Managerial agility and digital transformation of hydraulic basins: A case study of the Guir Hydraulic Basin Agency

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Abstract. This study aims to examine the impact of managerial agility on decision-making and water resources management within the Guir Hydraulic Basin Agency, focusing on digital approaches. Using a primarily quantitative approach, a questionnaire was administered to assess the perception of digital transformation success and the role of managerial agility among staff within the agency. The results underscore the pivotal role of managerial agility in optimizing water resources within the Hydraulic Basin Agency. The perceived success of digital transformation efforts, alongside the emphasis on collaborative decision-making and agile leadership, highlights the significance of this managerial approach. Furthermore, the recognition of digital training and cross-functional collaboration underscores the multifaceted impact of managerial agility on fostering sustainable water management practices. Agile communication emerges as crucial for aligning stakeholders with digital transformation objectives, thereby reinforcing the integral role of managerial agility in driving efficiency and sustainability in water resources management.

1 Introduction

In the global context characterized by climate change and escalating water demand, the sustainable management of water resources has emerged as a paramount concern (Gleick, 1993) [1]. Arid regions, in particular, confront unique challenges stemming from limited precipitation and increasing anthropogenic pressures (Alcamo et al., 2007) [2]. The necessity to reassess water management strategies for sustainability has become imperative (Bates et al., 2008) [3]. Our study is situated within this intricate framework, aiming to address the challenges of water resource management in arid zones and promote sustainable practices (Vörösmarty et al., 2000) [4]. The management of water resources in arid areas faces significant hurdles, including water scarcity, heightened climate variability, and ecosystem degradation. These obstacles underscore the need for innovative approaches to ensure effective and balanced water resource management. Overcoming these specific challenges and fostering sustainable water management practices in arid contexts are central to our study's objectives. To reinforce these assertions, we draw upon the insights of

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pioneering figures in water resource management. For instance, the works of Postel (2000) [5] emphasize the importance of understanding precipitation patterns in arid regions to develop tailored management strategies. Similarly, Rockström et al. (2009) [6] highlight the human activities’ impact on water resource degradation, advocating for conservation and restoration policies. By incorporating these perspectives, our study aims to contribute to advancing knowledge in the field of sustainable water resource management. The primary objective of this study is to assess how managerial agility and digital transformation can contribute to more efficient and sustainable management of water resources in arid zones. We will focus particularly on the Guir Hydraulic Basin Agency as a case study to examine how these approaches can be successfully implemented. Specifically, we seek to answer the following question: How can agile leadership, through concerted decision-making, contribute to the success of the digital transformation of hydraulic basins?

1.1 Digital transformation, agility, and agile management

1.1.1 Digital transformation

Digital transformation has emerged as a pivotal concept in contemporary business landscapes, reshaping how organizations operate, interact with customers, and create value. It encompasses a profound integration of digital technologies across all facets of business, necessitating fundamental shifts in operational paradigms, skillsets, and strategic frameworks. In navigating this transformative journey, scholars and thought leaders have contributed diverse perspectives, each offering valuable insights into the multifaceted nature of digital transformation. In the following discourse, we delve into the seminal works of various authors, elucidating their perspectives and contributions to our understanding of digital transformation.

Hanelt et al. [7] emphasize the organizational shift catalyzed by the diffusion of digital technology, exploring the adoption of flexible organizational models integrated into digital ecosystems to remain adaptive and responsive.

Nadkarni & Prügl [8] delve into the nuances of adapting businesses to the digital landscape, discussing the adjustments required in activities, processes, organizational capabilities, business models, and culture to thrive in the digital economy.

Rogers [9] provides insights into the changes induced by digital technologies in business models, products, and organizational structures, emphasizing the transformative impact of digitalization on traditional business frameworks.

Verhoef et al. [10] contribute insights into the strategic aspects of digital transformation, focusing on conceiving innovative digital business models aimed at creating and capturing enhanced value in the digital era.


In essence, digital transformation transcends mere technological integration, altering how businesses function, engage with customers, and generate value. It necessitates holistic adjustments across activities, processes, skills, business models, and culture, aimed at leveraging opportunities presented by technological advancements.
1.1.2 Agility and agile management

Goldman's [12] conceptualization of agility within the realm of business management unveils a sophisticated paradigm characterized by perpetual dynamism and adaptability to fluctuations in personnel, organizational performance, and the ever-shifting dynamics of product and service valuation in the market. This comprehensive response to the intricacies of the economic landscape demands an unwavering commitment to continuous learning and nimble adaptation.

Dove's [13] evolution of the agility definition accentuates the paramount role of knowledge management and skill versatility. According to Dove, agility emanates from the astute management and effective application of knowledge, placing a premium on the expeditious handling of information pertaining to markets, processes, technologies, and individual competencies. The organization's adept fusion of physical and intellectual responsiveness, coupled with strategic knowledge management, serves as the bedrock of true agility.

These scholarly perspectives contribute to a nuanced and sophisticated comprehension of agility as a multidimensional response to an ever-evolving environment. Initially articulated in the 1990s and 2000s as an organization's enduring capacity to navigate a complex, turbulent, and uncertain landscape, agility extends beyond swift responses to change it entails mastery of the very change itself. Anticipation, innovation, and continual learning stand out as pivotal components.

This refined viewpoint on agility transcends the mere adaptation to environmental shifts, it encompasses the perpetual creation of opportunities for profitability and growth by instigating changes that unveil novel markets beyond the existing realms. Barrand [14] delineates fundamental principles of agility, embracing cooperation, anticipation, innovation, a comprehensive offering, a customer-centric culture, complexity reduction, and an institutionalized culture of change.

In summation, agility emerges as a dynamic and all-encompassing response to the intricacies of a perpetually evolving environment, underscoring the significance of proactive change management, the deliberate creation of opportunities, and an unwavering alignment with the ever-evolving needs of the market.

1.1.3 Agile principles in water resource management: A pathway to efficient and sustainable solutions in arid environments

Agility, as defined by Goldman, Dove, and Barrand, exhibits significant correlations with our focus on digital transformation in water resource management in arid zones. By adopting an agile approach, organizations can better confront challenges specific to arid environments, characterized by resource scarcity, climatic variability, and the imperative for efficient water management.

Adaptability to changing conditions: Agility, emphasizing responsiveness and adaptability, provides solutions to address climatic variability in arid zones. Organizations can swiftly adjust their water management practices in response to meteorological changes and fluctuating environmental conditions.

Anticipation of future needs: Agility, according to Barrand, involves constant anticipation of market developments. Applied to water management, this translates to the capacity to foresee future water needs, whether due to predictable climate changes or increasing demands.

Innovation and creating opportunities: Dove highlights that agility stems from effectively managing knowledge and creating opportunities. In the context of water management, this can manifest as innovation in water conservation, distribution, and usage methods, thereby creating new opportunities for sustainable management.
Customer-centric culture: A customer-centric culture, a fundamental principle of agility according to Barrand, can be applied to meet the water needs of communities in arid zones. In-depth understanding of end-user requirements is crucial for designing tailored solutions. By integrating these agile principles into water resource management, our study aims to explore how managerial agility and digital transformation can catalyze more efficient and sustainable water management in complex environmental contexts. Agility becomes a guiding concept, directing how organizations respond and thrive in environments where variability and uncertainty are intrinsic elements.

1.1.4 Achieving digital transformation success in arid water resource management: The crucial role of managerial agility

The success of digital transformation in arid water resource management is inherently tied to the effectiveness of managerial agility. By adopting digital technologies and integrating agile approaches, organizations responsible for water management can overcome challenges specific to arid environments and promote sustainable use of water resources.

**Process optimization:** Digital transformation enables the automation of water management processes, from meteorological data collection to distribution. An agile approach ensures continuous optimization of these processes to adapt to the changing conditions of arid zones, ensuring efficient water use.

**Real-time data collection and analysis:** Digital technologies facilitate real-time collection and analysis of data related to water availability. Agile management uses this information to quickly adjust distribution strategies, anticipating seasonal fluctuations or scarcity situations.

**Flexibility in resource allocation:** The success of digital transformation depends on the ability to quickly and efficiently allocate resources. An agile approach allows for the rapid redistribution of efforts and investments based on emerging priorities, ensuring efficient use of funds allocated to digital transformation.

**Stakeholder engagement:** Digital transformation is also dependent on stakeholder engagement, including local communities. Managerial agility fosters ongoing stakeholder participation, ensuring that digital solutions meet the specific needs of end-users.

**Adaptability to climate change:** Arid environments are often sensitive to climate change. Digital transformation, coupled with agile management, allows for the anticipation and rapid response to climate variations, minimizing impacts on water availability.

In summary, the success of digital transformation in arid water resource management relies on the synergy of advanced digital technologies and managerial agility. This synergy addresses the specific challenges of water scarcity, climate variability, and anthropogenic pressures, ensuring sustainable and efficient management of water resources.

1.2 Formulation of hypotheses

The theoretical underpinnings, as discussed previously, highlight the potential of agile approaches in addressing the specificities of water resource management in arid zones. By introducing digital transformation into this equation, organizations may unlock new avenues for sustainability and efficiency. As the theoretical framework posits, agility brings forth adaptability to changing conditions, anticipation of future needs, innovation, and a client-centric culture, all of which are pivotal in water management. The ensuing investigation aims to delve into the practical implications of these principles in the unique setting of arid water resource management.: Building upon the theoretical groundwork, two hypotheses are posited.
H1: The first hypothesis asserts that the adoption of an agile approach, coupled with digital transformation, fosters a more efficient and sustainable utilization of water resources in arid zones.

H2: The second hypothesis contends that the triumph of digital transformation in arid water resource management is intricately linked to the implementation of agile managerial practices.

This proposition seeks to probe the interplay between managerial agility and the successful execution of digital strategies, incorporating variables such as concerted decision-making, cross-functional collaboration, effective internal communication, and agile leadership.

The subsequent sections of this research endeavor to empirically validate and interpret these hypotheses, utilizing insights garnered from a survey administered within the specific context of the Hydraulic Basin Agency. The results, while indicative, also underscore the inherent limitations of the study, primarily stemming from the constrained sample size. As we navigate through the intricacies of the findings, a nuanced understanding of the potential correlations and impacts will be unveiled, setting the stage for nuanced discussions and recommendations in the realm of arid water resource management.

2 Survey and Methodology

In our study exploring the impact of managerial agility on digital transformation and water resource management within the Guir Ziz-Rheris Hydraulic Basin Agency (ABH-GZR), a systemic methodological approach is imperative. This section offers a concise overview of our methodology.

Our approach aims to comprehensively capture the dynamics of digital transformation and water resource management, emphasizing the interplay between managerial agility, organizational processes, and sustainability goals. We employ quantitative data collection methods, primarily through a structured questionnaire distributed to 52 employees across various services within the Guir Hydraulic Basin Agency, including the Communication Cooperation Service, Evaluation and Planning of Water Resources division, Sustainable Water Resources Management division, Public Hydraulic Domain Division, and Administrative and Financial Division. The respondents encompassed diverse genders and qualifications (technicians, engineers, administrators..) reflecting the agency's multidisciplinary workforce.

The subsequent flowchart illustrates the sequential steps of our methodology:

Fig.1. Methodological framework for studying managerial agility, digital transformation, and water resource management
3 Results, Discussion and Verification of hypotheses

3.1 Presentation and discussion of survey results

The following section provides a comprehensive overview of the quantitative insights derived from our employee questionnaire, which delves into eleven pivotal themes related to digital transformation and water resources management. Each theme encapsulates the nuanced perceptions and perspectives of employees within the Agency, offering a snapshot of their attitudes toward various aspects of organizational change and sustainability practices.

We aim to illuminate the numerical dimensions of these perceptions. These visual aids serve as powerful tools to unravel the intricate interplay between digital transformation success, collaborative decision-making, the need for digital training, the encouragement of innovation, agile leadership's role, the organization's agile approach, the importance of cross-functional collaboration, the effectiveness of communication, and the potential contributions to sustainability and efficiency in water resources management.

The survey results provide valuable insights into the perceptions and attitudes of employees within the Hydraulic Basin Agency, shedding light on key aspects of digital transformation and agile practices in the realm of water resource management. The following discussion aims to delve into the implications of the findings, highlighting noteworthy patterns and correlations.

![Fig. 2. Perception of digital transformation success (SPSS)](image)

The majority of respondents (60%) perceive the digital transformation within the organization as entirely successful, indicating a positive overall sentiment. This suggests a substantial alignment between the organizational goals of digitalization and the perceptions of its success among employees. The 34% who view it as partially successful underscore the complexity and multifaceted nature of digital transformation endeavors.

![Fig.3. Impact of collaborative Decision-Making (SPSS)](image)
An overwhelming 88% of respondents believe that collaborative decision-making has a positive impact on the success of digital transformation. This emphasizes the pivotal role of teamwork and shared decision-making processes in navigating the complexities associated with digital initiatives. The mere 2% expressing an extremely negative view underscores the significance placed on collaborative approaches.

![Fig. 4. Digital training for employees (SPSS)](image)

The finding that 60% of respondents believe that entirely true digital training is needed for successful transformation highlights the importance of equipping employees with the necessary skills. This underscores the pivotal role of digital literacy and the need for comprehensive training programs to ensure a smooth digital transition.

![Fig. 5. Agile leadership and innovation (SPSS)](image)

The strong agreement (86%) that agile leadership supports innovation further solidifies the connection between agile practices and the organization's capacity for innovation. This finding underscores the role of leadership in setting the tone for an innovative and adaptive organizational culture, essential for successful digital transformation.

![Fig. 6. Encouragement of Risk-Taking and innovation (SPSS)](image)
A substantial 82% of respondents believe that agile leaders encourage employees to experiment and take risks for innovation. This positive correlation emphasizes the crucial role of leadership in fostering a culture of innovation. The encouragement of risk-taking aligns with the principles of agility, allowing for adaptability and creativity in the face of digital challenges.

![Fig. 7. Adoption of agile approach (SPSS)](image)

The reported 80% adoption of an agile approach to decision-making reflects a notable embrace of agile methodologies within the organization. The widespread adoption suggests recognition of the need for flexible and adaptive decision-making processes, aligning with the principles of agility.

![Fig. 8. Cross-Collaboration for digital transformation (SPSS)](image)

A remarkable 92% acknowledging the need for cross-functional collaboration underscores the organizational recognition of the interconnectedness of different departments in successful digital transformation. This high percentage highlights a shared understanding among employees about the importance of collaboration across functions.

![Fig. 9. Agile communication in digital transformation (SPSS)](image)
The finding that 90% of respondents believe that clear communication from agile leaders contributes to employees' good understanding of digital transformation goals emphasizes the crucial role of effective communication in ensuring a shared vision. This aligns with agile principles that prioritize transparent and frequent communication.

A significant 90% expressing that the adoption of an agile approach can contribute to sustainability in water resources management indicates a perceived link between agility and sustainable water practices. This finding suggests that agility is seen as a strategic enabler for environmentally conscious water resource management.

The overwhelming agreement (92%) that an agile approach can contribute to efficiency in water resources management reinforces the perceived connection between agility and the efficient utilization of resources. This resonates with the overarching goal of digital transformation to enhance operational efficiency and resource optimization.

### 3.2 Verification of hypotheses

**H1: Adoption of agile approach and digital transformation for sustainable water management:**

The first hypothesis posited that the adoption of an agile approach, in conjunction with digital transformation, fosters a more efficient and sustainable utilization of water resources in arid zones. The survey results support this hypothesis, as evidenced by the majority (90%) expressing that the adoption of an agile approach can contribute to sustainability in water resources management. The positive correlation between agility and sustainability aligns with theoretical expectations, suggesting that organizational agility, coupled with
digital initiatives, is perceived as conducive to more sustainable water management practices in arid regions.

H2: Link between agile managerial practices and digital transformation success:
The second hypothesis proposed that the success of digital transformation in arid water resource management is closely tied to the implementation of agile managerial practices. The findings corroborate this hypothesis, with a strong agreement (86%) among respondents that agile leadership supports innovation for successful digital transformation. Additionally, the high percentage (92%) acknowledging the need for cross-functional collaboration emphasizes the role of agile practices in ensuring a collaborative and adaptive organizational culture essential for digital success. These results suggest a strong interplay between agile managerial practices and the effective execution of digital strategies.
The survey results provide empirical support for both hypotheses, indicating that the adoption of agile principles, including leadership practices and collaborative approaches, positively influences the perceived success of digital transformation in water resource management within arid contexts. The findings not only validate theoretical expectations but also offer practical insights into the intricate dynamics between agility and digitalization in the specific domain of water resource management. As organizations navigate the challenges of arid environments, the symbiotic relationship between agility and digital transformation emerges as a strategic imperative for sustainable and efficient water resource management.

3.3 Limitations of the research

Sample size: The primary limitation of this study lies in the restricted sample size, constraining the ability to conduct advanced statistical tests such as regression analyses or specific correlation tests. A larger sample size would have enhanced the validity of the conclusions.
Generalizability: Given its focus on a specific agency, generalizing the results to other contexts should be approached with caution. The specific characteristics of the Hydraulic Basin Agency may not be representative of all similar organizations.
Subjective perceptions: The collected data relies on subjective perceptions of the respondents, offering valuable insights but lacking objective measures of performance related to digital transformation.
Specific context: The study specifically concentrates on water resource management in arid areas within the Hydraulic Basin Agency, potentially influencing the results and limiting their generalizability to other domains.
Future research with larger samples and mixed-method approaches, combining subjective and objective data, could provide a more in-depth understanding of the relationship between managerial agility and digital transformation in water resource management.

4 Conclusion

Based on the derived outcomes, it becomes apparent that the triumph of digital transformation within the Hydraulic Basin Agency is inherently linked to the embrace of an agile methodology. Leaders, through the cultivation of collaborative decision-making, effective communication, and an innovation-oriented culture, establish an atmosphere conducive to agility. Simultaneously, employees exhibit a dedication to ongoing training and adherence to sustainability principles, emphasizing the pivotal role of a shared vision in ensuring the transformation's success. These findings underscore the intricate interplay of agile practices across critical domains such as water resource management and the perception of digital transformation success. Consequently, the trajectory towards a
triumphant and enduring digital transformation demands a comprehensive approach, wherein agility assumes a central position in both strategic management and organizational ethos. It is imperative to note that this conclusion remains subject to potential refinement as our study advances.

References