Identifying and Documenting Best Practices in Digital Transformation

Mohammad Yusuf Momand and Valentino Vranić

Institute of Informatics, Information System and Software Engineering, Faculty of Informatics and Information Technologies, Slovak University of Technology In Bratislava Slovakia

Abstract

The current digital transformation and advanced technology mega-trend have a massive impact on society and organizations. Hence, digital technology has a fundamental role in public and private organizations, universities, and individuals' daily lives. The demand has been increasing rapidly. Nevertheless, there are often no standard policies defined for the use of digital technology. In our practical experience and from the literature, we found that the key issues and challenges in transforming traditional systems into digital systems are: a lack of public awareness, mindset, ICT skills, government support, and lack of collaboration between organizations and software engineering communities. Governments must define policies for digital transformation and provide guidelines on software development to public organizations in order to digitize their systems. Additionally, to provide or support research projects funded by government and non-government organizations in order to identify infrastructure and regulatory issues in the context of digital transformation in Afghanistan. In this work, we document six organizational patterns. We observed these patterns during our work experience, where we were transforming traditional systems into digital systems. We illustrate the sequence of the patterns and explain how we make a pattern language from these patterns.

Keywords

Patterns, Software Engineering, Organizational Patterns, Software Development, Digital Transformation

1 Introduction

Digital transformation is a continuous and complex process designed to transform an organization and its operations substantially. Transformation is the holistic change in the business processes of an organization. Or technology is used to change the traditional way of business into a digital form, we call this process a digital transformation[5]. It's not just about technology or organizational changes. Still, it impacts the whole process (workflows, tasks, methods, constraints), people (culture, skills, capacity), and the organization's infrastructure. Independent of the enterprise or firm, digital transformation has aspects that can be ascribed to four essential dimensions, that are changes in value creation, structural changes, technology use, and financial factors[13].

IT is revolutionizing all aspects of life worldwide, including technology, education, business, and the international economy. Developing countries have not fully experienced this global revolution. Developing countries encounter many challenges in the transfer and adoption of digital transformation. These challenges include government policies, inadequate infrastructure, training, business processes, lack of expertise, insufficient capacity building, and cultural difference. [8]. Firms and other organizations need to provide services effectively and efficiently through digital transformation; they should be appropriately managed and monitored. During each stage of the transformation, the practical application of sound practices, or the mismanagement of resources due to recurring problems, should be captured.

It is essential for organizations to innovate and embrace technologies in order to stay ahead of the

competition in the digital revolution that transforms every sector of business into digitalization. As Marc Andreessen [2] famously noted that "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, 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 skills that are needed during transformation and required for daily operations after transformation. We need people to have skills to use digital technologies and tools effectively. They are organizing people based on their existing technological capabilities and capacity for the adaption of newly acquired skills.

The core of digital transformation is to design digital services that simplify the traditional and classical ways of doing business.And transforming traditional documents and classic processes to digital, using technology solutions that drive business and business processes, is complex and not always feasible.

Digital transformation requires a solid process of designing digital services that value the organization. The IT infrastructure and tools that are used in digital transformation today, 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, the internet of things, and artificial intelligence represent some of the most common extents of digitalization.

Patterns had existed earlier and were developed by Christopher Alexander to solve the challenge of building towns and construction [1].

Our goal in this research is to document the best practices that normalized processes and led to an autonomous innovation. Identify the recurring challenges of digital transformation, and explore organizational aspects of digital transformation to cover best practices. From practical experience, literature, and lessons learned from digital transformation frameworks.

The rest of this paper is structured as follows.

Section 2 Explain the challenges and best practices during digital transformation, section 3 provides the story behind the patterns, Section 4 presents the patterns, Section 4.1 present format, section 6 explain digital transformation, section 6 covers digital awareness, section 7 discusses mindset creation, section8 presents digital maturity, section9 discusses digital transparency, section10 presents trust building section11 covers related work, section13 discusses conclusion and future work.

2 Challenges and Best Practices During Digital Transformation

For almost a decade, we were involved with the organizations. During the process of implementing digital transformation, several challenges and best practices were observed. It was a public organization that needed to digitize their traditional system.

Currently, digital transformation is difficult to implement in public organizations, and its success rate is less assured. Many challenges were encountered during the digital transformation process. As we have worked in organizations that converted their traditional systems into digital ones, we have been part of the operation team. We have experienced various challenges and observed some effective and efficient practices. The organization is using digital transformation for a different purpose. By integrating processes, creating new business opportunities, innovating products, reducing costs, and creating a new business model. For an organization to stay competitive, the implementation of digital transformation must be strategic. There are, however, some challenges from the employees' perspective. There is no desire to replace the traditional system with a digital one. An innovative approach recognized as a way to meet the challenges of the future and improve business. The common challenges of the digital transformation were communication gap, lack of required expertise, lack of IT resources, lack of awareness, no commitment, no transparency, wasting of time, corrupted employees, no trust, digital maturity,mindset,no trans-

parency and so on. These are the common problems and challenges. Many digital transformation systems have failed due to the above challenges and problems.[11].

During our work and observed with eight projects[1] Observing many organizations, we found many things to be concerned about. We wanted to highlight some of the challenges and best practices and document them in the form of patterns.

It may be necessary to change organizational culture, people, processes, and business models in order to control business challenges.[11].

3 The Story Behind the Patterns

We propose to tell a short story about a public organization in Afghanistan. The story behind the patterns is authentic and practical. And in the pattern story, the discovered patterns are presented in the order they were observed. Prior to documenting, it is critical to explore the patterns in real-world practice. The organization was working manually, but needed to digitalize their system. The organization name was KTK (for privacy reasons), but the rest of the story is true. In the story, we mention the corresponding organizational patterns in italics in parentheses. KTK was facing a shortage of IT resources, professional employees, and software developers. Furthermore, there was a need for software and hardware equipment, maintenance and support. The organization could not perform these tasks alone. Therefore, Nangarhar University related Computer Science Faculty (CSF) decided to cooperate and digitalize their entire organization's system to enhance transparency, facilities, and efficiency. The pattern story presents the discovered patterns in the order they were observed. Various branches of the organization aimed to implement digitalization with the appropriate resources, timelines, and budget. KTK had planned to digitalize the entire system. To ensure accuracy, speed, security and efficiency for all processes and communication, digital transformation is needed *(Digital Transformation, section6).*

As a result, CSF decided to begin digitizing the entire system of KTK. CSF (vendor) had analysed and re-engineered all the processes of the KTK (client), and the vendor built the prototype of the same part/department (Build Prototype[6]).

The development team of CSF was responsible for understanding the requirements, business process and reviewing the required system's structure (Developer Controls Process[6]).

The development team was also responsible for developing and simplifying the business processes of the system. Both organizations need to make sure they are on the right path towards development. (Engage Quality Assurance[6]), which is dependent on prototyping.

In most countries, organizations wish to digitize their systems, but don't have the skilled employees. In addition, there is poor awareness for the already recruited employees of technology usage and business processes because the employees don't have awareness of updated technology. In addition, there is a challenge to digitalize the public sector in developing countries such as Afghanistan. As technology is a new phenomenon, employees often do not know about the advantages of digital transformation. Thus, they need to be aware of technology and digital transformation *(Digital Awareness, section 6).*

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, and most of them are not IT oriented and they are IT illiterate.

According to reference [12] within the public organizations, a mindset refers to a "typical" manner of thinking, behaving, solving, relating, approaching, and stabilizing. It could also relate to organizational culture. This suggests that a mindset is a mental scheme. In order to improve the performance of employees and the implementation of digital transformation, the mindsets of employees toward technology need to be developed *(Mindset Creation, section 7).*

The public sector has been left out of digitalization for a decade because of some obstacles to-

[1]The eight projects are: E-NID Afghanistan, ASAN KHIDMAT Afghanistan, SIGTAS Afghanistan, HELMIS (Higher Education Learning Management Information System), Certificate Management Information System (CMIS) at MoE,E-ELECTION SYSTEM,HEMIS Project at MoHE,E-Passport System.

wards digitalization. If an employee works for an organization as a technician, he/she must possess technical skills. Conduct a digital maturity assessment to understand the organization's interest in creating value through digital transformation. Use a digital maturity model to evaluate the current digital maturity level of the organization *(Digital Maturity,section 8)*.

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 a delay 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 9)*.

There is a complex and complicated work flow 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 10)*.

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[6]).

If there are some problems still remained after the digitalization process has been accomplished. The organization can recruit few domain experts for certain roles, and build a small expert team. Teams and groups tend to form around common interests and focuses. Employees should take responsibility for their roles. Hiring domain experts is vital to the success of an organization (Domain Expertise In Roles[6]).

Although some parts of KTK are digitalized and successful results are achieved. KTK is still able to recruit competent employees across all departments where they are needed. This way, KTK can meet the requirements of the organization, and they can replace the unprofessional employees with the experts (Phasing It In[6].

4 The Patterns

We present our pattern language of digital transformation, and We document six patterns (highlighted blue in figure 1) .These patterns are observed in practice from real projects gradually while we were engaged with several organizations' projects in Afghanistan. The prominent, reoccurring, general, and proven methods are considered to document and write the patterns.

4.1 Pattern Format

We expressed the patterns (Sections 5 - 10) in Coplien and Harrison's pattern format [7] with the conflict of the most prominent contradicting forces expressed in the *but* form proposed by Vranić and Vranić [15].

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.

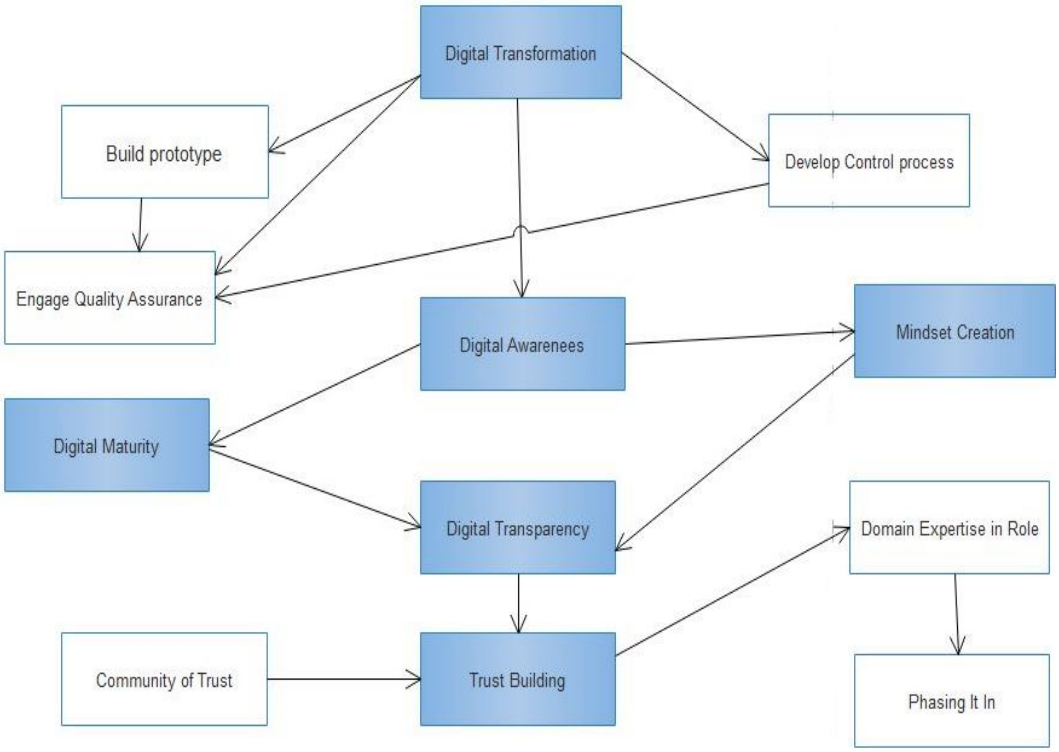

Figure 1: Pattern Diagram of Digital Transformation for KTK Organization.

5 Digital transformation

...**Several public organizations perform their daily tasks manually. A digital transformation plan has been prepared based on the results of the evaluation process. It is time to take the organization's activities digital, maximize their benefits, and explore cutting-edge technologies. As a result of technological advancements, changes in value creation, structural changes, and financial aspects.**

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By implementing cutting-edge technology, organizations strive to remain competitive, speed up organizational activities, and bring transparency to all processes. But legacy systems are a major obstacle, and employees fear they will lose their jobs with the advent of digital systems.

Since paperwork has impacted employees for years, digital systems may provide a solution to some of their main problems, but many forces are hampering the digital transformation process, such as lack of resources, infrastructure, budget, and public awareness. Moreover, current employees are also concerned about the implementation of cutting-edge technology, as they fear losing their jobs.

Therefore:

Develop a training program for your employees to help them become familiar with advanced technologies and explain the advantages of digital systems. You should create a safe working environment for your employees and ensure their employment opportunities are safe.

6 Digital Awareness

... Organizations need to transform their systems into digital ones. For digital transformation, the most critical factor is employees' awareness. While converting a traditional system into digital, it is neither feasible nor efficient to accomplish the task without digital awareness.

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Management and employees must be aware of and understand the advantages of the updated technology, but there is lack of public awareness program for the entire workforce.

Awareness of technological devices helps people simplify their lives and work, but some of them don't know how to use them and they have no knowledge of technology. The use of technology allows people to communicate effectively and smoothly, but some people are unable to utilize it. Others are not aware of modern technologies.

Therefore:

Governments and other IT-related organizations develop and operate public awareness campaigns for the management and employees of public and private organizations. The awareness program should be performed by professional employees through mass and social media, trainings, workshops, symposium, and seminars.

7 Mindset Creation

... Public organizations need to migrate from traditional systems to digital systems. The organization faces numerous challenges as a result of the transformation. In addition to creating awareness, adapting to the change requires a change of mindset as well.

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The main barrier to digital transformation is not technological advancements, but rather employees' resistance to change and fear of losing their job, as well as personal benefits. Even though the change is intended to benefit the organization and its employees. But employees' behavior does not always support the change.

Moving from a traditional to a digital system represents a significant change in an organization. But despite this, employees have negative perceptions of digital transformation. The goal is to encourage employees to consider the changes and their implications and explore alternative ways of introducing them. But employees tend to resist changes.

Therefore:

Create a mindset among the existing employees to familiarize them with the new system, and explain the benefits and uses of digitalization to the staff. To promote change, the organization uses its internal defense mechanism, and organizations should communicate and consult with their employees regularly to identify alternative methods of introducing change. Organizations must offer material, moral and emotional support according to the circumstances faced in a change process to encourage employee participation,and influence employees' behavior.

8 Digital Maturity

... The organization invests in technology and creates an environment that encourages and matures employees, enabling the organization to grow together. Therefore, successful digital transformation is essential. For organizations to leverage technologies to perform their activities on time, all processes must be accurate and transparent,but organizations and their employees are challenging to mature.

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The focus of the organization is strictly on technology, but there is no plan and vision of the current state of existing technology and what is needed. Further, the organization wants to implement the latest technologies, but due to its employees' low maturity level, it can't implement them .

Employees should know of current processes, usage, and latest technologies. But some employees find it challenging to learn these things. Digital maturity will make your organization more precise and faster, but if there is no maturity, it will negatively affect your operations, leading to losses of time and money.

Therefore:

Understand the current digital maturity level of the organization. Evaluate the organization's digital maturity to assess its willingness to implement digital transformation. Outline the processes, define the opportunities, goals, and strategies to minimize the gaps, and define the critical functions necessary to move through the digital transformation journey.

9 Digital Transparency

... Transparency in an organization is the practice of sharing information regarding the organization's operations with its employees. This creates trust between management and employees, colleagues, the organization as a whole, and between the organization and the public. Organizations can enhance communication and business processes with a transparent system, and bribes, corruption, and nepotism are reduced or eliminated.

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The organization's mandate is essential to completing tasks accurately and efficiently, but corrupt employees abuse the system. The current system is somehow active and functional, but the current team is corrupted. The organization's leadership plays a crucial role in transparency, but the existing employees tease customers and insist on getting paid.

In order to become more transparent, efficient, and accurate, organizations are implementing digital transformation, but corrupted employees resist change, and furthermore, they are not concerned with the necessity of radical changes. It is imperative that the organization's processes are clearly defined and that employees within the organization should be transparent with each other. But their employees are amoral and nontransparent.

Therefore:

Cultural digital transparency should be promoted by the media and some public and private IT organizations. Developing an open government plan will increase public transparency, accountability, and openness. Cultural digital transparency through government operations and decisions, and an effective governance model is crucial for public transparency. Develop an environment of transparency, where people, repositories, activities, and histories are readily accessible to all users, and develop mutual trust within the organization.

When transparency is applied and implemented, mutual trust should be established.

10 Trust Building

... An organization's digital transformation is facilitated by having a transparent management system and digital maturity. Employees should be encouraged to develop and implement digital working procedures, and should also establish trust with each other. An organization's digital transformation is based on trust in its processes and systems. Mmanagers must be confident that the personnel running the system are trustworthy, and the Organization's reputation depends on its trustworthiness, reliability, openness, and information security.

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Digital transformation can be completed without trust in the organization, but problems will arise without a culture of trust. Organizations strive to leverage digital transformation to build trust among their employees and within their organizations. Establishing trust, implementing proper procedures, and sharing of information are essential, but employees lack trust in one another.

It is imperative for employees who work in an organization to trust each other and to implement a culture of trust. But there is no trust among employees, and untrusted employees misuse the infrastructure on a regular basis. Employees need trust between them to share information and support each other to enhance activities, but they do not want to assist each other and are also afraid to share data and information.

Therefore:

Build trust as a social mechanism to reducing diversity and managing the risk associated with decisions, eyeing an unsure future. Trust the process of digital transformation of the organization and prioritize the factor of trust. Employees should be trusted to carry out the operations of organizations and institutions, and the organization must be able to trust its employees, employees should establish mutual trust.

11 Related work

Patterns were then applied to software development architecture, software engineering, and the organization of software businesses that provide a proven and generic solution in such domains. [6]. Patterns had existed earlier and were developed by Christopher Alexander to solve the challenge of building towns and construction [1]. Several studies conducted earlier focused on different methodologies and techniques for the documentation and involvement of digital transformation in an organization. These studies show's that digital transformations are the most dominant part of daily life and business. Without digitalization, daily communication, business, and all daily activities would not be possible in this era.

A successful digital transformation requires a deep understanding of the domain. The digital transformation can be more effective and efficient if we support the digital transformation involvement in the organizations, business, and daily activities and specify their roles.

A study conducted by Lina María Castro Benavides et al. [3] Digital transformation dimensions in HEIs are more intangible and generate changes in meaning in addition to technological progress. In addition to affecting university cultures, administrative, formative, and evaluation activities, they also impact teaching, research, extension, and administrative activities.

A study conducted by Vladimir Lvovich Vasilev et al.[14] 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.[11] An overview of a case study on Digital transformation. To integrate businesses process, create new businesses opportunities, innovate products, reduce costs, and make new business models, a company should have a strategic approach to digital transformation operation to create a better market position and stay concurrent on the global market. A digital transformation is a new approach recognized as a future way to improve business and answer the challenge in the future.

A research conducted by Hansen et al.[9]. Organizational leaders need to adapt existing approaches to digital transformation quickly. However, it is challenging to adopt new approaches without a shared mindset between IS and business leaders. The authors share their assumptions about IS leadership, challenge existing IT strategies and collaboration patterns and adapt the organization approach.

Companies face many challenges in managing their digital transformation in terms of key actors; based on a survey of Slovenian companies, discover six organizational patterns, Recommendations, and possible evolutionary paths for companies in each pattern; the patterns inform companies about their current positions, they decide which of the evolutionary paths to follow based on their current situation. [10]. This paper used for the digital technology role is increased day by day in the organizations and functioning of socio-economic relations. Looking at the literature, we mined six organizational patterns from practical experience during the project in this work. The sequence of the six patterns and relevant practices from the literature describes a pattern language. We involve the digital transformation problem in the public and private sectors. This paper recommends digital

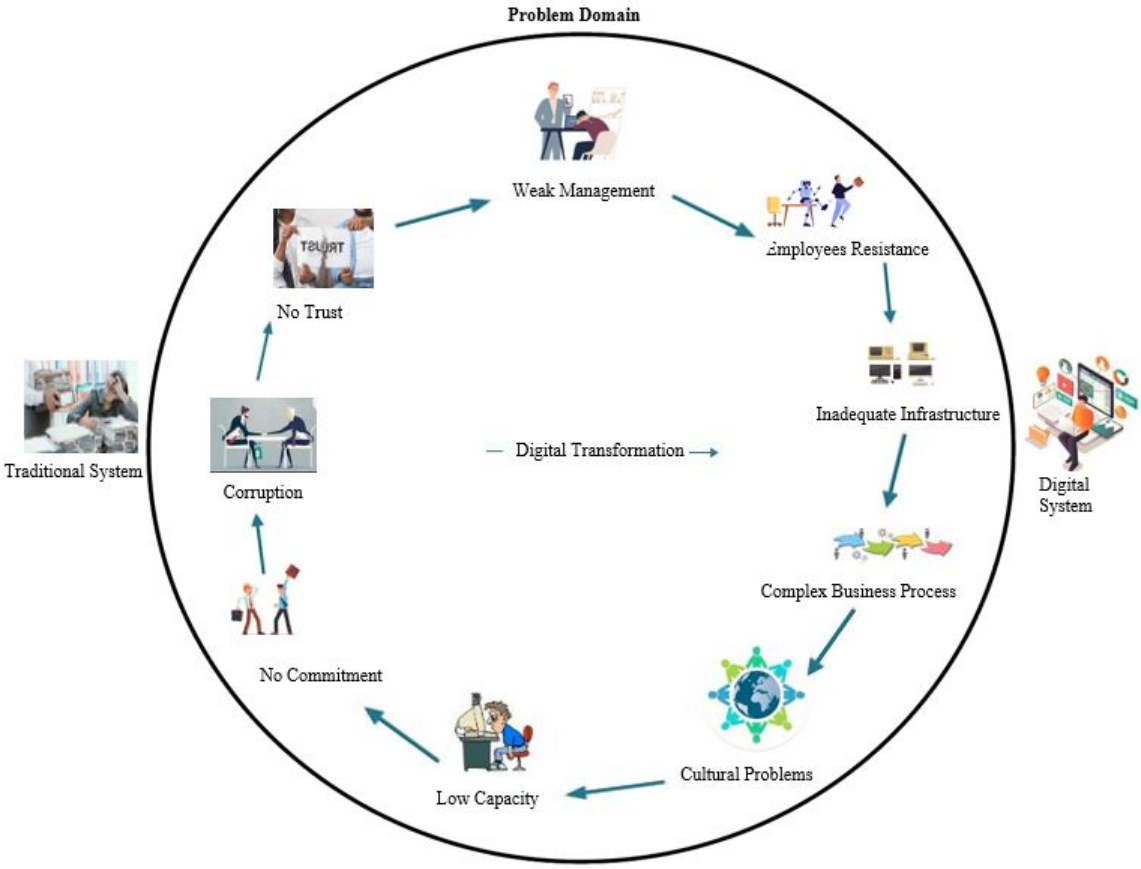

Figure 2: Common Problems During Digital Transformation Implementation.

transformation instead of manual or classic systems and emphasizes developing digital transformation.

12 Discussion

A common problem domain is transforming traditional systems into digital systems. Studying the KTK organization while implementing digital transformation.

There were several common problems in that organization, including corruption in current traditional systems, lack of commitment from employees, fears of digitalization, weak management, the lack of transparency, the lack of accuracy, the lack of effectiveness, and low capacity, etc. Reseacher[4] for successful transformation, digitized organizations must concentrate on technology and social domains.and[3] People, processes, strategies, structures, and competitive dynamics are also included in the digital transformation process.

The following results and recommendations were developed to help overcome these challenges: If an organization's daily activities are not digitalized, it should face different challenges. In order to become trustworthy, accurate, and transparent, the system needs to be digitalized. And the organization's employees preferred traditional systems over digitalization.

This is the right way to prepare them for digitalization and familiarize them with the latest technologies. Furthermore, they can rest assured that they won't lose their jobs. By using modern technology, they can improve their skills, knowledge, and perform daily activities with ease. Whenever a system or a complete solution is large and contains several independent business modules or infrastructures, employees are unable to

digitalize the traditional system.

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 solving their technical issues. Computer science faculty feels comfortable supporting KTK 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 KTK 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 KTK 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.

In spite of the discussion and common result mentioned above, there is still no common result that covers all the cases. Therefore, further study and research are needed to solve the problem.

13 Conclusion 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 the organizations. The main problems in digital transformations are the creation of mindset, culture, business process, skills, etc.

It brings 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.

As well, digital transformation takes more time, and the digital transformation goal is challenging to achieve. The above problems are the leading causes that create a complex process and difficulty in digital transformation.

We present to overcome the mentioned issues by providing a pattern language composed of six organizational patterns for the recurring structure of digital transformation We relate them to well-known patterns and practices, practically establish and documented during our practical work on some digital transformation to overcome these problems.

A pattern story of the actual active organizations is considered the general idea of a pattern language. Further study is required to digitalized 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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