

Digital Transformation Research: Identifying The Elements Influencing Digital Transformation at the National Level

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Abstract—The objective of this study is to construct a framework and provide a comprehensive model that effectively identifies and categorizes the factors influencing digital transformation at the national level, and conceptually determines the relationships among them. To this end, a systematic literature review (meta-synthesis) was conducted, examining 66 studies on digital transformation published between January 2018 and December 2022 across 13 databases. This review resulted in the identification of a framework comprising eight major factors influencing digital transformation. Subsequently, utilizing the resulting conceptual framework and considering Iran's plans and high-level documents such as the Seventh Development Plan, a conceptual model for Iran's digital transformation was designed. This model offers valuable insights for government, organizations, policymakers, and researchers seeking to implement digital transformation strategies.

Keywords: Digital transformation, Digital economy, Digital policy, Meta-synthesis, Conceptual framework, Conceptual model.

I. INTRODUCTION

A few developed countries ranked high on e-government index have embraced modern technology with speed to deliver services to their citizens. Very little has been studied on how they did this successfully as a strategy and what came out of it. There is also a new paradigm of public service innovation that entails

the employees and the consumers in the public sector, in which the development of the internet takes various actors through stages. Thus, we seek to explained their attitude towards the digitalization of traditional processes and digital transformation [1-4].

In reality, the fulfillment of citizen aspirations is predominantly treated as the public value in strategies directed towards digital change. This value can be

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categorized into three basic types: citizen value by way of interaction, economic value via improved administrative efficiency which saves money and time, and creating value for society resulting from increased transparency. However, recent literature illustrates a growing emphasis on the role of co-production in digital transformation. Co-production can enhance the process of service provision within the realm of public administration, enhancing the capacity of the public apparatus itself to create public value [3-8].

The objective of this research is to identify the factors influencing digital transformation at a national level for Iran and to present a conceptual model of these identified factors and their position in the implementation of the country's digital transformation. To this end, the literature presented in the field of digital transformation and the digital economy at the international level was reviewed using a meta-synthesis method, and the factors affecting digital transformation were identified as macro-factors and sub-factors and presented as a conceptual framework. Afterward, using existing models and considering the country's high-level documents, a macro model of how the effective factors influence digital transformation in a large-scale digital transformation implementation program at the national level was presented. The results of this research can guide policymakers and institutions in the country in directing and planning large-scale digital transformation. In addition, researchers interested in the field of digital transformation can make use of the results of this research in future studies.

II. LITERATURE REVIEW

A. The concept and definition of digital transformation

The concept of digital transformation underscores how information technology (IT) affects an organization's structure, processes, flow of information, and ability to adjust to IT changes. Essentially, it focuses on the technological aspect of IT and ensuring that IT aligns with business goals [9-15]. The concept of digital governance aims to diminish the conventional top-down approach in governmental practices and establish a setting where information exchange occurs in both directions. This shift from a hierarchical setup to a technology-driven networked framework represents a significant transformation in the way we handle public administration and management that deviates from the traditional ways we have been accustomed to [16]. Usually, the term digital transformation is associated with the corporate world. This leads to a requirement for defining it from a national standpoint that can be implemented in upcoming national development strategies. However, very few studies have been conducted that analyze digital transformation from the government's or nation's viewpoint. Some research has focused on studying the consequences of incorporating digital technologies into public management.

B. Digital transformation framework in national level

A framework of digital transformation elements at the national level is more visible in international reports provided by reputable global institutions. Elements influencing digital transformation can be seen more in international indexes, among them are World Digital Competitiveness Ranking, Network Readiness Index and Digital Readiness Index [17]. IMD, or the Institute for Management Development, releases an annual ranking called the IMD World Digital Competitiveness ranking. This ranking assesses and gauges how well different countries are incorporating and utilizing digital technologies for digital transformation in various sectors, such as government practices, business models, and society at large. The level of digital competitiveness of a country is chiefly determined by the extent of digital transformation at the enterprise level, but rankings also suggest that this transformation is taking place across all sectors of society, including governments and countries. The ranking methodology employs three key elements - Knowledge, Technology, and Future Readiness - which are further divided into additional subcategories [18]. The Network Readiness Index or NRI is introduced by the Portulans. This index measures the country's level of technology for the use of information and communication in the economy. This framework consists of four pillars: technology, government, people and influence [19]. Cisco has developed the Digital Readiness Index to assess countries' digital maturity levels, acknowledging the significant impact advanced digital technologies have on creating educational, health, and employment opportunities. Unlike traditional technology assessments, this index follows a comprehensive approach that consists of seven key elements: Basic Needs, Business and Government Investment, Ease of Doing Business, Human Capital, Startup Environment, Technology Infrastructure, and Technology Adoption [20].

III. MATERIALS AND METHODS

A meta-synthesis approach was utilized in the study to both extract and analyze information. A meta-synthesis refers to a form of qualitative analysis of data that is collected from pre-existing qualitative works in the topic of interest, and after aggregation offers a new insight into the matter at hand [21, 22]. The statistical population of this research included international reports related or close to the subject matter of digital transformation. Time is one factor that alters most of the scientific research performed and changes many of the research outcomes, and therefore the authors have confined the statistical sample to documents retrieved from citation sources dated between January 2019 to December 2022. Fig 1 depicts a concise seven step procedure for meta synthesis that was adopted in this particular study.

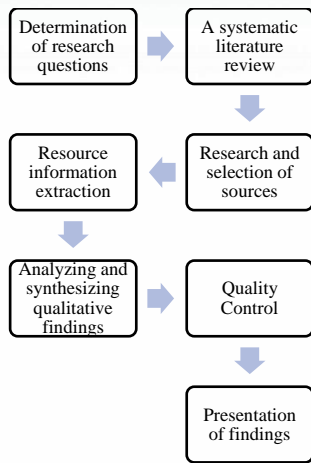


Figure 1. Theoretical framework based on Sandelowski and Barroso's seven-stage method.

A. The first stage, set the research questions

In preliminary factors, as in the other studies, the first stage revolves about defining the research question clearly. What is it that we are going to study? In defining the research question, attention needs to be given as to the fact that the scope of the issue under consideration is not narrow enough to be shallow in consideration. On the contrary, the investigated area should be as wide as is necessary and include enough hurdles such that the findings obtained are adequately conclusive. Generally, at this point, these four questions should be outstanding: what, who (target community), when (timeframes), and how. First, we seek an answer to the question of what element influencing digital transformation in national level. The second aspect wanted to assess the statistical population under study, which can be composed of all reports which are of or around the theme of digital transformation. The third focal issue has to do with the time range, which covers studies performed within January 2019 to December 2022. Finally, the fourth and last question concerns how it was attempted to perform the work which was addressed in the present study using secondary data for meta-synthesis.

B. The second stage, systematic literature review

This stage involved the compilation of a comprehensive list of all studies. To accomplish this, it is important to determine the keywords and alternative words. A list of the databases and the main keywords used is provided in Table 1 [21-24].

TABLE I. DATABASES AND KEYWORDS

Keyword	Databases
"digital transformation"	Web of science
"digital transformation framework"	Scopus
"digital transformation model*"	Elsevier
"digital transformation index*"	Science Direct
"digital transformation measure*"	Emerald
"element* influenc* digital transformation"	Springer
"digital transformation maturity model*"	Wiley
"digital revolution"	IEEE
"digital transformation interaction"	Taylor & Francis
"digital transformation concept"	SAGE Journals
	MDPI
	Google scholar

"digital transformation element*" "digital transformation strateg*" "digitization" "digitalization" "digital government" "e-government" "digital public administration policy" "society 5.0 era" "industry 4.0" "digital governance" "digital economy"	laws and regulations Portal of Iran
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C. The third stage, searching and choosing the right sources

In this search phase, appropriate sources were selected based on predetermined criteria. The extracted articles were evaluated and refined based on inclusion and exclusion criteria. After determining the results of the keyword search, articles were screened. We removed some reports because of the inappropriateness of content. During the research process, 1191 research were screened from the databases after filtering out.

Inclusion criteria:

- English language
- Published between Jan 2019 to Dec 2022
- Mentioning element influencing digital transformation
- Article, Review article, Book chapter, Conference paper, International reports

Exclusion criteria:

- Another language
- Published Before Jan 2019
- Not to mention the element influencing digital transformation
- Early access, Meeting abstract, Proceeding Paper, Letters, Book review

In Fig 2, the stages of article screening (flow chart) are presented.

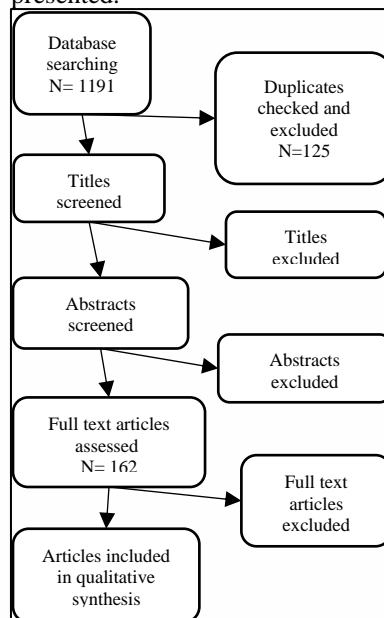


Figure 2. The chart of the process of refining the articles

D. The fourth and fifth stage, extracting information from sources

At this stage, the texts of the final articles were studied and analyzed. Each news statement related to the research question was coded, which is called open coding.

Then, the data obtained from the fourth stage were evaluated by combining the axial codes with common concepts. Axial codes were determined and categorized under the main theme of this research, which is digital transformation [21, 22]. In this study, open codes were categorized under 68 axial codes and eight main themes. Table 3 shows the axial codes and resulting themes which provides a framework of elements influencing digital transformation.

E. The sixth stage, quality control

At the quality control stage, experts evaluated the validity of the findings. To ensure the quality of the research, the opinions of two experts active in the field of digital transformation were analyzed using the Critical Appraisal Skills Programme (CASP) and considering the conditions of this method of analysis [21, 22]. Finally, the score obtained from this evaluation was good (30–40).

F. The seventh stage, presentation of results

Table 4 summarizes the identified element influencing digital transformation in national level.

TABLE II. AXIAL CODES AND THEMES

Theme	Axial codes
Infrastructure	Connection (satellite, 4G & 5G ,and fixed (copper and Optical fiber))
	Internet
	Availability
	Affordability
	Information Infrastructure (data center and cloud infrastructure)
Regulation	Regulatory Quality (complexity, bureaucracy, regulatory environment stability)
	Data Quality (speed, volume, and stability)
	Regulatory coverage
E-Government	Basic services (search engine, browser, map, and e-mail)
	Applications (platforms, messengers and social networks, cloud (electronic services), digital financial services, and content)
	Data protection
	Online services
	Cybersecurity
	Smartening (tourism, education, trade, transportation, health, agriculture, and smart city)
Governance	Policy (facilitation, incentives, support)
	Government Size & Productivity
	Internet Governance
	Virtual Space
	Policy
	Leadership
	Structure and Organization
	National & International cooperation
	Institutional mapping
	Data governance

Business ecosystem	Geopolitics
	Environmental Sustainability
	Social responsibility
	Green development
	Corruption
	Regional and international cooperation
	Competitive environment
	Digital transformation in the manufacturing sector
	Technology investment
	Startup environment (startup, accelerator, and incubator)
	High-tech industries
	Ease of doing business
	Digitization & Digitalization
Economy	Knowledge-based business
	ICT product/service
	Economic growth and stability
	Platform economy
	Algorithm economy
	Macroeconomic stability
	Productivity (manpower, structure and capital)
	Financial and monetary policies
	Export and Import
	Entrepreneurship
	New financing methods (crowdfunding, etc.)
	International and national investment
	Banking system (payments and digital banking system)
	Supply chain
	Economic justice
Human Resource	Social capital
	literacy & skill
	Workforce
	Labor laws
	Employment (new methods of employment and telecommuting, new jobs, loss of jobs)
	coverage of literacy
	Justice (digital divides, gender justice, ethnicity, etc.)
	Prosperity
Culture	
Innovation	Responsible innovation
	Open innovation
	Inventions
	Industry-university cooperation
	Education & Research
	Universities and research centers
Laboratory (specialized, research, and sample approval)	

TABLE III. SUMMARY OF IDENTIFIED ELEMENT INFLUENCING DIGITAL TRANSFORMATION IN NATIONAL LEVEL

Elements influencing digital transformation
Infrastructure
Regulation
E-Government
Governance
Business ecosystem
Economy
Human Resource
Innovation

IV. IRAN'S DIGITAL TRANSFORMATION MODEL

Considering the findings from our study of frameworks and models, and in light of Iran's Seventh Development Plan and National Information Network Development Plan, the need for a conceptual model for Iran's digital transformation became evident. Therefore, drawing on the resources studied in

previous sections, alongside the European Fisheries Performance Evaluation Model and the Brazilian Digital Governance Model, a conceptual model for Iran's digital transformation was developed. which can be seen in Appendix 1 [25, 26].

The proposed model presents the concepts of digital transformation in three layers:

National Challenges, Issues, and Opportunities: This layer encompasses a broad analysis of Iran's conditions, including concepts such as opportunities, threats, strengths, weaknesses, and existing issues. The outcomes and impacts resulting from the implementation of digital transformation strategies are defined in this layer due to the nature of their components. Therefore, the sections "Issues and Needs" and the two sub-sections "Outcomes" and "Impacts" under the "Output, Outcome & Impact" section are located in this layer [25].

Strategy and Planning: Utilizing the concepts from the first layer, this layer addresses the strategic and operational measures necessary to influence the country's conditions based on its requirements, capacities, and existing circumstances. The sections "Digital Transformation Strategy," "Input," and the sub-section "Output" under the "Output, Outcome & Impact" section are located in this layer [25].

Evaluation: In this model, performance evaluation is considered highly important and is therefore placed in a separate layer. This layer is defined without a separate section and is instead defined using the sections introduced in the other layers. In this layer, by employing the concepts of efficiency, effectiveness, utility, and sustainability, the country's performance is evaluated. The definition of each is as follows:

- Efficiency: This refers to the ratio of output, outcome and impact to inputs (especially financial resources). In other words, it is the percentage of correctly executed activities. In engineering literature, this concept is sometimes referred to as efficiency.
- Effectiveness: This concept refers to comparing output, outcome and impact with the intended goals in the planning process. By comparing what was achieved with what should have been achieved according to the digital transformation strategy, the degree of deviation from the goals can be analyzed, and decisions can be made about re-planning and changing the nature of the inputs.
- Utility: This concept examines whether the impact achieved from an intervention aligns with the issues and needs of society.
- Sustainability: This concept assesses the durability of the impacts of an implemented program for the medium and long term [25].

The process of Iran's digital transformation, according to the Iran's digital transformation model, consists of four parts:

- Issues and Needs (in the layer of National Challenges, Issues, and Opportunities)
- Digital Transformation Strategy (in the layer of Strategy and Planning)
- Input (in the layer of Strategy and Planning)

- Output, Outcome and Impact, including Results (in the layer of Strategy and Planning), Outcomes, and Impacts (in the layer of National Challenges, Issues, and Opportunities)

In the following sections, each part of this model will be examined.

A. issues and needs

In this section, issues and needs are examined. The country's issues can be categorized into three types: basic, intermediate, and final. Basic issues include inefficiencies and administrative corruption. These issues are basic because they are, in a sense, the root of the subsequent two categories of issues. Intermediate issues include poverty, unemployment, air pollution, and similar issues that are most visible to the public. The final category of issues includes ultimate issues such as a decline in social capital and psychological security, which are essentially the result of the previous two categories of issues. Conducting a SWOT analysis and accurately identifying national opportunities, threats, strengths, and weaknesses can play a decisive role in identifying the country's issues and paving the way for data-driven governance [26].

B. Digital Transformation Strategy

Following the examination of Iran's issues, the topic of strategies is addressed. Based on higher-level documents and defined legal obligations, Iran's digital transformation vision is defined. The vision serves as the foundation for the mission of organizations in the country and is, in a sense, a dream that creates a driving force and motivation for action. Five criteria for a good vision are considered, including:

- Future-oriented: The vision should represent Iran's future time horizon.
- Idealistic: The vision should be inspiring and encourage workforce engagement.
- Realistic: The vision should align with current realities, strengths, weaknesses, opportunities, and threats.
- Unique: The vision should not be a copy of another Iranian plan, although other countries can be used as models, but every Iran has a unique version.
- Ambitious: The vision should reflect a desirable future.

After determining the vision, overarching goals, policies, and priorities are established. The UK government, in a report titled "The UK's International Technology Strategy" notes that the UK cannot invest in all technologies and should therefore focus on those in which it excels and has specific capabilities, or those that are security-sensitive and must be invested in regardless of the country's capabilities. In setting digital transformation goals, which is done with an eye towards the vision and higher-level documents, it should be noted that multiple goals can be defined for the country, but prioritizing these goals will lead to better focus and efficiency. Additionally, given the rapid changes occurring in the field of digital technologies, having focused goals will increase agility

in responding to changes. After setting goals, the next stage is to develop overarching strategies, and these strategies are determined based on higher-level documents, goals, and policies. Subsequently, specific policies, actions, projects, and required activities are determined on a case-by-case basis.

Finally, by drawing a roadmap, the position of each institution and organization in implementing the digital transformation strategy is determined. The outcome of all these processes will be a roadmap based on all these elements. At each of these stages, higher-level documents and long-term plans are the reference, and the mentioned mandates are the criteria for selection. [26-28].

C. Inputs

Once digital transformation strategies have been determined, the implementation phase begins, and the term "Input" is considered for it. This section consists of four subsections: values, pillars, catalysts/barriers, and transformational tools, which are described below:

1) Values

At the top of the inputs are key values that have been extracted from higher-level documents related to the topic of digital transformation, such as the Seventh Development Plan and the National Information Network Development Plan, and considering reports from various international bodies on this concept. Additionally, concepts mentioned in Industry 5.0, as the most recent perspective on technology and industry, have been included in these values. For example, the principle of resilience refers to creating adaptable production capacity and flexible business processes. In explaining this principle, it should be said that geopolitical changes and natural crises such as COVID-19 have a significant impact on global production.

2) Pillars

The pillars of digital transformation consist of two categories: enabling pillars and driving pillars. The enabling pillars are in the position of causal factors, meaning that their impact on other pillars is greater than their influence from other pillars.

The second category of digital transformation pillars includes components of digital transformation that are in the position of driving factors, meaning that their influence from other pillars is greater than their impact on other pillars.

It should be noted here that the digital transformation pillars in this subsection include indicators that have an input nature.

In examining the indicators of the digital transformation pillars, some indicators have a special position in Iran's higher-level documents such as the Seventh Development Plan and the National Information Network Development Plan. Some of the most important of these indicators include:

- Indicators of literacy & skill and specialized digital literacy under the Human resource pillar;
- Indicators of institutional mapping under the governance pillar;

- Indicators of Basic services, Applications and Cybersecurity under the E-Government pillar;
- Indicators of Regulatory Quality under the regulation pillar;
- Indicators of new financing methods under the economic pillar.

3) Catalysts/Barriers

This subsection consists of two columns: tactics and culture. It can act like a double-edged sword, meaning that if it is given proper attention, it can act as a catalyst, but if it is neglected, it can act as a significant barrier to implementing the digital transformation strategy. [30].

4) Transformative Tools

Transformative tools encompass disruptive technologies that underpin the Fourth Industrial Revolution. These include artificial intelligence, the Internet of Things, social media and networks, digital platforms, blockchain, virtual/augmented reality, cloud computing, algorithm-based automation, 3D printing, robotics, big data, and quantum computing. Data plays a pivotal role here, interacting with each of these technologies. Data has emerged as a power element in the modern era, giving rise to the concept of geopolitics of information. In this subsection, data serves as the vital substance for these technologies.

5) Outputs, Outcome & Impacts

The Results of activities undertaken in the input section are observable at three levels: Outputs, Outcomes, impacts, and. Each is explained below.

- Outputs (Digital Economy/Transformation): Outputs indicators relate to activities measured in physical or financial units and manifest as goods and services resulting from input activities in various sectors. Transformation in sectors such as agriculture, health, and education, leading to their digitalization, ultimately contributes to the formation of a smart economy [25].
- Outcomes refer to the direct and immediate effects on the stakeholders of an operational program. They provide information about changes in stakeholders' behavior, capacity, or performance. Such indicators can be physical or financial in nature. The occurrence of Outcomes and digitalization across all sectors leads to the realization of three components: smart government, smart business, and smart citizen. Together, these components give rise to smart governance [25].
- Impacts: After achieving smart governance, long-term effects manifest in four key categories: economic Impacts, environmental Impacts, social Impacts, and finally, geopolitical Impacts [25].

V. MANAGERIAL IMPLICATIONS

Based on the elements that influence digital transformation, there are several managerial implications that the Iranian government can consider and by considering these managerial implications, the Iranian government can take concrete steps towards

accelerating digital transformation and promoting social progress and economic growth.

- Develop a comprehensive national strategy
- Increase investment in high-tech industries.
- Encourage public-private partnerships.
- Improve regulatory framework.
- Foster a culture of innovation and creativity.
- Promote environmental sustainability.

VI. CONCLUSIONS

In conclusion, this article has highlighted the various elements that play a crucial role in the process of digital transformation. It has identified eight key elements, namely Human resource, infrastructure, governance, regulation, e-government, economy, business ecosystem, and innovation. These elements collectively contribute to shaping the success and effectiveness of digital transformation initiatives. It is crucial to invest in the necessary skills and knowledge of individuals to ensure a smooth transition to the digital era. Additionally, the presence of robust infrastructure, both in terms of technology and connectivity, is vital for the seamless integration of digital tools and platforms. Security and regulation are critical aspects that need to be addressed to ensure the protection of digital assets and the privacy of individuals. Governments and regulatory bodies play a significant role in creating an environment that fosters trust and encourages innovation. This article also highlights the significance of e-government initiatives, as they facilitate efficient and transparent government services, ultimately contributing to the overall digital transformation of a nation. Effective governance, both at the organizational and national level, is essential to drive digital transformation initiatives forward. Moreover, the economic landscape and business ecosystem need to adapt to the digital era to remain competitive. The integration of digital technologies and the establishment of supportive policies can create opportunities for businesses to innovate and grow. Lastly, innovation play a crucial role in advancing digital transformation. Continuous innovation and investment in research and development are necessary to keep up with the rapidly evolving digital landscape.

VII. LIMITATION AND FUTURE RESEARCH

Future research can focus on several areas:

Empirical studies: Future research can conduct empirical studies to evaluate the impact of different interventions on digital transformation in Iran. This includes assessing the effectiveness of Human resource, infrastructure, governance, regulation, e-government, economy, business ecosystem, and innovation.

Comparative analysis: Future research can conduct a comparative analysis of digital transformation in Iran and other countries with similar socio-economic conditions. This can help identify best practices and lessons learned from other countries that can be applied in Iran.

Stakeholder engagement: Future research can engage stakeholders from diverse sectors, including government, academia, civil society, and the private

sector, to identify the challenges and opportunities for digital transformation in Iran.

Long-term impact assessment: Future research can assess the long-term impact of digital transformation on social progress and economic growth in Iran. This includes evaluating the impact on employment, poverty reduction, inequality, and environmental sustainability.

By addressing these research gaps, future studies can provide more robust evidence to inform policy and practice related to digital transformation in Iran.

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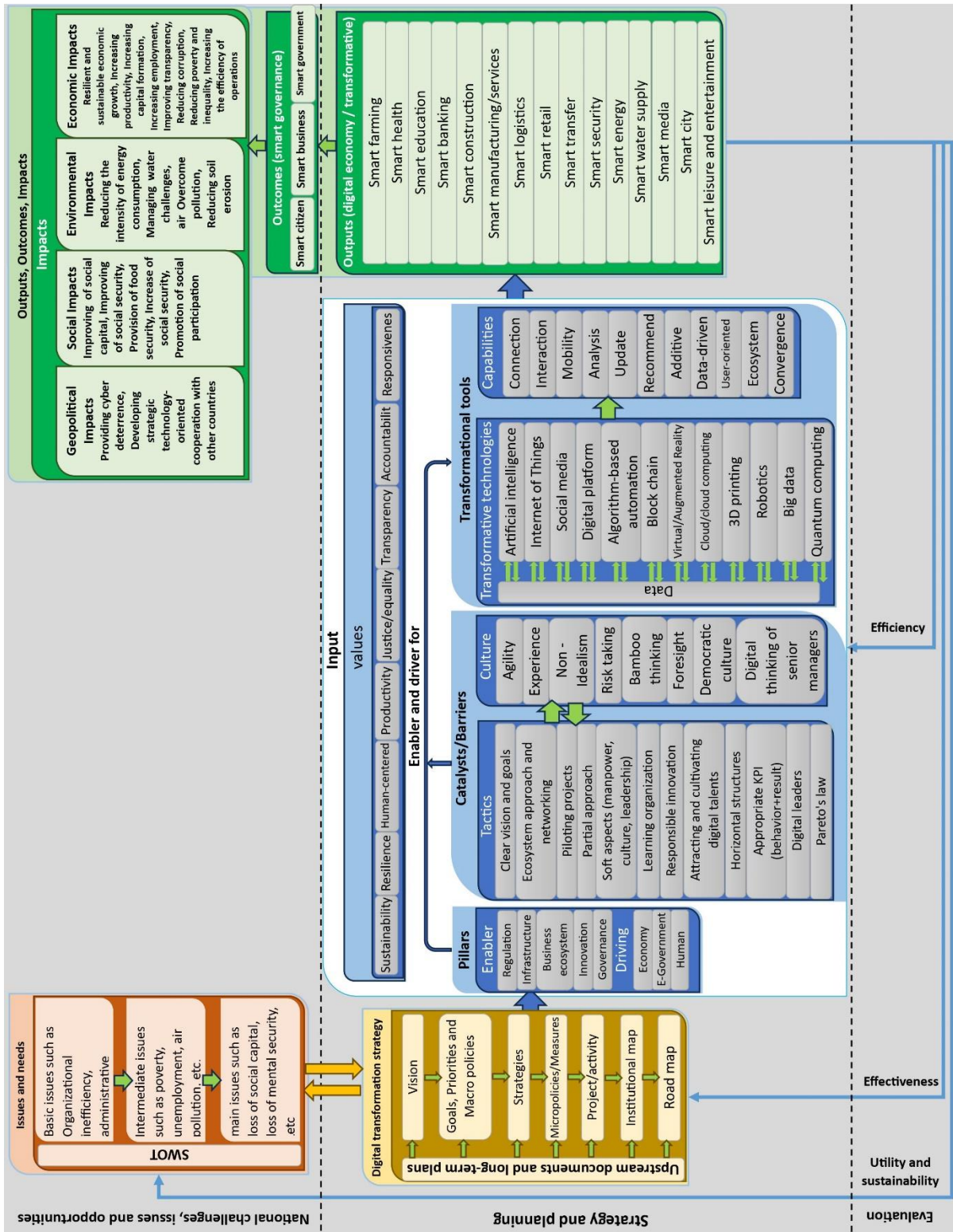


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Appendix 1. Iran’s Digital transformation Model



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