

Designing a Public Policy Dashboard for Smart Governance: A Systematic Review

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Abstract

A dashboard, as a visual display, plays an effective role in enhancing knowledge and information sharing across various domains. The use of dashboards in the field of policy, equipped with modern data-driven technologies and aligned with the expansion of e-government, creates a platform for achieving smart governance, enabling progress toward transparency, accountability, forward-looking decision-making, and greater participation. In smart cities, participation often occurs through dedicated participation platforms, such as dashboards, through which citizens can vote, discuss, and brainstorm ideas. The aim of the present research is to provide a framework for designing a dashboard in public policy-making to realize smart governance. To this end, through a review conducted in the Scopus and Web of Science databases, 40 articles published between 2012 and 2025 focusing on dashboard design were selected and qualitatively analyzed. In this study, the design of managerial dashboards in various domains was observed, and subsequently, considering the multitude of

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features and approaches used, the design of dashboards in public policy-making was addressed from a broader perspective. The research findings, using a thematic analysis approach based on the Brown and Clarke (2006) framework, revealed that for designing smart public policy-making dashboards, 55 sub-themes could be categorized into 6 main themes. The main themes are: needs assessment, intelligent data collection and management, spectacularization, intelligent data analysis, technical capabilities, and smart evaluation and support.

Keywords: Smart Governance, Smart Policymaking, Smart Policy Dashboard, Data-Driven Governance, Information Visualization.

Introduction

Public policy is a decision made in response to a public issue; but beyond a simple decision, it is a dynamic and complex process that begins with problem identification and definition, ends with design and approval of implementation, evaluation of results, learning from lessons, and closure. Policymakers are faced with a multitude of diverse and sometimes contradictory issues, sometimes beyond their mental processing capacity. They are under time pressure (especially in crises), and may even resort to simplistic solutions, personal experiences, or incomplete analyses. These decisions often have unintended consequences, such as unfair distribution of benefits or exacerbation of other problems. Political changes (such as changes of government) may also lead to interruptions in the implementation of policies and waste of resources; that is, even when previous policies have the capacity to solve the problem, they may be abandoned. For example, in some countries, changes in government can even lead to the closure of unfinished projects, while sometimes continuing the same relatively good or poor policies can reduce people's suffering. This phenomenon indicates a weakness in the memory of policymakers and a lack of institutional frameworks for the continuity of policies. Therefore, for effective policymaking, it is crucial to institutionalize continuous evaluation and learning from past experiences to avoid repeating mistakes. Decision-making gains quality and depth in situations where public accountability is required. Decision-makers in such situations are required to carefully evaluate the options and consequences of their decisions from an ethical, economic, and social perspective, and to prepare for possible challenges. Such a process naturally enhances the quality of decision-making (de Fine Licht, 2020).

Access to information is a cornerstone of democratic governance and effective decision-making and can be considered as the lifeblood of democratic systems (Slusariuc, 2018). The fundamental right to access information is essential not only for citizens but also for policymakers and government institutions to be able to adopt fact-based policies. Meanwhile, data visualization acts as a bridge between raw information and deeper understanding. Data visualization is the process of transforming textual and numerical information into meaningful or abstracted graphical representations for mental perception and imagination (Molinari & Raineri, 2021). Data visualization may help uncover hidden patterns and trends in data, facilitate evidence-based decision-making, effectively communicate information to various stakeholders, and significantly save time and cost of data analysis (Hemanth et al., 2019). As one of the manifestations of data visualization, information dashboards provide decision makers with immediate insight by integrating and simplifying a large volume of data into a visual presentation (Masiello et al., 2024). By providing layers of abstraction and simplification, this tool enables quick and accurate understanding of key points in data (Bach et al., 2022) and helps empower decision-makers to make good changes and better decisions to improve the situation (Kobi, 2024). Therefore, considering the importance of decisions in the

policy-making process, the use of this tool is crucial and decisive for public policy-making. The policy dashboard can monitor key performance indicators, identify existing policy patterns and trends, and enable decision-making based on up-to-date data (Kameswari et al., 2025). In addition, it allows for greater transparency in the policy-making process, more informed citizen participation, and more effective accountability of government institutions (Chokki et al., 2022). This will ultimately lead to improved quality of public decision-making and the realization of good governance. These issues have attracted the attention of governance scholars in Iran and the world, and have led to different studies on the themes of "transparency", "smart urban dashboards", and "smartening the policy-making cycle". Despite the importance of these issues, no comprehensive research has been conducted to present a smart policy-making dashboard design model in Iran. Therefore, this research aims to fill this gap by collecting and analyzing global experiences and using thematic analysis method, systematically analyzing studies, and by extracting the core components, proposing a local framework for designing a policy dashboard. By combining theoretical knowledge and digital technologies, this framework increases the transparency of policy-making processes, enables organizational learning and continuous improvement, and paves the way for intelligent stakeholder participation in the policy-making process. Therefore, it is considered a new step on the path to making the country's public governance smarter. The researchers of the present study seek to find an answer to this central question: What components and features should dashboard design have in the public policy-making process?

Research Background:

Few (2006) defines a dashboard as “a graphical representation of critical information needed to achieve specific goals, organized on a single interface, allowing for immediate data monitoring” In completing this definition, Gartner (2021) points out that dashboards are performance monitoring tools that, by aggregating and representing key performance indicators, enable users to make quick assessments without the need for deep analytical exploration. This mechanism helps improve the quality of decision-making by visually representing the relationships between performance measures and strategic objectives (using live charts). Bach et al. (2022) describe dashboards as integrating visual displays and graphical embellishments that provide layers of abstraction and simplification for relevant data points (Bach et al., 2022). As decision support tools, dashboards play a pivotal role in facilitating policy-making processes in complex social systems, and by providing advanced analytical capabilities, they enable the improvement of the quality of managerial decision-making (Kameswari et al., 2025). By enabling systematic monitoring, dashboards provide the outcomes of policies within the framework of sustainable development indicators and improve the quality of life of citizens, enabling continuous monitoring of the effects of policies (OECD, 2020). In addition to facilitating government decision-makers' access to vital data, dashboards

also facilitate public access to information, increase citizen participation in policy-making processes and social oversight of government performance, and create transparency in governance (Matheus et al., 2020). From a technological perspective, recent advances in artificial intelligence and big data analytics have transformed the analytical capabilities of policy dashboards (Löfgren & Webster, 2020). This development has enabled the development of policy insights and enabled policymakers to address complex public issues with a systematic and evidence-based approach (Mergel et al., 2016). By using big data and predictive analytics, dashboards enable timely identification of policy errors and their correction before social costs are incurred (Giest, 2017). By applying these technologies, they can help strengthen democracy, improve governance efficiency, and increase social capital (Matheus et al., 2021). They also help rulers make and guide better decisions in the here and now, with less time and expense (compared to implementing the wrong decision), and in a more comprehensive view, implicitly taking into account the conditions there and then. In order to design an effective information dashboard and reduce the risks of confusion, misdirection, and deception, the dashboard design and development process requires adherence to information governance principles and standards, such as data coverage principles, adherence to legal requirements, and implementation of accountability mechanisms. Furthermore, the dashboard design process must be systematically managed to ensure that the information displayed is accurate and reliable (Susnjak et al., 2022, Nasir et al., 2025). An effective information dashboard must be designed in accordance with established design principles. Core design principles, such as user-centeredness, simplicity, and clarity, should always be adhered to (Myakala et al., 2024; Nasir et al., 2025). Adherence to these principles reduces the likelihood of errors and creates a balance between usability and ethical aesthetics (Martins et al., 2022). Dashboards optimize organizational performance with data-driven analysis and intelligent tools. Some of the core functions of dashboards, as reported in the articles reviewed, include.

Table 1: An overview of some of the core functions of dashboards

Feature	purpose
-Possibility of real-time and continuous monitoring of current and emerging issues in the country (de Fine Licht, 2020). -Rapid identification of improvement points in processes (Coulthart & Riccucci, 2022). -Facilitation of evidence-based decision-making (Chokki et al., 2022) .	Intelligent integration of performance indicators with data visualization
-Strengthening collaborative decision-making between units (Iftikhar et al., 2019). -Simulating "what if" scenarios through interactive tools (Kobi, 2024).	Empowering various levels of decision-making

Feature	purpose
-Reducing analysis time and increasing planning efficiency (Franklin et al., 2017).	
-Show causal relationships between performance variables (Nasir et al., 2024). -Synchronize insights with real-time updates (Bartlett & Tkacz, 2017). -Facilitate cross-departmental dialogue with a common data-driven language (Löfgren & Webster, 2020).	Improving organizational coordination
-Agile decision-making and the ability to respond quickly to changes (Bartlett & Tkacz, 2017). -Organizational learning and continuous improvements in processes (Nasir et al., 2024). -Forward-looking planning based on quantitative data and predictive models (Samad & Setyabudhi, 2023).	Strategic achievements

As research shows, combining data mining with transactional visibility, in addition to increasing operational efficiency, significantly improves strategic decision-making flexibility. A review of the research background in the field of dashboard design shows that, in general, little research has been conducted or reported on the design of policy dashboards due to the nature of confidentiality; given the nature of the present study, in this section, some selected studies that have conducted a kind of meta-study on this concept are reported.

Table 2: Review of some previous studies

N	Researcher	The name of the research	Research Objectives and Scope
1	Kameswari et al. 2025	Dashboard framework for decision support in smart cities.	Providing an smart dashboard architecture based on data collection, processing, analysis, and visualization using machine learning and predictive analytics and through real-time updates.
2	Nasir et al. 2025	Information Governance Integration as a Foundation for an Information Dashboard Design Ontology	Extracting eight principles of information governance including quality, security, compliance, integrity, availability, transparency, accountability, and effectiveness, and recommending user-centered design, simplicity, and clarity in dashboard design.
3	Singh et al 2025.	Transactional Data Dashboards: Design Principles, Best Practices, and	Introduce key principles of dashboard design including user-centeredness, accessibility, and clarity, and outline its challenges and solutions to address them.

N	Researcher	The name of the research	Research Objectives and Scope
		Applications	
4	Kobi 2024	Development of dashboard analysis tools for effective performance management and continuous process improvement	Providing solutions that, through the effective design of dashboards, help organizations monitor key performance indicators, identify areas for improvement, and make data-driven decisions.
5	Samad et al. 2023	Designing a management dashboard in the public sector	Providing a framework for dashboard design by collecting, processing, and visualizing data through: collecting data from primary and secondary data by observation and interviewing, analyzing needs, designing the system, writing the code for the public service management dashboard program, testing the public service management dashboard program system, and implementing the program.
6	Chokki et al. 2022	Engaging citizens with open government data: The value of dashboards versus individual visualizations	Dashboard design with accurate and high-quality data collection, audience identification, user-friendly visualization methods, data interpretation, privacy protection and support for two-way interaction, receiving and integrating user feedback, and allowing customization.
7	Young et al. 2020	Creating design guidelines for building urban dashboards from a user perspective	Emphasis on designing the dashboard from the user's perspective, taking into account their needs, abilities, and interpretive contexts, and expressing a set of design guidelines including usability, understandability, and practical value.
8	Matheus et al. 2020	Data Science Empowering the Public: Data-Driven Dashboards for Transparent and Accountable Decision-Making in Smart Cities	Presenting the role of data-driven dashboards using data science to empower the public and promote transparent and accountable decision-making in smart cities, as well as the ability to monitor government performance and participate in governance processes, as well as to

N	Researcher	The name of the research	Research Objectives and Scope
			articulate challenges and provide solutions to address those challenges.
9	Bugwandeen et al. 2019	Investigating the design of performance dashboards in relation to achieving organizational strategic goals.	Introducing dashboard design criteria and features, including indicators related to the framework, appearance, functionality, content, and analytical features of the dashboard.
10	Kourtiti et al. 2018	Big data dashboards, decision support tools for smart cities	Expressing solutions for achieving a dashboard system and applying advanced techniques of big data technology and data mining.
11	Jesperse 2017	Dashboard design guidelines to improve evidence-based decision-making in developing countries	Providing dashboard design principles and guidelines such as layout, page borders, attractiveness, tool design, and dashboard updates.
12	Cahyadi 2016	Beyond functionality and user interface: A design thinking perspective on dashboard design.	Propose a framework and principles for dashboard design consisting of six components: data, technology, user, organization, performance characteristics, and charts and metrics.

Despite studies that have explained the concept and dimensions of dashboards in the general areas of governance and urban management, no comprehensive research has been found that has addressed the design of smart dashboards for policymaking with the aim of its design features. While little research has been conducted on dashboard design in the public sector, there is a significant gap in this area. Therefore, the present study, as the first study, pursues the design of a smart dashboard for national policymaking with the aim of filling this necessary gap.

Method

This research was applied in terms of purpose and was conducted using a systematic review method and a content analysis approach, based on the research framework of Brown and Clark. The statistical population of the study consisted of all internationally recognized articles related to dashboard design in the field of governance and policymaking. The data analysis process was carried out in the six-step framework of Brown and Clark (2006), after collecting and selecting articles related to the topic, as follows.

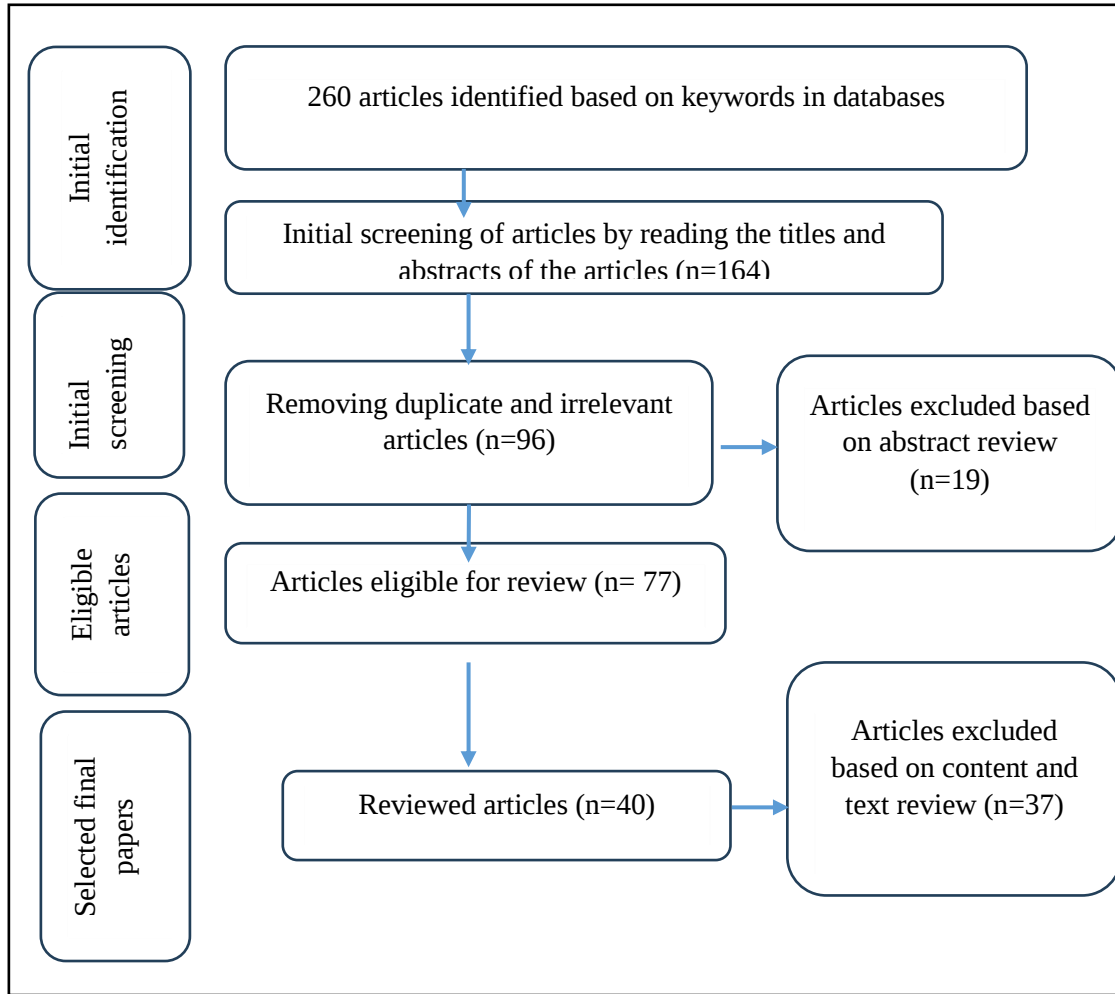
1. Review selected articles several times, paying attention to meanings and patterns, and taking notes on important points of each article;
2. Extract and compile initial codes;

- 3 .Find themes;
- 4 .Review themes and merge similar themes;
- 5 .Name themes;
- 6 .Prepare a report :.(2006).

All coding and theme analysis steps were performed using MAXQDA software to ensure the accuracy and objectivity of the process. Finally, six main themes were extracted as the conceptual framework of the research..

Description of the articles studied

Based on the content analysis approach, an in-depth search of the information database should be conducted at the beginning. Initial search in Scopus and Web of Science databases in the period 2012 to 2025 using English keywords (public policy dashboard, Smart policymaking, Smart Policy Dashboard, dashboard design principles, dashboard analysis , Policy Monitoring Dashboard, Governance Dashboard, Urban Policy Dashboard, Smart Government Dashboards) and Persian (public policy dashboard, policy monitoring with data-driven tools, policy intelligence, smart policy dashboard). Choosing this range allows for coverage of new studies and forward-looking trends in this field. The criteria for selecting articles included articles published in reputable journals, relevance to the topic of dashboards in the field of policy and governance, and inclusion of smart dashboard design concepts. Articles that were not relevant to the policy area or lacked sufficient scientific weight were also excluded. The screening and final selection process, detailed in Figure 1, was also carried out in two stages. The first stage was based on reviewing the title and abstract with the aim of selecting articles related to the dashboard concept. In the second stage, the full texts of the remaining articles were reviewed, focusing on the findings and practical applications of smart policy dashboards, and irrelevant articles were discarded. Finally, 40 selected articles and their content were subjected to final review and thematic development using MaxQDA software.

Figure 1: Article review process

The research questions were: The validity and reliability of the selection of articles were examined based on the journal, the quality of the research method, and the relevance to the research topic. Table 3 provides an example of how to take notes and write down ideas and patterns when reading articles.

Table 3: Example of the data familiarization and note-taking phase

Research	description
the author	Nasir et al. , 2025
method	Narrative review of the literature.
question	How can information governance principles be used as a basis for designing the ontology of information dashboards?
Findings	To create a theoretical framework that directly links data governance principles to practical dashboard design strategies. To this end, eight core principles of information governance have been extracted that should be applied to dashboard design: accuracy and quality, safety and security, compliance, truthfulness and accuracy, accessibility, clarity, accountability

Research	description
	and responsibility, and efficiency and effectiveness.
Limitation	This research faces three main limitations: 1. Methodological, due to the researcher's subjectivity in selecting and interpreting sources; there is a possibility of bias in selection and inability to systematically assess the quality of studies. 2. Data, due to reliance on a limited number of models and studies, which affects the comprehensiveness of the results in the nascent field of integrating information governance and dashboard design; and 3. Application, the findings may not be generalizable to all organizations due to the differences in data governance requirements in different sectors (such as health and finance).

Step 2: Initial Coding (Concept Extraction)

After reading the articles and preparing the first list of ideas, initial codes were created. At this stage, in order to check the validity and reliability of the study, the codes were compared by two people and it was checked whether the criteria for defining each code were met or not. A total of 85 initial codes were extracted from the study of the articles, and an example of these codes can be seen in Table 4.

Table 4: Example of initial coding

Patterns and central ideas of the article	Primary codes
For the dashboard design process, due attention should be paid to criteria selection (defining criteria to include in dashboards), data collection (collecting data sets), and data processing (cleaning and transforming data sets) as a basis for starting the design.	-Data collection and data sets. -Appropriate and accurate data selection and preparation -Data processing and cleaning
The effectiveness of a dashboard largely stems from its ability to integrate multiple data from various sources and present them in a unified and coherent display.	-Data fusion -Integrated and coherent display

Step Three: Extracting Themes

In this stage, after collecting and coding the data, the codes were categorized into themes. In order to extract appropriate themes, the initial codes were reviewed again, and then similar codes were merged and duplicate codes were removed. To confirm the validity and reliability of this stage, the themes were reviewed by experts. In total, 55 sub-themes were extracted from the review of 85 initial codes.

Step 4: Reviewing the themes

In this step, the extracted themes were reviewed several times and the process of reviewing the data, reviewing the themes, continued until an acceptable structure of codes and themes was achieved. It was also ensured during this step that the codes and sub-themes accurately and completely reflected the concepts contained in the main

theme.

Step 5: Naming the themes

In this stage, after categorization and integration, the extracted themes were named in the form of central themes, and finally 55 sub-themes were categorized in the form of 6 main themes (Table 5).

Table 5. Themes extracted from articles

Themes	Definition of theme	Secondary codes	Primary codes
needs assessment	The process of identifying and analyzing stakeholder requirements, organizational goals, and technical requirements to design an effective dashboard.	Identifying goals and needs in order to define key performance indicators (KPIs)	-Setting goals -Identifying requirements -Identifying audiences -Identifying stakeholders -Identifying and defining measurement criteria according to the type of audience -Identifying constraints
		Organizationl considerations	-In line with organizational goals -Target budget
		Environmentl considerations	-Appropriate to socio-cultural norms -Appropriate to the political and cultural needs of users -Appropriate to urban infrastructure
Intelligent data collection and management	The systematic process of collecting, measuring, and recording information from various sources for analytical purposes.	Data preparation	-Data collection and datasets -Selection and preparation of appropriate, accurate and up-to-date data -Data cleaning -Data processing
		Data set integration	-Data fusion -Robust data integration -Support for multiple data sources -Data documentation
Spectaculari zation	The process of transforming complex, quantitative/qualitati ve data into intuitive, interactive graphical	Data visualization techniques	-Display clarity -Design consistency -Choosing the right visualization method such as charts and graphs -Effective color combination

Themes	Definition of theme	Secondary codes	Primary codes
	representations.		-Displaying visibility hierarchy -Displaying critical KPIs -Displaying alerts -Reporting -Saving and printing reports
		User-centricity Usability	-User-centered design, i.e. based on the needs of stakeholders (policymakers, citizens, experts) -Responsive and compatible with devices -Support for users with special needs -Attracting users' attention -Keyboard navigation -Using interaction features such as displaying interaction feedback -Interaction features: Providing capabilities such as navigation, filtering, and dynamic selections to users
Intelligent data analysis	The process of refining, processing, and transforming raw data into actionable insights with the help of big data and artificial intelligence.	Data analysis and trends	-Analysis of collected data -Historical data analysis -Comparative analysis -Identification of anomalies
		Data Shaping	-Data Mining -Data Modeling
		Using advanced intelligent analytics	-Predictive Analysis -Scenario-Based Analysis -Performing various types of analysis and analytical forms, including prescriptive analysis, descriptive analysis, diagnostic analysis, root cause analysis, data-driven analysis -Creating analytical documentation
Technical capabilities	A structured process, based on systems engineering and data science standards, in	Infrastructure technology and its prerequisites	-System architecture -Bandwidth -Processing capacity -Storage

Themes	Definition of theme	Secondary codes	Primary codes
	which hardware and software requirements are designed and implemented according to policy-based needs, scalability, and security.	Dashboard design and implementation	-Suitable dashboard design tools -Suitable dashboard implementation tools -Scenario modeling tools -Support for future changes
		security	-Security considerations -Data encryption -Role-based access control -Logging and maintenance
Smart evaluation and support	A systematic, proactive, and agile process that uses quantitative and qualitative criteria to measure the performance, efficiency, and impact of the dashboard in achieving goals, ensuring that the system always remains stable, up-to-date, and tailored to changing needs.	Smart evaluation and testing	-Performance evaluation (compliance with established goals) -Evaluation of system infrastructure and system continuity in critical conditions -Efficiency evaluation -Evaluation of response speed and rapid data recovery -Evaluation of hazards and risks- Security assessment -Ethical concerns assessment -Privacy and confidentiality assessment -Previous research and policy assessment - Compliance assessment with social and cultural norms considerations
		Smart support	-Performance optimization -Visibility optimization -Evidence-based continuous improvement -Version control -Technical and periodic support -User training

Step 6: Report Preparation

In this stage, the extracted codes and themes are analyzed and discussed, and the themes are described. The following are definitions and examples of the six main themes: needs assessment, intelligent data collection and management, spectacularization, intelligent

data analysis, technical capabilities, and smart evaluation and support.

Needs Assessment

The manifestation of dashboard design thinking varies based on the target audience. Existing literature emphasizes that with careful planning, effective design, and regular feedback, a quality dashboard can be achieved that covers the needs of both business and technical users for data analysis and visualization (Shah, 2020). Within the framework of this research, the design process begins with the fundamental step of identifying goals and applications.

Although previous studies have generally emphasized the importance of defining the main objectives, identifying stakeholders and audience needs, determining key performance indicators (KPIs), and specifying different usage scenarios and identifying dashboard limitations, But the present analysis shows how these elements should be considered in interaction with each other in designing an integrated dashboard for complex environments. This research specifically emphasizes that the output of this stage is an irreplaceable building block for the data collection, analysis, and dashboard design phases.

Furthermore, the findings of this study extend the scope of these considerations and show that other factors also need to be seriously considered. In this regard, our analysis includes other critical issues such as organizational considerations (such as alignment with the organization's macro strategy and budgetary constraints), It introduces and highlights environmental considerations (including socio-cultural norms and political imperatives) as well as the layout of existing technical infrastructure as an integral part of the successful dashboard design process.

Intelligent data collection and management

The quality and validity of an information dashboard lies in its data. As emphasized in the literature, data and its quality (accuracy, reliability, and security) are the cornerstones of any effective dashboard design, and deviation from these standards can lead to undesirable consequences such as user confusion and misguided decision-making processes (Masiello et al., 2024; Susnjak et al., 2022).

In this study, to design an effective dashboard, a framework for data management has been considered, based on which data collection should be based on specific criteria and pivotal parameters, considering the purpose of the dashboard. Accordingly, data can be divided into three types:

- 1) Structured data, such as information in tabular format such as databases, Excel files ;
- 2) Semi-structured data, including XML or JSON data that can be processed ;
- 3) Unstructured data, including text, images, and videos that require processing for analysis.

From the perspective of this research, sources of data collection can include interviews with stakeholders, studying documents, upstream policies, observing existing

systems; external sources, such as data collected from websites or public databases; user data, including user votes and feedback. The data processing steps in the proposed framework of this research include data cleaning, noise removal, correction of outliers with statistical methods, completion of missing data with advanced big data and artificial intelligence techniques, and strategies for replacing missing data based on the percentage of filled fields. Then, data unification is addressed based on standardization of formats (dates, units of measurement), resolution of semantic conflicts (for example, merging "Tehran" and "Tehran"). And in the next step, data integration and data merging from various sources into a single overall data set is carried out with professional and scalable software and intelligent tools in accordance with data layering, until finally, the data is stored in the data warehouse. In this direction, observing principles such as: 1) confidentiality, privacy, and data security; 2) data transparency, to enable public oversight and organizational accountability, and the ability to trace the origin of data; 3) data quality, With the aim of reducing analytical errors caused by incomplete or incorrect data; 4) Data accuracy and the extent to which it corresponds to reality; 5) Data completeness and the absence of information gaps and comprehensive coverage of the subject; 6) Data coherence and ensuring that the data does not contradict each other. and can be linked to each other; 7) Data compliance and collection in accordance with national laws and international standards in any field; 8) Data updating is of great importance (Sosa et al., 2025). Finally, this research emphasizes the need for complete documentation of methods for describing sources, collecting, and structuring data as an integral part of the dashboard design process.

Spectacularization

Effective data visualization in dashboards plays a pivotal role in user experience and information comprehension. Since users actively interact with dashboard components, it is essential to adhere to user-centered design principles and interactivity (Sosa et al., 2025). According to Jespersen, every time a user looks at a dashboard, they should be able to fully understand it and quickly find answers to their questions (Jespersen, 2017). The literature identifies key criteria for evaluating visibility design as including display clarity; visibility hierarchy; color consistency, and design consistency (Bach et al., 2022; Kobi, 2024). Accordingly, the following operational principles for effective design are proposed in this study :

a) Using appropriate colors to make information clear and easily distinguishable; 2) Choosing readable and appropriate fonts with the right size for users; 3) Using simple and clear titles for each section or chart; 4) Appropriate arrangement of elements to organize information so that users can easily navigate between data; 5) Grouping data to place related data together and facilitate understanding of the information; 6) Using clear zones to divide the dashboard into specific sections and areas to focus on each topic.

Another factor for visibility is choosing the appropriate display method. Choosing

the appropriate visibility method depends on the type of data, the complexity of the analysis, and the goals of the users (Bach et al., 2022). The right choice between chart types depends on the type of data and the events they want to describe; common tools for displaying data in dashboards are tables (suitable for structured data), line, bar and pie charts (showing trends and comparisons, ratios), scatter plots (relationships between variables) and heat maps (showing data density) (Kobi, 2024). Interaction features are also important in designing dashboard visibility, such as the ability to click on elements to display more details, filters and search controls, and more guides to display additional information by hovering over elements (Bugwandeen & Ungerer, 2019).

Intelligent Data Analysis

Data analysis is a vital part of dashboard design because the quality and accuracy of information displayed directly impacts the effectiveness of users' decisions. Proper analysis enables users to gain deep and valuable insights from data. Based on theoretical foundations, key issues in data and trend analysis generally include:

1) retrospective data analysis to identify trends and changes over time; 2) comparative analysis to measure data against specific criteria; and 3) anomaly detection to detect unusual patterns that could indicate potential problems.

Within the framework of this research, the process of shaping data using smart technologies such as data mining, statistical techniques, and machine and deep learning algorithms (especially for complex data such as images and texts) has been considered. Accordingly, and in accordance with the classification made by the researcher, advanced analyses that can be used in this framework include: predictive analysis, scenario-based analysis, prescriptive analysis, descriptive analysis, diagnostic analysis, and root cause analysis.

Technical Capabilities

Designing efficient dashboards is based on adhering to specific technical principles and parameters, as well as the technologies used in design and implementation, which directly impact the optimal performance and security of the dashboard. In this study, by combining these principles, a framework for designing a policy dashboard with a flexible architecture based on software engineering principles is proposed. In addition to providing real-time monitoring of the policy process, this framework is intended as a tool for increasing transparency and accountability in public governance.

In the literature on the subject, the dashboard implementation infrastructure technology includes the following: a) modular architecture and the ability to add, remove, or change components without affecting other parts; b) multi-layer architecture and separation of presentation layers from business logic to establish infrastructure technology. In the analysis and design of this research, the infrastructure parameters of the system architecture have been formulated by considering the bandwidth and minimum requirements for data transfer, the required processing capacity and power, as

well as the type and volume of storage. Also, the expected performance parameters for the proposed dashboard, including loading time, error rate, and availability, have been determined.

In the design section of this research, emphasis is placed on selecting the appropriate design tools, scenario modeling tools, and other software design considerations. Also, in the implementation process, selecting the appropriate programming language is of great importance. To ensure data security, they emphasize adherence to principles such as access control to ensure authorized users have access to information, data encryption to protect sensitive data, and recording and maintaining logs to track changes and unauthorized access. These principles have been used as a basis for developing the security mechanism in the proposed architecture.

Smart Evaluation and Support

Evaluation and testing of dashboard performance is recognized as a key principle in the literature to identify its strengths, weaknesses, and continuous improvement. In this study, a three-stage evaluation framework is proposed: Pre-deployment evaluation of the dashboard to align with strategic goals, during-deployment evaluation to help inform policymaking, and post-deployment evaluation of the dashboard to receive user feedback and correct errors.

In designing the evaluation framework of this research, the following items were considered as the main pillars: infrastructure and reliability evaluation, security and privacy evaluation, ethical and social considerations evaluation, and socio-cultural compatibility evaluation. Also, in the technical testing section, user testing approaches are foreseen to examine efficiency and usability, security testing to identify system weaknesses, and the use of performance monitoring tools to collect information and analyze how the dashboard is used.

In the area of performance and optimization, specific solutions have been designed in this research, including: optimizing loading with a gradual approach, ensuring fast response to inputs and requests, and analyzing dependencies between data and components to optimize performance. In the scalability and support section, comprehensive mechanisms have been proposed, including: ensuring optimal performance with increasing users and data volume, a version control system for managing changes, preparing complete technical documentation, and establishing a continuous and periodic technical support system.

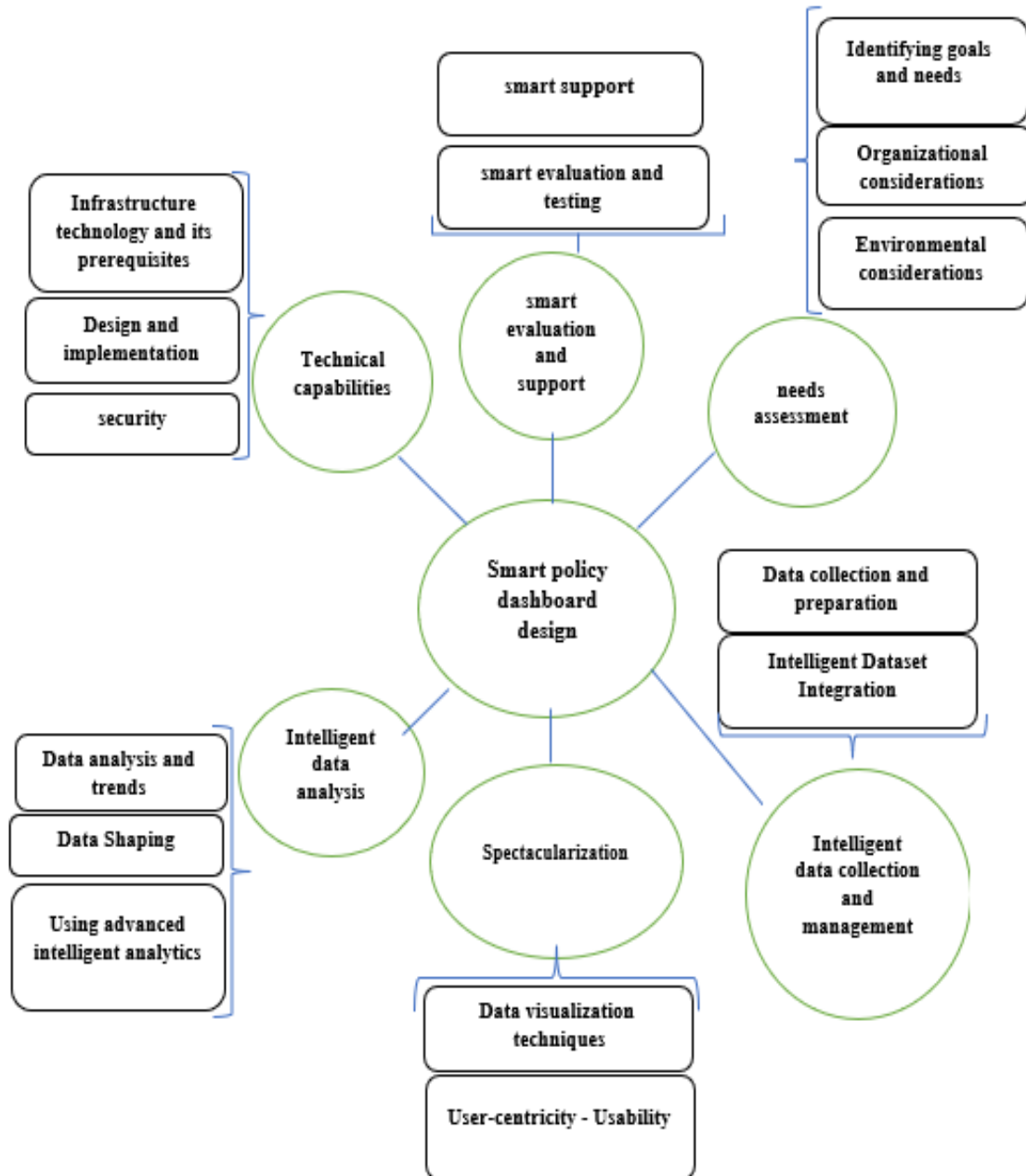
This proposed framework, which is the result of combining theoretical foundations with the innovations of this research, provides comprehensive criteria for measuring the success of implementing smart policy dashboards and ensures that the designed dashboard can be updated and improved in line with the changing needs of stakeholders and organizations and make an effective contribution to the development of smart policymaking.

Step 7: Presenting the findings and final framework

Previous research suggests that the knowledge of policy dashboard design is a dynamic and multifaceted field that is rapidly evolving and requires further understanding. This research was conducted with the aim of aligning with the goals of the Smart Government Roadmap of the Islamic Republic of Iran, in accordance with Resolution No. 6726 dated 01/31/1404 of the Supreme Administrative Council, which emphasizes data-based decision-making and smart governance. The findings of this study show that the design and implementation of a policy dashboard can lead to a departure from one-dimensional approaches in decision-making and strengthen smart governance by dynamically displaying key indicators, identifying complex patterns through new technologies, and real-time monitoring, so that policymakers understand that what events are likely to occur and what actions should be initiated. This dashboard leads to improved organizational learning and, by recording and publishing decision-making documentation, enables policy critique and review, helping to refine policies in the long term and learn from them. The findings of this study provide a comprehensive framework for designing a smart policy dashboard in the form of six main themes. In the needs assessment, the researcher's analysis showed that beyond conventional considerations, organizational, environmental, and infrastructural factors are the cornerstones of successful design. In smart data management, a systematic framework for collecting, processing, and storing data was designed with an emphasis on eight key principles of data governance, quality, security, compliance, integrity, accessibility, transparency, accountability, and effectiveness in dashboard processes. In the visibility section, operational principles were developed for user-centered design and effective selection of visualization methods based on data type and user goal. For intelligent data analysis, the use of advanced technologies such as machine learning and data mining to perform six types of advanced analysis was put on the agenda. In terms of technical capabilities, a flexible architecture with specific infrastructure and performance parameters, along with comprehensive security mechanisms, was proposed. Finally, in Smart evaluation and Support, a three-phase assessment framework was designed with operational solutions for optimization, scalability, and ongoing support. This integrated framework provides the capacity to transform raw data into strategic insights to enhance smart governance.

In this study, while systematically reviewing the theoretical literature in the dashboard design section, findings were obtained that, due to the necessity of integrating them, in order to create a proper understanding, these themes, along with their subthemes, have been presented schematically.

Figure 1. Themes extracted from a review of articles on dashboard design in public policymaking (Source: Researcher findings)



Discussion and Conclusion

This research aimed to design a local framework for a public policy dashboard in line with smart governance in Iran, and was conducted through a systematic review of 40 reputable international articles. The key findings of the research were the identification and classification of six main themes (needs assessment, intelligent data collection and management, visualization, intelligent data analysis, technical capabilities, and smart evaluation and support) as the fundamental pillars of designing such a dashboard.

In this section, the findings are discussed in response to the research questions, compared with the relevant literature, and the necessary step is taken to localize this international framework in the political-organizational context of Iran.

The main issue of this research was the lack of a comprehensive and indigenous framework for designing a dashboard that could cover the complexities of the public policy-making process in Iran. The research question focused on “identifying the key components and themes that constitute such a framework”. The findings of this research clearly demonstrate that an effective dashboard is more than a simple visualization tool and is a dynamic, multi-layered system defined by these six interconnected themes. For example, although visualization (Theme 3) is a key feature (Kob1, 2024; Matheus et al., 2020), this capability has little strategic value without intelligent data analytics (Theme 4) and a strong data collection and management infrastructure (Theme 2). This finding is directly aligned with the work of Wasenir (2020) and Czocki et al. (2022), who emphasize data integrity and predictive capabilities as foundations of data-driven governance.

Each of these themes has been confirmed and expanded upon in the international literature, but what distinguishes this research is its combination of them into an integrated model for the policymaking domain. For example, the emphasis on needs assessment (Theme 1) and stakeholder identification is a direct response to the gap identified by Jespersen (2017) and Korteit and Nijkamp (2018) regarding the failure of IT projects due to a lack of attention to the real needs of users. Similarly, the theme of smart evaluation and support (Theme 6), which emphasizes real-time monitoring and organizational learning, confirms and complements the findings of Samad et al. (2023) and Bagundin and Ungerer (2019) in closing the feedback loop in the policy cycle.

Accepting the principle that the present findings are rooted in international contexts, the fundamental question now arises: How can this framework be localized and prioritized for the Iranian governance context? The answer to this question requires a logical analysis: Priority 1: intelligent Data Collection and Management (Theme 2) and Technical Capabilities (Theme 5): In a context where there are infrastructure challenges such as fragmentation of government data, security issues, and weaknesses in data integration, these two themes are the cornerstones of any practical action. Without a centralized and secure data architecture, other themes such as intelligent analytics and visualization will be unachievable.

Priority 2: Needs Assessment (Topic 1): Designing a successful dashboard requires considering the unique characteristics of Iran's political-administrative context, including specific administrative hierarchies, cultural considerations in transparency, and local data privacy laws. Accurate identification of stakeholders (from top policymakers to executives and even regulatory bodies) and analysis of their different needs ensures that the dashboard is deployed as an acceptable and user-friendly solution, not as an imported tool.

Priority 3: intelligent Data Analysis (Theme 4) and Smart Evaluation and Support (Theme 6): After establishing the technical foundations and needs assessment, these themes can be implemented gradually, taking into account the maturity level of data-driven governance in the country. For example, initially, descriptive analytics can be used to monitor macro performance indicators and gradually move towards predictive and prescriptive models as organizational maturity increases.

Visualization (Theme 3): This theme is present in all phases, but its form and level of detail should be adapted to the above priorities and local considerations (such as the balance between transparency and security).

The most important achievement of this research is to move beyond a purely technical perspective and emphasize managerial and process dimensions (such as needs assessment and support) alongside technical dimensions. It is hoped that the dashboard will be used as a roadmap for Iranian policymakers and implementers on the path to realizing smart governance and achieving the goals of the Smart Government Roadmap document.

Suggestions for future research

It is suggested that future research should specialize dashboard design to develop smart governance more precisely for each stage of the policymaking process, considering the content and nature of that stage, such as developing a "smart dashboard for identifying public issues". Also, case studies should be conducted to pilot the implementation of this framework in a specific executive body (such as a ministry) in order to conduct practical validation, identify implementation challenges, and develop practical guidance for other organizations.

Conflict of Interest

There is no conflict of interest.

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