Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies

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Dissertation Thesis Abstract

Patterns of Digital Transformation

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1. **Abstract:**
   This thesis explores the effects of digital transformation, shedding light on the path toward a more digitally integrated society and organizational landscape. It aims to identify recurring challenges and organizational aspects of digital transformation, drawing from practical experience, academic literature, and lessons learned from digital transformation frameworks.

These insights are presented in the form of organizational patterns. The most difficult part in digital transformation is not how to bring in new technology, but how to guide people to understand its potential and learn how to use it. Responding to the thesis that proven digital transformation practices can be collected and operationalized in the form of organizational patterns this work brings the patterns of digital transformation, which address essential aspects of digital transformation, its cultural aspects, and aspects specific to public administration, patterns for bridging the digital gender divide in Afghanistan, as a specific part of digital transformation efforts related the inclusion of women, and evaluation of the patterns, as a survey conducted for the patterns of digital transformation addressing aspects specific to public administration, but also based on observing actual instances of the patterns in practice, which were presented as pattern stories and as examples in pattern descriptions themselves Together, the contributions show that digital transformation is not merely a technological upgrade, but a systemic and cultural shift that requires coordinated patterns of change across people, processes, and institutions. The patterns developed throughout this research provide a framework for policymakers, practitioners, and civil society actors. It emphasizes the importance of iterative, context-aware strategies to build sustainable, inclusive, and resilient digital systems in challenging environments.

Keywords: digital transformation, public administration, digital governance, technology adoption, digital skills, organizational patterns

Abstrakt:

Predkladaná dizertačná práca sa zaoberá skúmaním dopadov digitálnej transformácie a načrtáva cestu k viac digitálne integrovanej spoločnosti a organizačnému prostrediu. Cieľom práce je identifikovať opakujúce sa výzvy a organizačné aspekty digitálnej transformácie, pričom vychádza z praktických skúseností, poznatkov akademickej literatúry a záverov odvodených z etablovaných rámcov digitálnej transformácie. Uvedené poznatky sú spracované a prezentované vo forme organizačných vzorov. Najväčšou výzvou digitálnej transformácie nie je zavádzanie nových technológií, ale usmerňovanie ľudí k pochopeniu ich potenciálu a osvojeniu si spôsobov ich efektívneho využitia.

V súlade s východiskovou tézou, že overené postupy digitálnej transformácie možno systematicky zhromaždiť a operacionalizovať prostredníctvom organizačných vzorov, práca prináša súbor vzorov digitálnej transformácie pokrývajúcich kľúčové technické, kultúrne a inštitucionálne aspekty, vrátane špecifík verejnej správy. Osobitná pozornosť sa venuje vzorom zameraným na prekonávanie digitálnej rodovej priepasti v Afganistane, ktoré predstavujú významný prvok digitálnej transformácie v kontexte zapojenia žien. Hodnotenie týchto vzorov bolo realizované formou prieskumu orientovaného na aspekty digitálnej transformácie vo

verejnej správe a zároveň pozorovaním reálnych prípadov ich aplikácie v praxi, ktoré sú dokumentované ako príbehy vzorov a ilustračné príklady v ich popisoch.
Výsledky výskumu potvrdzujú, že digitálna transformácia nepredstavuje iba technologickú modernizáciu, ale predovšetkým systémovú a kultúrnu zmenu, ktorá si vyžaduje koordinované a navzájom prepojené zmenové vzorce v oblasti ľudských zdrojov, procesov a inštitúcií.
Vytvorené vzory poskytujú metodický rámec pre tvorcov verejných politík, odborníkov z praxe aj zástupcov občianskej spoločnosti. Práca zdôrazňuje význam iteratívnych a na kontext citlivých stratégií pri budovaní udržateľných, inkluzívnych a odolných digitálnych systémov v podmienkach s vysokou mierou výziev.

Kľúčové slová: digitálna transformácia, verejná správa, digitálne riadenie, prijímanie technológií, digitálne zručnosti, organizačné vzory

2. Problem Statement

The idea behind the work reported here can be concisely expressed as the following thesis:
Proven digital transformation practices can be collected and Operationalized in the form of Organizational patterns.

Identify and analyze the challenges in digital transformation adoption.

Digital transformation (DT) initiatives often emphasize technology and overlook critical organizational, human, and social factors.

Public institutions face complex barriers, including:

- Limited digital literacy
- Cultural resistance to change
- Resource shortages
- Weak or absent strategic frameworks

Existing digital strategies often lack structured, practical guidance designed for the realities of low-resource or complex environments.

To address these gaps, the research:

- Observed public organizations to understand DT challenges.
- Conducted a survey to identify key organizational and human obstacles.
- Developed a set of reusable organizational patterns—structured,
- context-sensitive solutions to recurring DT challenges

These patterns aim to support effective and sustainable digital transformation in resource-constrained public sector environments.

3. Research Objective

- To identify key barriers to digital transformation in public organizations, focusing on often-overlooked organizational, cultural, and human factors.
- To develop a set of reusables and validated organizational patterns that address recurring transformation challenges.
- To provide actionable insights and evidence-based best practices for the effective planning and implementation of digital transformation
    - strategies.
- Evaluate the relevance and effectiveness of these patterns through real-world case studies and survey data.

4. Research Contributions

To address the thesis statement, this thesis brings the following contributions:

Patterns of digital transformation, which address essential aspects of digital transformation, its cultural aspects, and aspects specific to public administration.

Patterns for bridging the digital gender divide in Afghanistan, as a specific part of digital transformation efforts related the inclusion of women.

Evaluation of the patterns, as a survey conducted for the patterns of digital transformation addressing aspects specific to public administration but also based on observing actual instances of the patterns in practice, which were presented as pattern stories, and as examples in pattern descriptions themselves.

Analysis of digital transformation challenges and benefits, covering different aspects of digital transformation, including the digital gender divide.

Pattern Theory

- Based on Christopher Alexander's pattern language.
- Organizational format adapted from Coplien–Harrison.
- Patterns: structured solutions to recurring problems in a context.

Pattern Structure

- Name
- Context
- Problem
- Forces
- Solution
- Consequences

Pattern Template Example

Name: Digital Literacy for Government Workforce

Context: Many government staff lack basic digital skills, limiting the impact of digital tools**.**

Problem: Without structured training, employees misuse or avoid digital systems, relying on external consultants and weakening internal capacity.

Forces: Digital skills are essential but not developed without targeted training.

Consultants assist with systems but don't build lasting internal skills.

Solution: Introduce mandatory, role-based digital training with ongoing IT support and link progress to performance reviews.

Consequence: Stronger skills boost tool usage, cut consultant reliance, and support lasting transformation.

People-Centered Patterns

- Perform Employee Evaluation
- Digitally Literate Employee
- Promote Employee Confidence
- Digitalization Mindset

Example: Digital Literacy for Government Workforce

- Name: Promote Employee Confidence
- Context: Employees resist digital tools.
- Problem: Fear, lack of support, cultural uncertainty.
- Forces: Employees want to engage with digital tools, but fear making
- mistakes and losing their jobs.
- Solution: Use role models, storytelling, and micro-training.
- Consequence: Improved trust and participation.

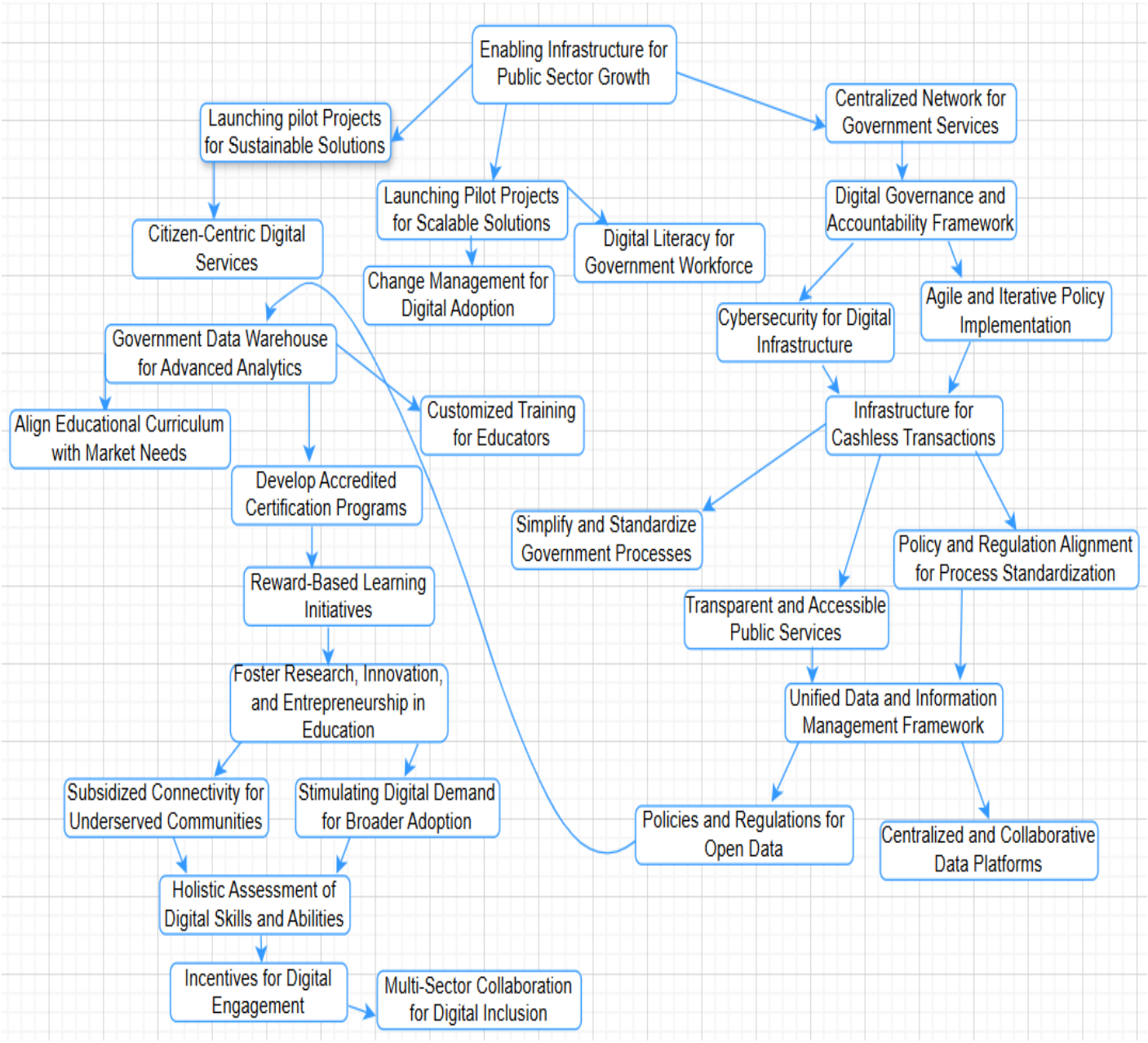
Technical and Infrastructure Patterns

- Adopting Updated Technology
- Enabling Infrastructure for Public Sector Growth
- Infrastructure for Cashless Transactions
- Agile Policy Implementation
- Change Management for Digital Adoption
- Cybersecurity for Digital Infrastructures
- Simplify and Standardized Government process

Equity and Inclusion Patterns

- Digital Literacy for Women
- Community-Based Training
- Remote Digital Learning Programs
- Digital Mindset
- Digital Awareness
- Digital Maturity
- Trust Building

Below figure shows an overview of the pattern language these patterns form. The arrows show typical directions in which these patterns are applied, forming meaningful pattern sequences. The sections that follow describe the patterns.



Field Case Studies

- **e-Tazkira:** National digital ID implementation.
- **ASAN KHIDMAT:** Integrated public service centers.
- **HELMIS:** Higher education learning management information system.
- **E-Passport System:** A prototype of the e-Passport system in Kabul was tested to identify technical barriers, user experience issues.
- **MIS (Certificate Management Information System):** faced document losses, stakeholder dissatisfaction, and bureaucratic inefficiencies.
- **SIGTAS:** Standard Integrated Government Tax Administration System, the tax administration system, faced similar usability issues because of its outdated technology.

Research Methodology

This research followed a multi-stage field-based design to systematically study digital transformation efforts in Afghanistan's public sector. The research workflow is depicted in Figure1.

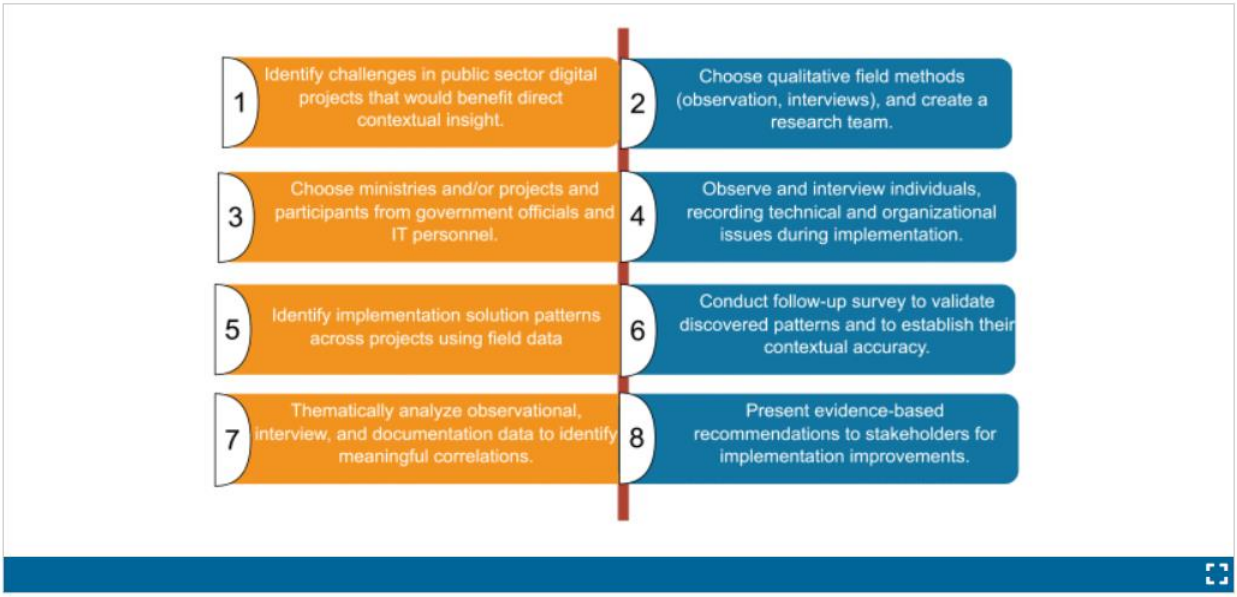


FIGURE 1.
Research workflow.

A. Field Observations and Data Collection

Between 2019 and 2022, the first author was professionally involved in several major digital transformation initiatives across Afghanistan, gaining firsthand experience in their development and implementation. These included e-Tazkira (national ID), ASAN KHIDMAT (public services), SIGTAS (tax administration), HELMIS (education), and projects within the Ministries of Interior, Higher Education, and Finance. After year 2022, the first author revisited these initiatives through follow-up field visits, informal discussions with former colleagues, and interviews with stakeholders to reflect on and document recurring challenges and emerging solutions that formed the basis for the patterns presented in this paper.

As a participant-observer in many of these projects, the first author engaged directly with implementation teams, attended project meetings and system demonstrations, and informally interviewed numerous project stakeholders. These unstructured discussions, conducted over multiple visits, offered firsthand insight into the technical, organizational, and cultural challenges encountered during digitalization. Extensive field notes and internal reports were maintained to document emerging issues and solutions.

This study follows qualitative field research principles as outlined by Neuman [44] and Creswell [45], incorporating direct observation, informal interviews, and contextual immersion in natural public sector settings to understand organizational dynamics and digital transformation practices.

B. Pattern Identification and Analysis

The patterns were identified through inductive thematic analysis of the field notes, interview summaries, and project documents. Recurring challenges and their responses were compared across cases, and solutions that reappeared in different contexts were abstracted as transformation patterns. The pattern mining process drew on prior experience of both authors in documenting organizational and technical patterns, with over 15 previous publications in this area.

The patterns presented in this study were shaped through an iterative analysis process grounded in multiple data sources, including field observations, informal interviews, project documentation, government strategies [36], [37], and stakeholder survey responses. The

identified patterns were continuously reviewed and refined by the authors in collaboration with two senior colleagues (see acknowledgments). One is a leading author in the pattern community and a direct stakeholder in several of the documented initiatives. The other is a senior public sector practitioner in Afghanistan who provided extensive feedback based on firsthand experience with the studied projects. Their involvement ensured that the patterns reflected practical realities, were clearly articulated, and resonated with the challenges and responses encountered in real-world settings. In line with the Rule of Three often referred to in the pattern community [46], each pattern was derived from at least three distinct instances across different projects. This ensured that the patterns captured recurring solutions applicable beyond isolated cases.

C. Survey Design and Validation

To validate the relevance and applicability of the identified patterns, we conducted a survey using stratified random sampling methods. The five target groups included university lecturers from IT departments, civil servants directly involved in the transformation, government IT staff, recent graduates, and technical staff. The survey involved individuals with firsthand experience or impact in digital transformation initiatives.

A critical proportion of respondents had direct operational roles in the digitization process. For instance, as civil servants or as observers on inter-ministerial digital boards. The survey used both structured Likert-scale questions and open-ended responses to gather quantitative and qualitative validation. The data were analyzed using Python (with pandas, seaborn, and Matplotlib). Open-ended responses were coded thematically to triangulate with observed patterns. Thus, our method combined the approach of participatory observation, informal expert interviews, pattern documentation, and stakeholder validation to ensure that the findings are empirically grounded and methodologically robust.

Patterns and Challenges

In order to assess the relevance of the patterns we identified in a broader context, we conducted a survey with the participants actively engaged in or influenced by the implementation of digital initiatives in Afghanistan. Table presents the questions.

Q1	Which digital initiative are you involved in or aware of within Afghanistan's public administration processes?
Q2	Which areas do you believe current or planned digital initiatives have the potential to improve in Afghanistan's public administration processes?
Q3	On a scale of 1 to 10, how much potential do you believe current or planned digital initiatives have to improve Afghanistan's public administration processes?
Q4	To what extent do current or potential digital information systems improve transparency and accountability in Afghanistan's public administration processes?
Q5	On a scale of 1 to 10, how much do you believe the lack of technological infrastructure is a barrier to successfully implementing digital initiatives in public administration processes?
Q6	How would you rate the current state of digital infrastructure in your department/institution (e.g., computers, software, internet connectivity, and digital tools)?
Q7	To what extent do you believe political instability affects the success of digital transformation efforts in public administration?
Q8	In your opinion, how does resistance to change within the government make it difficult to implement digital transformation efforts?
Q9	How does the lack of skilled technical staff affect the successful implementation of digital initiatives in the public sector?
Q10	What is/are the biggest obstacle(s) to improving digital capabilities among staff in your department/organization?
Q11	What are the main security concerns affecting the implementation of digital initiatives in Afghanistan's public administration?
Q12	What improvements do you expect digital transformation to bring to Afghanistan's administration?
Q13	What are the main security concerns affecting the implementation of digital initiatives in Afghanistan's public administration?
Q14	What should be prioritized to bridge the digital divide in Afghanistan's public administration processes?
Q15	What impact will the digital strategy have on Afghanistan's administration in the next five years?

Figure 4.3 shows the exact number of respondents by their role. This diversity ensured a wide range of insights, reflecting both top-down administrative challenges and bottom-up experiences of system users. In total 75 valid replies were collected from different institutions and ministries from different provinces.

The respondents were asked not only to identify key challenges but also to reflect on their impact on digital project success or failure. This process offered a quantitative

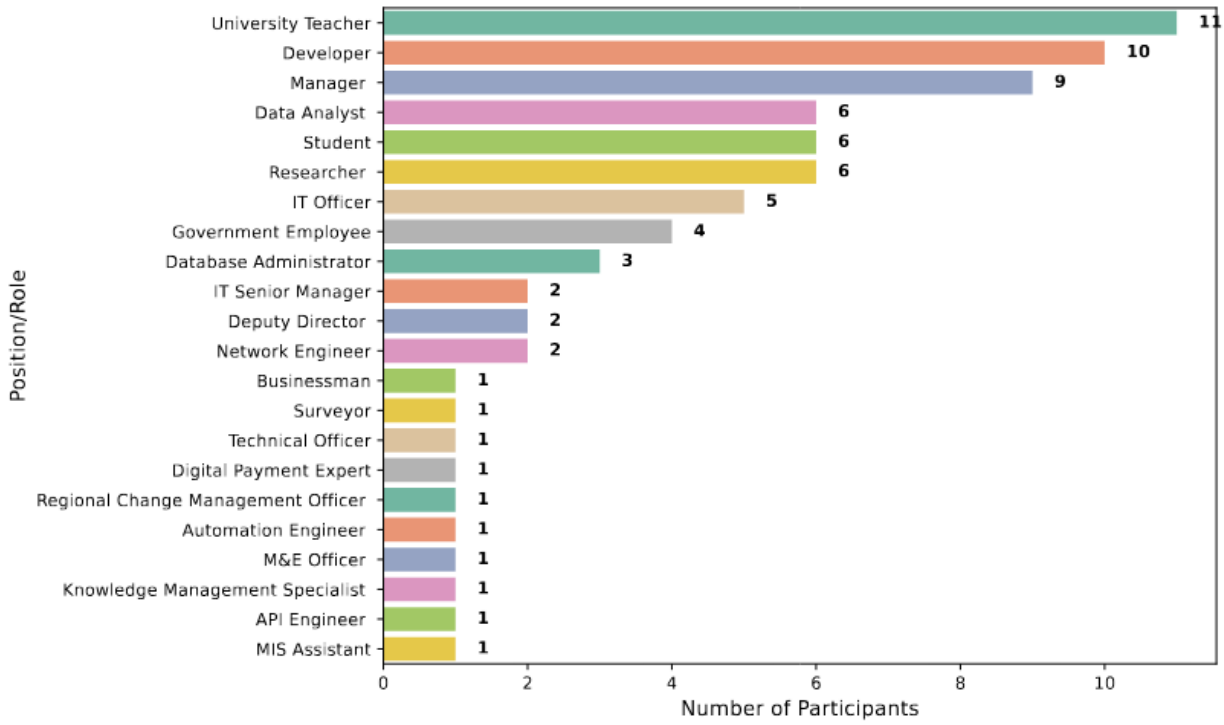


Figure 4.3: Survey respondents by their role.

view of where digital transformation faces the most significant resistance or delay.

Fifteen patterns out of all the patterns proposed in Sections 4.5 and 4.6

Aligning with the most frequently reported challenges and reflect on the stakeholders lived experiences and the practical insights collected in the survey. Figure 4.3 shows the actual alignment.

Mapping Challenges to Patterns

To draw meaningful understandings from the survey data, the collected responses were analyzed in relation to the organizational patterns previously identified through direct observation of digital transformation efforts in Afghan public sector institutions. Figure 4.4 shows how they are aligned with the patterns. These patterns were not imposed in advance but were derived from recurring operations and solutions documented across real ICT projects. They were formalized into a set of patterns such as Digital Literacy for Government Workforce, Agile and Iterative Policy Implementation, and Citizen-Centric Digital Services, each reflecting a specific organizational response to commonly encountered challenges.

In the analysis step, each challenge identified in the survey was mapped to its corresponding pattern. This mapping was guided by the conceptual alignment between the nature of the challenge and the core purpose of the pattern. For example, survey responses highlighting resistance to change and bureaucratic resistance were

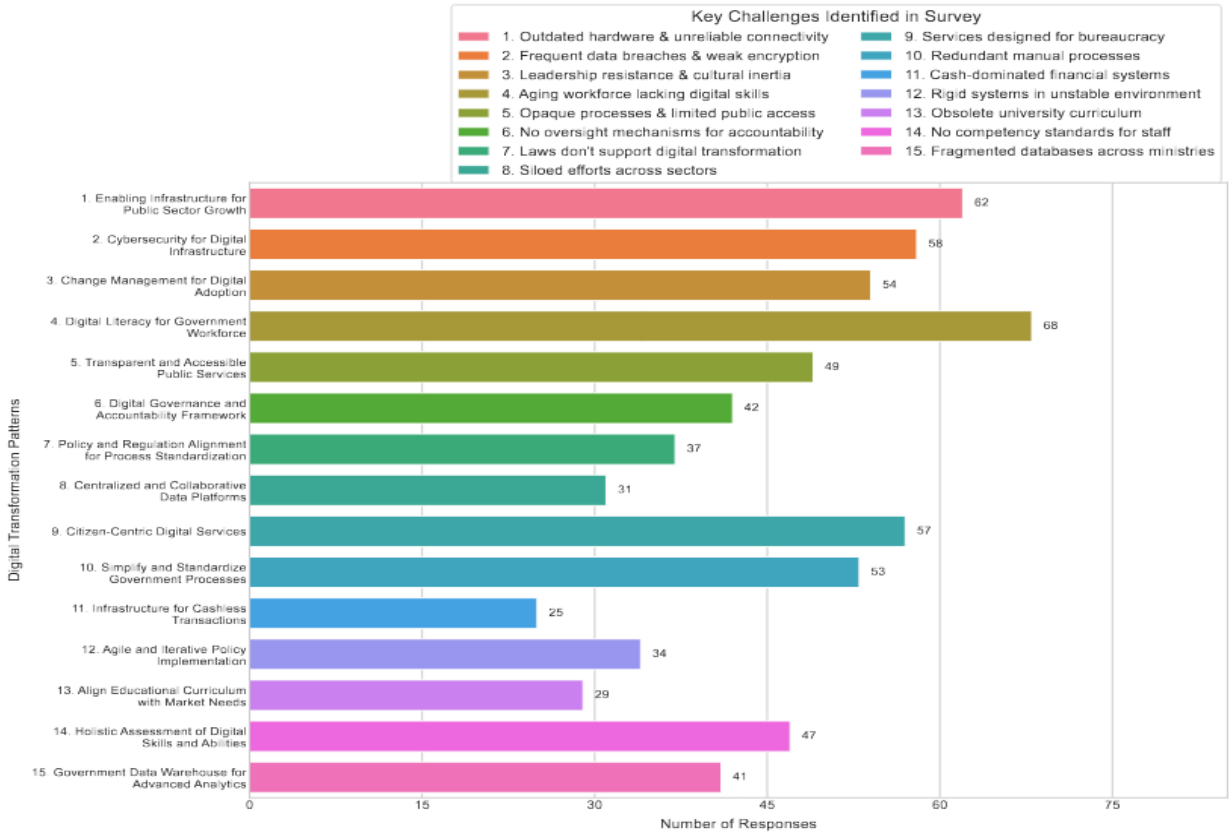


Figure: Key challenges identified in the survey and their alignment with the patterns.

associated with the Change Management for Digital Adoption pattern. At the same time, challenges about weak encryption and frequent data breaches were mapped to Cybersecurity for Digital Infrastructure. This mapping enabled a structured visualization of how observed patterns in real projects correspond to stakeholders' lived experiences and concerns. A detailed summary of all 28 identified patterns, including their related challenges and corresponding high-level solution strategies, is presented in Tables 4.2 and 4.3.

The results of this mapping process were illustrated in a horizontal bar chart (Figure 4.4), where each bar represents a pattern challenge pair and its corresponding number of survey responses. The diagram shows the volume of respondents who identified each challenge and visualizes how closely these challenges align with the practical patterns observed in the field. The bar chart indicates a strong intersection between the problems raised in the survey and the patterns developed from project observations. For instance, the challenge associated with digital literacy was the most

frequently selected by the respondents (two responses), aligning directly with the Digital Literacy pattern. Similarly, a high number of participants identified problems in transparency, infrastructure, and service accessibility, all of which were mapped to patterns such as Transparent and Accessible Public Services and Enabling Infrastructure for Public Sector Growth.

Lessons Learned

The comparative analysis between project-derived patterns and survey answers provides significant takeaways for understanding and promoting digital transformation in Afghanistan's public organizations. First, it reinforces the observation that many critical challenges facing government institutions are systemic rather than isolated. The high degree of alignment between the survey findings and observed patterns ensures that the problems are deeply embedded across multiple layers of governance and administration. As a result, the organizational patterns derived from successful ICT initiatives have the potential to serve as repeatable strategies for overcoming these systemic obstacles. Second, the survey validates that these patterns are grounded in practical facts, not theoretical constructions. The fact that challenges such as outdated infrastructure, lack of interoperability, poor data management, and absence of citizen-centric creation were consistently reflected by survey respondents suggests that the solutions emerging
from observed projects have direct applicability. This convergence lends credibility to using pattern-based thinking as a framework for policymaking, institutional reform, and project design. Also, the survey responses reveal that digital transformation cannot be driven by technology alone; changes in organizational culture, capacity building, and inclusive governance structures must accompany it. Lastly, the survey results highlight the need for participatory procedures in digital transformation by incorporating the perspectives of government employees, educators, university faculty members with ICT background, government institution employees,
IT staff of different organizations, and university graduates. This diversity provided a broad range of insights, reflecting both top-down administrative and study benefits from a more nuanced understanding of challenges and expectations. This inclusive approach improves the quality of pattern identification and ensures that future digital strategies are co-created with the communities they are intended to serve. Finally, the survey underlines that while technological

infrastructure and digital tools are essential, transformation's human and institutional elements, such as capacity, trust, accountability, and leadership, are equally critical for meaningful and sustainable progress.

Publications

1. Faizi J, Sharifi AZ, Momand MY, Habibi Z. Climate Change Adaptation through Smart Cities in Developing Countries: A Review. Nangarhar University International Journal of Biosciences. 2024 Feb 10:327-30.
2. Niazi, Badam, Zargay Habibi, M. Yusuf Momand, Jamilurahman Faizi, and Said Ajmal NAQSHBANDI. "From Data to Action: Exploring Technological Interventions in Climate Change Mitigation." *Nangarhar University International Journal of Biosciences* (2024): 348-350.
3. Momand, Mohammad Yusuf, and Valentino Vranić. "Digital Transformation: Exploring Organizational Patterns at the Intersection of Society, Culture, and Technology." *Proceedings of the 30th Conference on Pattern Languages of Programs*. 2023.
4. Momand, Mohammad Yusuf, and Valentino Vranić. "Identifying and Documenting Best Practices in Digital Transformation." *Proceedings of the 28th European Conference on Pattern Languages of Programs*. 2023.
5. Momand, Mohammad Yusuf, and Valentino Vranić. "Patterns of Digital Transformation: Stories from Afghanistan's Public Administration." *IEEE Access* (2025).
6. Patterns for Bridging the Digital Gender Divide in Afghanistan--- This paper has been accepted.

Conclusions and Future Work

The most difficult part in digital transformation is not how to bring in the new technology, but how to guide people to understand its potential and learn how to use it. Responding to the thesis that proven digital transformation practices can be collected and operationalized in the form of organizational patterns this work brings the patterns of digital transformation, which address essential aspects of digital transformation, its cultural aspects, and aspects specific to public administration, patterns for bridging the digital

gender divide in Afghanistan, as a specific part of digital transformation efforts related the inclusion of women, and evaluation of the patterns, as a survey conducted for the patterns of digital transformation addressing aspects specific to public administration, but also based on observing actual instances of the patterns in practice, which were presented as pattern stories and as examples in pattern descriptions themselves Together, the contributions show that digital transformation is not merely a technological upgrade, but a systemic and cultural shift that requires coordinated patterns of change across people, processes, and institutions. The patterns developed throughout this research provide a framework for policymakers, practitioners, and Civil Society actors. It emphasizes the importance of iterative, context-aware strategies to build sustainable, inclusive, and resilient digital systems in challenging environments.
The patterns brought by this thesis could be made more powerful by connecting them better between themselves. This requires further observations of the practices applied in successful digital transformation projects. Also, this may lead to the discovery of further patterns of digital transformation.

References

[1] Afghanistan Telecom Regulatory Authority, Telecom statistics: 3rd quarter 2018, 2018. [Online]. Available: https://atra.gov.af.

[2] G. Aghakhani, Y. Wautelet, and M. Kolp, “Towards strategic support and guidance of the digital transformation: A conceptual model.,” in PoEM Workshops, 2021, pp. 42–54.

[3] C. Alexander, A pattern language: towns, buildings, construction. Oxford university press, 1977.

[4] ——, The Timeless Way of Building. Oxford University Press, 1979.

[5] C. Alexander, S. Ishikawa, M. Silverstein, J. R. i Ramió, M. Jacobson, and I. Fiksdahl-King, A Pattern Language. Oxford University Press, 1977.

[6] A. Amin, S. Ali Khattak, and M. Hayat Khan, “Issues in the implementation of e-governance in Khyber Pakhtunkhwa (KP),” Global Regional Review, vol. IV, no. II, pp. 489–500, 2019.

[7] M. Andreessen, “Why software is eating the world,” Wall Street Journal, vol. 20, no. 2011, p. C2, 2011.

[8] A. Antonio and D. Tuffley, “The gender digital divide in developing countries,”

Future Internet, vol. 6, no. 4, pp. 673–687, 2014.
[9] BBC News. “Afghan girls robotics team makes waves.” (2020), [Online]. Available: https://www.bbc.com/your_article_link_here.
[10] W. Becker and O. Schmid, “The right digital strategy for your business: An empirical analysis of the design and implementation of digital strategies in smes and lses,” Business Research, vol. 13, no. 3, pp. 985–1005, 2020.
[11] L. M. C. Benavides, J. A. Tamayo Arias, M. D. Arango Serna, J. W. Branch Bedoya, and D. Burgos, “Digital transformation in higher education institutions: A systematic literature review,” Sensors, vol. 20, no. 11, p. 3291, 2020.
[12] A. Burlea-Schiopoiu, I. Borcan, and C. O. Dragan, “The impact of the covid-19 crisis on the digital transformation of organizations,” Electronics, vol. 12, no. 5, p. 1205, 2023.
[13] S. Chanias, M. D. Myers, and T. Hess, “Digital transformation strategy making in pre-digital organizations: The case of a financial services provider,” The Journal of Strategic Information Systems, vol. 28, no. 1, pp. 17–33, 2019.
[14] X. Chen, M. Despeisse, and B. Johansson, “Environmental sustainability of digitalization in manufacturing: A review,” Sustainability, vol. 12, no. 24, p. 10 298, 2020.
[15] A. Cockburn, Agile Software Development: The Cooperative Game, 2nd Edition. Addison-Wesley, 2006.
[16] J. O. Coplien and N. B. Harrison, Organizational Patterns of Agile Software Development. Prentice-Hall, 2004.
[17] J. O. Coplien and N. B. Harrison, Organizational patterns of agile software development. Prentice-Hall, Inc., 2004.
[18] ——, Organizational patterns of agile software development. Prentice-Hall, Inc., 2004.
[19] V. Cornescu and R. Adam, “Organizational change—managing employees resistance,” in Challenges, performances and tendencies in organisation management, World Scientific, 2016, pp. 381–389.
[20] J. W. Creswell, Qualitative inquiry and research design: Choosing among five approaches. Sage, 2009.
[21] S. Dhal, “Situating digital india mission in pursuit of good governance: A study of electronic governance initiatives in the indian province of odisha,” Indian

Journal of Public Administration, vol. 66, no. 1, pp. 110–126, 2020.
[22] V. Díaz-García, A. Montero-Navarro, J. - L. Rodríguez-Sánchez, and R. Gallego-Losada, “Digitalization and digital transformation in higher education: A bibliometric analysis,” Frontiers in psychology, vol. 13, p. 1 081 595, 2022.
[23] N. Edelmann, N. Haug, and I. Mergel, “Digital transformation in the public sector,” in Economics 2023, Edward Elgar Publishing, 2023.
[24] S. A. Ejiaku, “Technology adoption: Issues and challenges in information technology adoption in emerging economies,” Journal of International Technology and Information Management, vol. 23, no. 2, p. 5, 2014.
[25] D. Etinosa, Women in tech startups in afghanistan: Breaking barriers and building the future, Darling Keyz Blog, darlingkeyzblog.com/2024/09/21/women-in-tech-startups-in-afghanistan-breaking-barriers-and-building-the-future, 2024.
[26] F. Forough, Code to inspire, codetoinspire.org, 2016.
[27] A. Frenzel, J. C. Muench, M. Bruckner, and D. Veit, Digitization or digitalization?–toward an understanding of definitions, use and application in is research, 2021.
[28] R. P. Gabriel, Patterns of Software: Tales from the Software Community. New York, NY: Oxford University Press, 1996.
[29] P. Gerli and J. Whalley, “Fibre to the countryside: A comparison of public and community initiatives tackling the rural digital divide in the uk,” Telecommunications Policy, vol. 45, no. 10, p. 102 222, 2021.
[30] T. Gkrimpizi, V. Peristeras, and I. Magnisalis, “Classification of barriers to digital transformation in higher education institutions: Systematic literature review,” Education Sciences, vol. 13, no. 7, p. 746, 2023.
[31] E. Gökalp and V. Martinez, “Digital transformation capability maturity model enabling the assessment of industrial manufacturers,” Computers in Industry, vol. 132, p. 103 522, 2021.
[32] T. Gollhardt, S. Halsbenning, A. Hermann, A. Karsakova, and J. Becker, “Development of a digital transformation maturity model for it companies,” in 2020 IEEE 22nd Conference on Business Informatics (CBI), vol. 1, 2020, pp. 94–103. doi: 10.1109/CBI49978.2020.00018.