is vital to ensure successful growth.



The main obstacle to digital transformation lies in employee resistance, stemming from fears about the effect on their

roles. Senior employees may be particularly concerned about job loss or adapting to new tasks, and their mindset needs to shift from fixed to growth-oriented.

Digitalization presents numerous benefits and opportunities for public organizations, but employee resistance fueled by fears of role changes and job security can hinder progress and limit the potential benefits. Cultivating a growth mindset among employees is crucial to overcoming resistance and increasing adaptability. However, a lack of digital skills and proficiency can impede progress and limit the potential for success in digital transformation.

Therefore:

To achieve successful digital transformation, organizations should foster a growth mindset among employees through various initiatives. This includes providing comprehensive training, ensuring consistent communication, establishing internal support mechanisms, and involving employees in the planning stages. Moreover, offering material, emotional, and moral support, along with incentives, while fostering a learning culture, can enhance employee engagement and facilitate effective change implementation.

7 DIGITAL MATURITY

... Employee and organizational maturity is paramount for sustained success in the ever-changing digital landscape. With digital maturity, employees effectively leverage technology, innovate, and make data-driven decisions, supporting the organization's growth and agility.



The organization is challenged to keep pace with emerging technologies, impacting their competitiveness and operational efficiency. Simultaneously, employees face the challenge of developing and maintaining digital skills to meet the needs of a rapidly growing digital environment.

Emerging technologies are continually being developed, requiring organizations to keep up with the pace of change to remain competitive. However, organizations lack the digital maturity needed to integrate these new technologies into their operations. Furthermore, organizations must prioritize digital maturity to maintain a culture of continuous learning and development, but some employees may lack the skills and ability to utilize emerging digital technologies effectively, posing a challenge to their successful adaptation.

Therefore:

Organizations should assess their current digital readiness to achieve digital maturity and outline a clear transformation process. Prioritize continuous learning, foster innovation, and establish a mature digital environment. Implement comprehensive training, encourage employee experimentation, and prioritize data security. This pattern was successfully implemented by the University of Nangarhar and the Department of HELMIS, with the support of the Ministry of Higher

Education. The pattern was designed to facilitate the teaching staff in delivering lectures, managing course material, recording attendance, and conducting exams.

8 DIGITAL TRANSPARENCY

... In the digital era, emphasizing transparency and effective communication is crucial. It involves leveraging technology to share information and foster honesty, openness, and teamwork. Promoting organizational transparency empowers individuals and creates a better creative and transparent work environment.



Organizations face challenges in establishing and maintaining transparency among employees and in their daily activities. They need to ensure transparency in communication and information sharing, both internally and with stakeholders. The lack of transparency can hinder collaboration and potentially lead to harmful practices.

Digital transformation can increase transparency and efficiency, but organizations may encounter resistance from certain employees, especially those with corrupt tendencies, who are reluctant to embrace radical changes. Leveraging technology to share information enhances transparency, but achieving consistency in information sharing within a digital environment poses challenges, particularly when some employees lack commitment to transparency and ethical practices. This can lead to inconsistencies in data sharing and hinder the organization's transparency efforts.

Therefore:

To develop a culture of digital transparency, organizations must prioritize honesty, clarity, and accessibility in their communication and information-sharing practices with employees internally and with external stakeholders. This concerns leveraging technology to promote openness, cooperation, and ethical behavior, such as using digital tools to share information and foster teamwork among employees. By embracing digital transparency, organizations can enable well-informed decision-making, foster trust and accountability, and reduce the risk of harmful practices, resulting in a more innovative, efficient, and ethical work atmosphere for employees and stakeholders alike.

9 TRUST BUILDING

... Organizations must prioritize transparency, accountability, and security in the modern business landscape to build trust with their customers, partners, employees, and stakeholders. Trust-building efforts enhance the organization's reputation, foster meaningful connections, and simplify processes, leading to greater success in the digital era.



Within digital operations, organizations face challenges building trust with employees, customers, and stakeholders due to transparency, accountability, and security issues. The

lack of trust can lead to lost opportunities, customers, partners, and employees, ultimately hindering the organization's growth and success.

The organization faces trust-related challenges, including a lack of trust within the organization and among employees. But, for a successful and unified digital transformation, the organization must prioritize transparency and accountability and overcome these obstacles. Transparent communication is essential in rebuilding trust and creating a cohesive environment conducive to a successful transition to digital operations. Despite organizations' efforts to build trust through these principles, a lack of trust can significantly impact an organization's reputation, resulting in missed opportunities and weakened connections, ultimately impeding overall growth and progress.

Therefore:

To foster and sustain trust in the digital landscape, organizations must prioritize transparency, accountability, and security, while actively engaging stakeholders through open communication and inclusive processes. However, maintaining trust consistently can be challenging in the ever-evolving digital environment, where online risks are prevalent. Establishing robust data protection measures becomes essential to safeguard sensitive information and ensure security. Organizations should embrace a culture of admitting mistakes, learning, and process improvement, promoting ethical behavior, integrity, and mutual trust among employees and aligning with core values and the organization's mission.

10 DISCUSSION

A common problem domain involves the transformation of traditional systems into digital systems. As we delved into the KTH organization's digital transformation process, we encountered persistent challenges that merit in-depth examination. There were several common problems in that organization, including corruption in current traditional systems, lack of commitment from employees, fears of digitalization, weak management, lack of transparency, lack of accuracy, lack of effectiveness, and low capacity, inaccuracies in data, operational inefficiencies, and overall limited capacity. Our investigation into these common problem domains revealed a pressing need for innovative techniques and comprehensive solutions to address the underlying issues hindering the organization's transition to a digital landscape. By delving into these specific problem areas, we aim to contribute insights to facilitate the successful digital transformation of other organizations facing similar hurdles.

For a successful transformation, organizations should focus on technology and social competencies, encompassing tools, analytics, soft skills, intercultural abilities, and decision-making. An interactive learning platform enhances competencies in ICT, virtual collaboration, and digital transformation, enabling knowledge creation and collaborative solutions in complex organizational environments. It blends theoretical and practical learning, utilizing integrated collaboration, gaming simulation, and blended methods to teach critical digitization skills, including information management,

privacy, complex problem-solving, teamwork, and intercultural proficiencies. A study conducted by MarkusBresinsky et al. [6]

Digital transformation is an emerging field that deals with the complex relationships among various actors in technologically supported education. This comprehensive process involves people, processes, strategies, structures, and competitive dynamics, as highlighted by Benavides. [5]

Several key recommendations and findings have emerged to address the challenges associated with digital transformation. When an organization's daily operations remain non-digital, it can encounter unique challenges. Digitalizing these operations becomes crucial to establish trust, accuracy, and transparency within the system. Interestingly, it's worth noting that the organization's employees prefer traditional systems over digitalization. This preference underscores the importance of effectively preparing employees for digitalization while familiarizing them with the latest technologies. Importantly, this approach can also provide job security, dispelling concerns of potential job loss. Furthermore, embracing modern technology empowers employees to enhance their skills and knowledge, making daily tasks more efficient. However, it's important to acknowledge that in cases where a system or solution is extensive and comprises multiple independent business modules or infrastructures, employees may need help digitizing traditional systems.

Traditional systems can lead to employee corruption, so it is necessary to digitalize the system to reduce corruption. In addition, the organization's current employees are unable to maintain the system. The computer science faculty member suggests collaborating with them to computerize their system. As well as providing assistance in utilizing the entire digitalization system, as well as solve their technical issues. The computer science faculty feels comfortable supporting KTH technically.

The organizational structures of today are being transformed by digital transformation when an organization's entire solution is composed of multiple independent modules. Moreover, the KTH manager is not capable of integrating and coordinating several modules of digital transformation, so they need the support and assistance of the faculty of computer science. So the faculty assigned technical members to work on the various modules.

The KTH organization will be focused on the quality of deliverables, while the integration of modules and handling of tasks will be the responsibility of the computer science faculty. These tasks will include managing and integrating all modules for the entire organization. All modules for the entire organization can be managed and coordinated through the technology mediated communication platform within the organization to provide parallel access to all technical employees. Additionally, it will reduce the gap between the organizations in the exchange of information. As organizations become digital, they'll perform their daily activities digitally in a sufficient and accurate manner.

Despite the discussions and mentioned common results above, it is important to note that no single solution covers all cases. Therefore, further study and research are necessary to address this issue. Figure 3 illustrates the common problems encountered during the implementation of digital transformation.

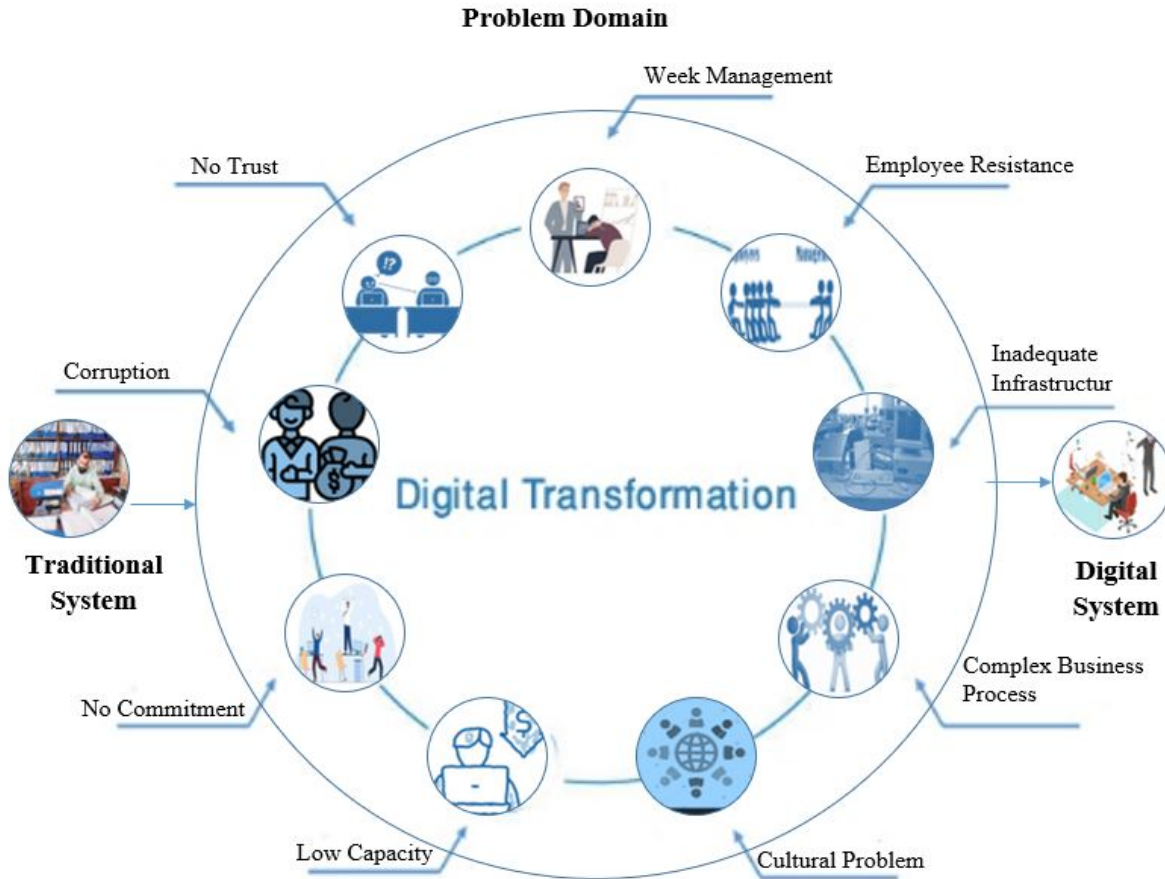


Figure 3: Common problems while implementing digital transformation.

11 RELATED WORK

Digitalization can challenge traditional organizational perceptions by exploring innovative approaches and board structures. In this context, initiatives that aim to familiarize employees with technology and provide training play a pivotal role. Additionally, digitalization facilitates knowledge exchange, promotes a growth mindset, transparency, trust, and improves information accessibility for businesses. The study identifies several critical success factors for digital transformation, including cost-effectiveness, heightened employee productivity, increased innovation, and a reduced culture of mistrust. Furthermore, our research aligns with prior work on digital transformation and digitalization, emphasizing the need to promote digital transformation over manual or traditional systems, particularly in the public and private sectors. In comparison to existing research, such as that of Hansen et al. (2011) and Aghakhani et al. (2021), who proposed strategies and frameworks for digital transformation, our study introduces a unique approach by identifying and presenting six organizational patterns derived from practical experiences. These patterns constitute a pattern language, offering a versatile and proven solution across various domains, including software development, architecture, and the organization of software businesses. Building on the foundational work of Benavides et

al. (2020) in exploring digital transformation in Higher Education Institutions (HEIs), our study extends the concept of digitalization patterns to diverse sectors. Additionally, our research considers digital transformation's financial insights and impacts, as highlighted by Xinxian et al. (2022) and Chen et al. (2020). By offering a comprehensive approach to digitalization and transformation, our study makes a substantial contribution to the existing literature and provides valuable insights into the challenges and opportunities within the digital era.

The patterns were applied in software development architecture, software engineering, and the organization of software businesses, providing a proven and versatile solution in these domains. [9] Patterns had already existed and were developed by Christopher Alexander to address the challenges of building towns and construction. [2] Several earlier studies have focused on various methodologies and techniques for documenting and implementing digital transformation within organizations. These studies demonstrate that digital transformations are integral to daily life and business operations. In this era, digitalization is essential for enabling daily communication, conducting business, and facilitating all daily activities.

A successful digital transformation requires a profound understanding of the domain. Supporting the involvement of digital transformation in organizations, businesses, and daily activities and specifying their roles can enhance the effectiveness and efficiency of the digital transformation process.

A study conducted by Lina María Castro Benavides et al. [5] The dimensions of digital transformation in Higher Education Institutions (HEIs) are primarily intangible and bring about shifts in meaning and technological advancements. These dimensions influence university cultures and impact administrative, educational, and evaluative activities, as well as teaching, research, extension, and administrative functions.

A research study by A. Xinxian et al. [19] Emphasizes the importance of embracing digital transformation, understanding its impact on enterprise growth, and utilizing financial insights for successful navigation. It highlights that digital transformation is a revolution in the competitive landscape, and businesses must actively embrace the changes it brings. The study also develops a financial early warning model based on CNN data to guide corporations through the digital transformation process.

A study conducted by Aghakhani et al. [1] Proposed a framework for modeling and strategizing digital transformation concepts within organizations. It emphasizes the importance of adopting a consistent digital strategy and shifting from a technology-driven approach to a systematic, integrated one. The conclusion highlights that the framework helps organizations effectively understand and operationalize their digital transformation approach.

A study conducted by Vladimir Lvovich Vasilev et al. [17] This study aimed to specify the level, problems, and prospects of the development of digital competencies in higher education organizations in Russia; the authors used the methods of sociological survey and statistical information processing.

A research study by A. Kutnjak et al. [14] Provides an overview of a case study on digital transformation. This research explores the integration of business processes, the creation of new business opportunities, innovation of products, cost reduction, and the development of new business models. It emphasizes the need for companies to adopt a strategic approach to digital transformation to enhance their market position and competitiveness on a global scale. Digital transformation represents a novel approach recognized as a means to enhance businesses and address future challenges.

A research conducted by Hansen et al. [12] Organizational leaders must rapidly adapt existing approaches to digital transformation, requiring a shared mindset between IS and business leaders. The authors challenge IT strategies, align IS leadership with organizational assumptions, and recommend adaptive approaches. A survey of Slovenian companies discovered six organizational patterns, guiding the company to determine its unique path forward.

A research study by Indihar Štemberge et al. [13] For the digital technology role is increased day by day in the organizations and functioning of socio-economic relations. [4] This research paper examines the use of digitalization strategies by small and medium-sized enterprises (SMEs) and large enterprises (LSEs). It looks at how these companies are using new technology, changes in value-added, structural changes, and financing to achieve a holistic transformation. The study also compares similarities or differences between SMEs and LSEs regarding their approach toward digitization. [8]

This paper has contributed to understanding digitalization's impact on environmental sustainability in manufacturing. It identified two main findings. First, digitalization can contribute positively by increasing resource and information efficiency as a result of applying Industry 4.0 technologies throughout the product lifecycle. Second, the negative impacts are primarily due to increased energy use, waste production, and emissions from the hardware used for technology lifecycles. Based on these findings, this study proposed a new perspective that considers both positive and negative implications when funding new digital technologies related to manufacturing operations. [20] The research on digital transformation and digitalization indicates the growing importance of these concepts across sectors, including organizational transformations, educational institutions, and various industries. Understanding the challenges and opportunities of digital transformation is crucial in today's digital era.

This paper significantly contributes to the existing literature by quantitatively analyzing the association between digital transformation and traditional operations. Moreover, it explores digitalization and transformation across various domains and introduces six organizational patterns derived from practical experiences during the project, complemented by a comprehensive literature review. Together, these elements constitute a pattern language. The research strongly emphasizes promoting digital transformation over manual or traditional systems, with a focus on the public and private sectors and the overall development of this transformative process.

12 CONCLUSIONS AND FUTURE WORK

Digital transformation demand and identification of organizations and businesses have been increasing rapidly, but finding the entire organizations and firms and involving them in digital transformation is challenging for organizations. The main problems in digital transformations are the creation of mindset, culture, business process, skills, etc.

It takes a long time to find the actual workflow when faced with various problems in the field. The problem is the difficulty of some employees to change their mindset. Several expectations and different information make the digital transformation process more complex and overload the digital transformation scope. Also, digital transformation takes a lot of time and it is challenging to achieve.

To overcome these issues, we provide a pattern language composed of six organizational patterns for digital transformation. We relate them to well-known patterns and practices documented during our practical work on real digital transformation problems.

A pattern story of the actual active organizations is considered the general idea of a pattern language. Further study is required to digitalize and merge some public organizations due to their daily tasks based on a qualitative survey to uncover additional patterns and links between them.

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