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Artificial Intelligence as a Lever for Reducing Cognitive Biases in Public Investment Evaluation: An Exploratory Institutional Analysis of the Moroccan Case

L'intelligence artificielle comme levier de réduction des biais cognitifs dans l'évaluation des investissements publics : une analyse institutionnelle exploratoire du cas marocain

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Artificial Intelligence as a Lever for Reducing Cognitive Biases in Public Investment Evaluation: An Exploratory Institutional Analysis of the Moroccan Case

Abstract:

Public investment assessment is a core component of achieving efficient allocation of public resources. Existing research in this field has two core flaws. First, the rational decision-making assumption that underpins traditional assessment models has been widely challenged in behavioral economics, and current studies have confirmed that cognitive biases can severely distort the assessment outcomes of public investment projects. Second, while the academic community has gradually recognized AI's decision-support attribute, very few studies have tested AI's role in mitigating cognitive biases in public investment assessment, and relevant research is particularly lacking in developing-country contexts. This study takes Morocco as its research setting, proposes a comprehensive analytical framework that integrates behavioral economics, public management, and AI decision support systems, and conducts exploratory empirical assessment using secondary institutional data from internationally recognized databases and official Moroccan sources. The study finds that AI can optimize information processing and improve assessment consistency, but AI's effectiveness is constrained by three conditions: institutional quality, governance arrangements, and access to reliable data. Therefore, AI should serve as a supplementary decision-making tool rather than a replacement for human judgment. This study also puts forward the concept of augmented rationality under institutional constraints, which expands existing research frameworks by integrating multi-dimensional perspectives.

Keywords: Artificial Intelligence; Cognitive Biases; Public Investment; Behavioral Economics; Public Decision-Making; Institutional Governance; Morocco.
Classification JEL: D91, H54, O38, C83
Paper type: Exploratory Empirical Research

Résumé :

L'évaluation des investissements publics constitue un élément clé d'une allocation efficiente des ressources publiques. Les modèles d'évaluation traditionnels reposent sur l'idée d'une prise de décision rationnelle, hypothèse largement critiquée par la recherche en économie comportementale. Des travaux antérieurs ont montré que des biais cognitifs peuvent fortement influer sur l'évaluation des projets d'investissement public. La littérature académique souligne un rôle croissant de l'intelligence artificielle (IA) en tant qu'outil d'aide à la décision ; toutefois, à notre connaissance, peu d'études ont testé son potentiel pour atténuer les biais cognitifs liés à l'évaluation des investissements publics, en particulier dans les pays en développement.
En prenant le Maroc comme cadre de référence pour cette analyse, nous proposons un cadre analytique fondé sur l'économie comportementale, la gestion publique et l'aide à la décision basée sur l'IA. Il s'appuie sur une analyse exploratoire empirique fondée sur des données institutionnelles issues d'autres sources, à partir de bases de données mondiales reconnues et d'institutions marocaines officielles. Nos résultats exploratoires montrent que l'IA peut jouer un rôle important pour renforcer le processus de traitement de l'information et rendre les évaluations des investissements publics plus cohérentes. Néanmoins, cela n'est efficace que lorsqu'il existe des institutions solides et des mécanismes de gouvernance en place, ainsi que des données fiables disponibles. Par conséquent, l'IA devrait être utilisée comme un mécanisme d'aide à la décision complémentaire plutôt que comme un substitut au jugement humain.
Cette recherche contribue à cette littérature en proposant le concept de « rationalité augmentée sous contraintes institutionnelles », qui développe de nouveaux cadres analytiques et intègre des perspectives comportementales, institutionnelles et technologiques dans une nouvelle théorie portant sur l'évaluation des investissements publics.

Mots clés : Intelligence artificielle ; biais cognitifs ; investissements publics ; économie comportementale ; décision publique ; gouvernance institutionnelle ; Maroc.
JEL Classification : D91, H54, O38, C83
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1. Introduction

We define public investment as a core policy tool for governments to drive long-term economic development, improve infrastructure, strengthen public services, and boost social welfare, while also fulfilling the key function of supporting regional development, sustainable environmental transition, digital transformation, and the implementation of various national strategies. As public investment mobilizes large-scale resources, spans long construction cycles, and exerts wide-ranging social impacts, the quality of its assessment has long been a shared core concern for governments worldwide and major international organizations. The World Bank, OECD, and IMF have all explicitly stated that refining project assessment and investment screening is the core prerequisite for improving public sector efficiency and ensuring the sustainable allocation of scarce public resources. we review that the current mainstream traditional public investment assessment paradigm is constructed on the rational actor framework of neoclassical economics.

This paradigm assumes that decision-makers can objectively evaluate projects, process information efficiently, compare all feasible options, and select the investment plan that maximizes combined economic and social benefits, with supporting general analytical tools including cost-benefit analysis, the discounted cash flow method, and multi-criteria decision analysis. Although this traditional set of methods remains the core support for global public investment management, its underlying assumption of perfect rationality is almost impossible to hold in real-world scenarios that are full of uncertainty, characterized by incomplete information, and constrained by political limits and organizational complexity. The bounded rationality theory first proposed by Simon in 1955 and 1957 pointed out that decision-makers' decision-making capacity is always constrained by their cognition, access to information, and time, meaning they are in no way perfectly rational actors. The behavioral economics research of Tversky and Kahneman published in 1974, and Kahneman's work in 2011, proved that the cognitive heuristics individuals rely on can produce predictable judgment biases. Empirical studies conducted by Flyvbjerg in 2009 and 2021 found that optimism bias, strategic misrepresentation, and forecasting errors often lead to public projects having underestimated costs, overestimated benefits, and delayed construction schedules, ultimately resulting in resource misallocation.

Reports released by the World Bank in 2023, and the OECD in 2023 and 2024, also confirm that flaws in public investment assessment cannot be explained by technical inadequacies alone, laying a sufficient theoretical foundation to support the core research question of this paper. The quality of public decision-making is constrained by four categories of problems: organizational restrictions, governance challenges, institutional deficiencies, and behavioral factors. In large-scale infrastructure projects, these flaws can trigger massive economic, financial, and social costs due to inaccurate project appraisals. Recent advances in the artificial intelligence sector have brought new opportunities to optimize public decision-making. Machine learning algorithms, predictive analytics, and AI-supported decision-making systems have demonstrated notable potential in improving information processing efficiency, prediction accuracy, risk assessment capabilities, and the level of evidence-based policy analysis. However, recent studies released by the Stanford Institute for Human-Centered Artificial Intelligence (2024), the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2021), and the Organisation for Economic Co-operation and Development (OECD, 2024) jointly emphasize that AI cannot eliminate cognitive biases on its own. The effectiveness of AI-assisted decision-making is highly dependent on five core conditions: institutional quality, governance arrangements, organizational capacity, data quality, and human oversight. Absent governance will furthermore give rise to three new types of risks: algorithmic bias, automation bias, and excessive reliance on technical systems. At present, while research across

four major fields—behavioral economics, institutional economics, public management, and artificial intelligence—has expanded rapidly, a critical theoretical gap remains. Most existing studies examine disciplinary perspectives in isolation: behavioral economics focuses on individual decision-making processes, institutional economics centers on governance and organizational arrangements, public management prioritizes administrative performance, and AI research concentrates on technical capabilities. Very few studies explore how interactions between these complementary dimensions affect public investment appraisal. Relevant research is extremely scarce, especially in developing countries where institutional environments, governance systems, and digital transformation processes feature high levels of heterogeneity.

Accordingly, this study puts forward its core research question: ***Under Morocco's institutional constraints, to what extent can artificial intelligence mitigate cognitive biases and improve the quality of public investment appraisal?***

To address this question, the study constructs an interdisciplinary analytical framework that integrates the four disciplines, treating each perspective as a complementary dimension that jointly shapes public investment appraisal rather than competing explanations. This framework is used to explain the interaction mechanisms of institutional quality, cognitive limitations, and technical capabilities in public decision-making.

This study will also contribute to existing literature along three complementary directions. This study proposes three core academic contributions in the field of public investment assessment, with a clear research arrangement across all sections of the full paper.

The core contributions cover three areas: First, at the theoretical level, this study integrates the behavioral, institutional, and technological dimensions to build a unified analytical framework, extends Simon's bounded rationality theory, puts forward the concept of augmented rationality under institutional constraints, and applies it to public investment assessment. Second, at the exploratory empirical level, this study conducts analysis using internationally authoritative databases and official secondary institutional data from Morocco and only verifies the consistency between its derived theoretical relationships and existing institutional evidence, without testing any causal relationships. Third, at the contextual level, taking the emerging economy of Morocco as a case, this study examines the opportunities and challenges of integrating artificial intelligence into public investment assessment. The subsequent sections are arranged in order as follows: section 2 sorts of our existing literature to fill theoretical gaps; section 3 constructs the integrated conceptual framework; section 4 puts forward research propositions; section 5 introduces the research methods and empirical approach; section 6 discusses empirical findings; and the final concluding chapter summarizes the study's contributions, explains its limitations, and proposes directions for future research.

2. Literature Review

2.1 Decision-Making Rationality and the Limits of Traditional Approaches

The evaluation of public investment has traditionally been grounded in the normative paradigm of rational decision-making inherited from neoclassical economics. This perspective assumes that decision-makers can identify all available alternatives, processing complete information objectively, and selecting the option that maximizes expected social welfare. Consequently, analytical tools such as cost-benefit analysis, discounted cash flow models, and multi-criteria decision analysis have become the dominant methodologies for evaluating public investment projects (Arrow, 1951; Debreu, 1959; Boardman et al., 2021).

Although these approaches remain central to public investment management, they rely on assumptions that are rarely satisfied in real-world public decision-making. Public investment projects are characterized by high uncertainty, incomplete information, multiple stakeholders, political constraints, and long implementation periods. Under such conditions, the assumption

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of fully rational decision-makers becomes increasingly difficult to sustain. Recent reports published by the World Bank (2023) and the OECD (2024) emphasize that weaknesses in project appraisal are often associated not only with technical deficiencies but also with institutional and organizational factors affecting decision quality.

A major theoretical shift occurred with Herbert Simon's theory of bounded rationality. Rejecting the assumption of perfect optimization, Simon (1955, 1957) argued that decision-makers operate under cognitive limitations, limited information, and time constraints. Rather than maximizing utility, individuals seek satisfactory solutions that remain acceptable given the constraints they face. This perspective fundamentally transformed decision theory by replacing the concept of perfect rationality with a more realistic understanding of human decision-making under uncertainty.

Behavioral Economics subsequently extended Simon's work by demonstrating that decision-makers are systematically influenced by cognitive heuristics and psychological biases. Tversky and Kahneman (1974) showed that individuals frequently rely on mental shortcuts when making complex decisions, while Kahneman (2011) further demonstrated that intuitive thinking often dominates analytical reasoning in uncertain environments. These findings have significantly challenged the assumption that public investment decisions are exclusively driven by objective analytical models.

Within the field of public investment, Flyvbjerg (2009, 2021) provided compelling empirical evidence showing that optimism bias and strategic misrepresentation frequently contribute to systematic underestimation of project costs and overestimation of expected benefits. Similar conclusions have been reported in recent international assessments of infrastructure governance, which highlight persistent weaknesses in forecasting accuracy, project selection, and risk assessment despite continuous methodological improvements (World Bank, 2023; OECD, 2024).

Despite these important theoretical contributions, existing research remains fragmented. The literature on rational decision-making primarily emphasizes analytical methods, Behavioral Economics focuses on individual cognitive processes, while public management studies generally concentrate on institutional performance. Comparatively little attention has been devoted to understanding how these perspectives interact within contemporary public investment evaluation, particularly in contexts where Artificial Intelligence increasingly supports public decision-making. This limitation provides the foundation for the integrated analytical framework developed in the present study.

2.2 Cognitive Biases, Institutions, and Artificial Intelligence in Public Decision-Making: Towards Augmented Rationality

This study reconstructs the cognitive framework for public decision-making using the core logic of behavioral economics, overturning the rational person assumption that has long underpinned traditional public investment assessments, and lays a core theoretical foundation for analyzing the impacts of cognitive biases. Drawing on the cognitive heuristics theory first proposed by Tversky & Kahneman in 1974 and further refined by Kahneman in 2011, this study identifies five typical cognitive biases that profoundly affect public investment assessments: optimism bias, anchoring bias, confirmation bias, representativeness heuristic, and availability heuristic. Among these, a series of studies by Flyvbjerg in 2009 and 2021 confirm that optimism bias is the core cause of the widespread cost overruns and schedule delays plaguing large infrastructure projects globally. Explaining public investment decision-making defects solely from the cognitive dimension has clear limitations. Drawing on the classic institutional economics frameworks of North (1990), Williamson (2000), and Acemoglu & Robinson (2012), this study finds that the institutional environment exerts a two-way moderating effect on cognitive biases: weak institutions characterized by insufficient capacity, fragmented

governance, and low transparency amplify the negative impacts of all types of biases, while strong institutions equipped with standardized processes, independent external oversight, and evidence-based assessment mechanisms can effectively mitigate the risk of behavioral distortion.

Integrating foundational artificial intelligence (AI) research by Russell & Norvig (2021) and the public governance report released by the OECD in 2024, this study notes that three categories of AI tools—machine learning algorithms, predictive analytics, and data-driven decision support systems—can reduce information-related cognitive biases by drastically improving public sector information processing capacity, providing a feasible implementation path for optimizing public decision-making. Many people mistakenly assume that AI is a universal solution capable of overcoming all cognitive limitations, but this is not the case.

Both a 2021 study by Mehrabi et al. and a 2021 UNESCO report point out that algorithms can reproduce and amplify biases. AI still depends on institutional governance, regulatory frameworks and human oversight to function properly. Public managers retain discretionary authority over AI outputs, and AI only acts as a supplement rather than a replacement for human judgment.

This observation has given rise to the emerging concept of augmented rationality, according to which Artificial Intelligence extends human analytical capacity without eliminating the institutional and behavioural constraints affecting public decision-making. Rather than replacing decision-makers, AI functions as a cognitive support system capable of improving evidence processing, reducing forecasting errors, and strengthening analytical consistency. Its contribution therefore depends not only on technological performance but also on data quality, institutional maturity, governance arrangements, and organizational learning.

Despite the growing body of research on Behavioral Economics, Institutional Economics, and Artificial Intelligence, relatively few studies have examined the interaction among these three dimensions within the specific context of public investment evaluation. Existing contributions generally analyse behavioural mechanisms, institutional performance, or digital technologies separately.

Existing research in the field of public investment decision-making mostly focuses on the impact of institutional quality, with obvious limitations in its research perspective. We break through this single research framework, introduce variables of cultural influence, draw on the findings of Hofstede (2001) and Douglas & Wildavsky (1982), and point out that three types of cultural factors act on three categories of core decision-making behaviors of public officials. In a strong hierarchical environment with high uncertainty avoidance, decision-makers rely more heavily on heuristics. The efficacy of AI decision support tools is constrained by three layers of limitations, and this research needs to be improved by integrating two major academic disciplines.

Table 1. Main Cognitive Biases Affecting Public Investment Evaluation

Cognitive Bias	**Decision Mechanism**	**Consequences for Public Investment**	**Potential AI Contribution**
Optimism Bias	Underestimation of costs and risks	Cost overruns and unrealistic forecasts	Predictive analytics and scenario simulation
Anchoring Bias	Excessive reliance on initial estimates	Inaccurate budgeting and planning	Dynamic forecasting models
Confirmation Bias	Selective interpretation of information	Poor project selection and weak evaluation	Evidence-based data analysis
Representativeness Bias	Decisions based on simplified patterns	Misallocation of public resources	Pattern recognition algorithms
Availability Bias	Reliance on recent or memorable events	Distorted risk perception	Large-scale data processing

Source: Author's compilation based on Simon (1957), Tversky and Kahneman (1974), Kahneman (2011), and Flyvbjerg (2021).

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Consequently, literature still lacks an integrated framework capable of explaining how cognitive biases, institutional quality, and Artificial Intelligence jointly shape public investment evaluation. Addressing this gap constitutes one of the principal theoretical contributions of the present study and provides the basis for the conceptual framework developed in the following section.

Table 1 summarizes the principal cognitive biases identified in the literature and illustrates how they may affect public investment evaluation. It also highlights the potential contribution of Artificial Intelligence in supporting more objective, evidence-based, and consistent decision-making processes.

2.3 Critical Synthesis of the Literature: Towards an Integrated Framework of Public Investment Evaluation

Over the past few decades, research in the field of public investment assessment has continued to evolve, and the academic community has developed four core research streams in sequence. While each stream has addressed the limitations of prior research, the overall body of work still suffers from a prominent theoretical fragmentation gap and has failed to establish an integrated analytical framework.

As the traditional research stream in this field, neoclassical economics is built on the core assumption that decision-makers are fully rational in an environment with sufficient information. Its research focuses primarily on improving the technical efficiency of assessment methods, and its core limitation is that it does not examine the cognitive mechanisms that influence human judgment in uncertain scenarios. The subsequent rise of the behavioral economics stream challenged this traditional rationality assumption, proposing that decision-makers systematically rely on heuristics that produce predictable cognitive biases. This framework can explain common real-world problems in the public investment sector, such as cost misestimation, project schedule delays, and benefit misjudgment. However, this stream only focuses on individual decision-making, completely ignoring the institutional context in which public decisions are made.

The institutional economics stream that emerged later addressed the gaps in behavioral research, proposing that four institutional factors—governance quality, organizational arrangements, accountability mechanisms, and formal rules—shape public decision-making processes. Strong institutions can reduce the impact of behavioral biases through standardized procedures and independent oversight, while weak institutions amplify cognitive biases due to information asymmetry and insufficient transparency. That said, this stream rarely explicitly incorporates behavioral mechanisms into its own explanatory models. The artificial intelligence research stream that emerged in recent years is a new direction for decision support, with core tools including machine learning, predictive analytics, and data-driven assessment systems. These tools can improve public decision-making's information processing capacity, prediction accuracy, and analytical consistency.

However, the application of AI is highly dependent on data quality, institutional governance, and human oversight; AI can only alter the conditions that enable cognitive biases to operate, rather than eliminate those biases entirely. This review finds that most existing studies independently explore the four dimensions of rational decision-making, cognitive biases, institutional governance, and artificial intelligence, with very few examining how interactions between the four-shape public investment assessment. An important distinction emerging from the public investment literature concerns ex ante and ex post evaluation. Ex ante evaluation is conducted before project implementation and aims to assess the expected costs, benefits, and risks to support investment decisions. Ex post evaluation, by contrast, takes place after project completion and focuses on measuring actual performance, implementation outcomes, and the effectiveness of public spending. Cognitive biases may affect both stages of the evaluation

process. During ex ante appraisal, optimism bias and anchoring may lead to underestimated costs and overestimated benefits, whereas ex post evaluations may be influenced by confirmation bias or hindsight bias when interpreting project outcomes. Artificial Intelligence can support both phases by improving forecasting before implementation and by facilitating evidence-based performance assessment after project completion.

Public investment evaluation is also influenced by the nature of the shocks affecting the economic environment. The literature distinguishes between cyclical shocks, which arise from normal fluctuations in economic activity, and exogenous shocks, which originate outside the economic system, such as pandemics, geopolitical conflicts, natural disasters, or major financial crises. While cyclical shocks generally require adjustments to investment priorities, exogenous shocks create higher levels of uncertainty and increase the likelihood of cognitive biases in public decision-making. Under such conditions, decision-makers may rely more heavily on heuristics and simplified judgments, potentially leading to inaccurate project selection or resource allocation. These observations reinforce the need for flexible evaluation frameworks supported by reliable data and Artificial Intelligence tools capable of rapidly integrating new information into the decision-making process.

Another relevant perspective concerns the distinction between rational and irrational bubbles, which has received growing attention in Behavioral Economics and Finance. Rational bubbles arise when decision-makers knowingly continue to support overvalued investments because they expect future benefits or political returns, whereas irrational bubbles result from systematic cognitive distortions, excessive optimism, herd behavior, and biased expectations (Akerlof & Shiller, 2009; Baker & Xiong, 2021). In the context of public investment, these mechanisms may contribute to the persistence of projects whose expected economic or social returns are overestimated despite weak supporting evidence. Integrating insights from the literature on bubbles therefore strengthens the understanding of how behavioral distortions interact with institutional incentives and reinforces the need for evidence-based evaluation supported by Artificial Intelligence.

The Moroccan context provides a particularly relevant setting for examining the interaction between cognitive biases, institutional quality, and Artificial Intelligence in public investment evaluation. Recent public governance reforms have strengthened public investment management and accelerated digital transformation. However, compared with many OECD countries, Morocco continues to face important challenges related to institutional capacity, project appraisal practices, and data governance. This contrast highlights the relevance of comparative research examining how differences in governance quality and digital maturity influence the effectiveness of AI-supported public investment evaluation across countries. Future comparative studies between Morocco and other emerging or developed economies would therefore contribute to validating and extending the conceptual framework proposed in this research.

This core gap lays out a central direction for future research in the field. Existing research generally lacks an integrated analytical framework that can simultaneously explain the three categories of determinants of public investment evaluation quality: behavioral, institutional, and technological factors. To address this gap, this study adopts an interdisciplinary perspective that integrates insights from behavioral economics, institutional economics, public management, and artificial intelligence. It breaks from the conventional practice of treating these perspectives as competing explanations and instead defines them as complementary dimensions of the same decision-making process. Subsequent chapters will elaborate on this study's conceptual framework and put forward research hypotheses to guide empirical analysis.

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3. Conceptual framework

3.1 An Integrated Framework for Public Investment Evaluation

The preceding literature review demonstrates that no single theoretical perspective is sufficient to explain the complexity of public investment evaluation. While neoclassical approaches emphasize analytical optimization, Behavioral Economics highlights the role of cognitive limitations, Institutional Economics focuses on governance structures and organizational environments, and Artificial Intelligence introduces new opportunities for data-driven decision support. Considered independently, each perspective provides only a partial explanation of public investment performance. This study therefore adopts an integrated framework that combines these complementary approaches into a unified model of public decision-making.

The proposed framework assumes that the quality of public investment evaluation results from the interaction between three fundamental dimensions: cognitive factors, institutional factors, and technological capabilities. First, cognitive biases influence the way decision-makers perceive, process, and interpret information. Optimism bias, anchoring, confirmation bias, and representativeness may distort project appraisal by affecting cost estimation, benefit forecasting, and risk assessment.

These behavioral mechanisms increase the likelihood of evaluation errors, particularly in situations characterized by uncertainty and incomplete information.

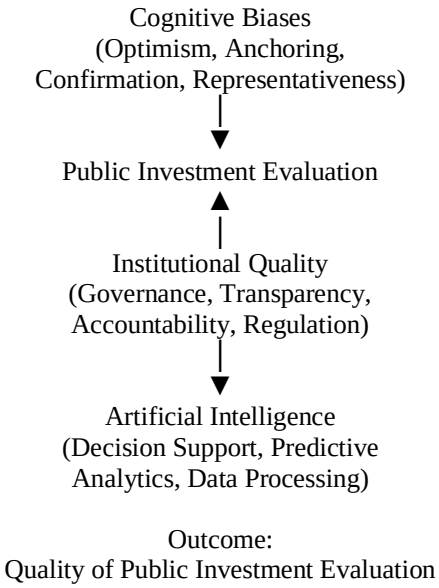
Second, institutional quality determines the context within which public investment decisions are made. Governance effectiveness, transparency, accountability mechanisms, regulatory quality, and organizational routines may either mitigate or amplify the influence of cognitive biases. Strong institutional environments encourage standardized evaluation procedures, independent review mechanisms, and evidence-based decision-making, whereas weak institutions increase information asymmetries and discretionary behavior, thereby reinforcing behavioural distortions.

Third, Artificial Intelligence is introduced as a technological capability that supports human judgment rather than replaces human judgment. AI-based decision-support systems contribute to processing large volumes of information, improving forecasting accuracy, identifying hidden patterns within complex datasets, and strengthening analytical consistency. Nevertheless, their effectiveness depends on the availability of reliable data, institutional maturity, and appropriate governance arrangements. Artificial Intelligence therefore operates as an enabling mechanism whose impact is conditioned by both behavioral and institutional factors.

Accordingly, this study conceptualizes public investment evaluation as a multidimensional process resulting from the continuous interaction between cognitive biases, institutional quality, and Artificial Intelligence. Rather than considering AI as an autonomous decision-maker, the proposed framework adopts the concept of augmented rationality under institutional constraints, according to which technological systems extend human analytical capacity while remaining embedded within institutional and behavioral environments.

Figure 1 presents the integrated conceptual framework for public investment assessment independently developed for this study, whose core premise is that public investment assessment is shaped by the interactions of three complementary dimensions. The cognitive bias dimension refers to behavioral biases that distort decision-makers' perception, interpretation, and processing of information during project evaluation; these biases can trigger three types of negative outcomes: inaccurate forecasting, improper risk assessment, and inefficient investment. The institutional quality dimension includes four core elements: governance effectiveness, regulatory quality, accountability mechanisms, and organizational capacity, and it can mitigate the impacts of cognitive biases through three mechanisms: advancing transparency building, standardizing assessment processes, and adopting evidence-based decision-making.

Figure 1 – the theoretical relationships examined in this research.



Source: Auteurs

The artificial intelligence dimension is positioned as a decision-support tool that complements rather than replaces human judgment; it can only moderate rather than eliminate biases, and its utility depends on data quality and the institutional environment. The
next section will develop research hypotheses to be empirically tested based on this framework.

3.2 Summary of the Conceptual Framework

Summary of the Conceptual Framework established in this study summerizes the main theoretical insights identified throught the literature review into a unified analytical perpective. It assume that the quality of public investement evaluation is not determined by a single factor but reasults from the continuous interaction between three complementary dimensions: Cognitives biases, institutional quality, and Artificial Intelligence.

Cognitives biases impact how public decision-makers perceive, process, and interpret information during project appraisal, whereas institutional quality shapes the governance environment within which these decisios are made. Artificial Intelligence is incorporated as a decision-support capability that enhances information processing, forcasting accuracy, and analytical consistency without replacing human judgement.

Within this integrated perspective, institutional quality plays a central moderating role by influencing both the emergence of cognitive biases and the effectiveness of AI-supported decision-making systems. Strong governance, transparent procedures, and reliable data infrastructures strengthen the capacity of Artificial Intelligence to support evidence-based public investment evaluation, while weak institutional environments may amplify behavioural distortions and reduce the effectiveness of technological tools.

Accordingly, the framework adopts the concept of **augmented rationality under institutional constraints**, according to which Artificial Intelligence extends human analytical capabilities while remaining embedded within behavioural and institutional contexts. This integrated perspective provides the theoretical foundation for the exploratory empirical analysis conducted in this study and serves as the basis for the research propositions developed in the following section.

4. Development of Research Propositions

This section develops a set of research propositions derived from the integrated conceptual

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framework presented above. Given the exploratory nature of the study and the use of secondary institutional data, these propositions are not formulated as statistically testable hypotheses. Rather, they provide analytical guidance for exploring how cognitive biases, institutional quality, and Artificial Intelligence may jointly influence public investment evaluation.

Studios in the Field of Behavioral Economics confirm that cognitive biases under conditions of uncertainty can interfere with individual judgment. In the context of public investment assessment, optimism bias, anchoring bias, confirmation bias, and representative bias distort estimates of project costs, expected benefits, implementation delays, and investment risks, leading to inaccurate assessment outcomes and inefficient allocation of public resources. Research in institutional economics addresses limitations of the cognitive perspective, arguing that governance quality and organizational arrangements moderate the impact of cognitive biases on public decision-making. A robust institutional environment can constrain the effects of cognitive distortion by reducing information asymmetry.

Recent studies in the field of artificial intelligence show that AI-supported systems can improve the accuracy and consistency of information processing and predictive analysis.

However, existing literature points out that the effectiveness of AI depends on institutional quality and data reliability. Operating only as an enabling mechanism, the role of AI is Constrained by the governance environment in which it functions.

P1. Cognitive biases may reduce the quality of public investment evaluation by distorting cost estimation, benefit forecasting, and risk assessment.

P2. Institutional quality may moderate the influence of cognitive biases on public investment evaluation by strengthening transparency, accountability, and standardized appraisal procedures.

P3. Artificial Intelligence may contribute to public investment evaluation by improving information processing, forecasting capacity, and analytical consistency.

P4. The contribution of Artificial Intelligence to public investment evaluation may depend on institutional quality, data reliability, and governance arrangements.

P5. Public investment evaluation may be better understood through an integrated perspective combining cognitive, institutional, and technological dimensions rather than through isolated explanatory approaches.

The five propositions presented above translate the conceptual framework into exploratory analytical relationships. They do not aim to establish causal effects, but rather to guide the interpretation of the secondary institutional data used in this study. The following section presents the research methodology adopted to explore these propositions through an exploratory empirical assessment.

5. Research Methodology

5.1. Research Design

This study adopts an exploratory quantitative research design based on secondary institutional data. Rather than testing causal relationships, the study aims to illustrate the relevance of the integrated conceptual framework developed in this research. The empirical assessment explores how cognitive biases, institutional quality, and Artificial Intelligence may jointly influence public investment evaluation within the Moroccan context using internationally recognized institutional indicators and official national sources. Unlike most prior similar studies that rely mainly on questionnaires and experimental protocols, this study uses institutional and macro-level indicators from internationally authoritative databases and official reports to analyze correlations between variables. Because the cognitive biases that influence public investment decision-making cannot be directly observed through secondary data, because cognitive biases cannot be directly observed through secondary institutional data, this study does not attempt to

measure individual psychological processes. Instead, it uses institutional indicators as indirect proxies for decision-making environments in which cognitive biases are more likely to emerge or remain insufficiently corrected. This approach aligns with the long-standing academic tradition of using institutional proxy variables to explore complex behaviors in public decision-making, a line of inquiry consistently adopted in previous scholarship.

5.2. Data Sources

The study relies on secondary data collected from internationally recognized institutions, including the World Bank, the International Monetary Fund (IMF), the OECD, the Global Infrastructure Hub, and Oxford Insights. Accordingly, the empirical component should be understood as an exploratory assessment intended to illustrate the relevance of the proposed framework within the Moroccan context. The objective is not to test hypotheses statistically but to examine whether available institutional indicators are broadly consistent with the theoretical relationships identified in literature. These sources are used to provide an exploratory empirical illustration of the conceptual framework developed in this research rather than to establish causal relationships or statistically validate the proposed propositions. Morocco constitutes the primary unit of analysis, while international datasets published by the World Bank, the OECD, the International Monetary Fund, the Global Infrastructure Hub, and Oxford Insights are used to complement the national information and provide internationally comparable institutional and governance indicators. This approach allows the study to examine the evolution of public investment evaluation within the Moroccan context while drawing on internationally standardized measures. The Moroccan case constitutes the central focus of the study due to the increasing importance of public investment reforms, digital transformation, and governance modernization undertaken during recent years.

The database combines information obtained from the World Bank, the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), the Global Infrastructure Hub (GI Hub), Oxford Insights' Government AI Readiness Index, and official Moroccan institutional reports. These sources provide internationally comparable indicators covering public investment management, governance quality, infrastructure performance, digital transformation, and Artificial Intelligence readiness.

The use of multiple institutional databases improves the robustness of the analysis by reducing dependence on a single information source while allowing a broader understanding of the institutional and technological environment surrounding public investment evaluation.

5.3. Definition of Variables

The dependent variable of this study is the quality of public investment evaluation. Since this concept cannot be directly measured through secondary data, it is operationalized using institutional indicators reflecting public investment efficiency, infrastructure performance, project implementation capacity, and the effectiveness of public investment management systems.

The use of institutional indicators as proxies for cognitive biases requires methodological clarification. Since cognitive biases cannot be directly observed through secondary macro-level data, this study does not attempt to measure individual psychological processes. Instead, institutional indicators are used as indirect proxies for decision-making environments in which cognitive biases are more likely to emerge or remain insufficiently corrected. Weak governance, limited transparency, low regulatory quality, and deficiencies in public investment management are therefore interpreted as institutional conditions that may facilitate the persistence of cognitive biases rather than as direct measures of those biases themselves. Consequently, the proposed framework should be understood as an exploratory conceptual approximation rather than a direct measurement of individual cognitive behavior.

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The independent variables are organized into three complementary dimensions corresponding to the conceptual framework developed in the previous section.
The first-dimension concerns cognitive biases. Because behavioural biases cannot be directly observed using macro-level data, they are approximated through institutional proxies associated with planning quality, forecasting reliability, governance effectiveness, transparency, and project appraisal capacity. These indicators capture the institutional conditions under which optimism bias, anchoring bias, confirmation bias, and other cognitive distortions are more likely to influence public investment decisions.
The second dimension relates to institutional quality. Governance effectiveness, regulatory quality, accountability, control of corruption, and public sector capacity are considered essential determinants of evaluation quality because they shape the organizational environment within which public investment decisions are made.
The third dimension represents Artificial Intelligence and digital readiness. This dimension is measured through indicators reflecting digital government maturity, data governance, digital infrastructure, and institutional capacity to integrate AI-supported decision systems into public administration.
To reduce omitted-variable bias, several contextual variables are considered, including economic development, public investment intensity, infrastructure needs, and macroeconomic conditions.

Table 2 – the operational Definition of the Study Variables

Variable	Operational Definition	Proxy / Indicator	Expected Relationship	Main Source
Dependent Variable	Quality of Public Investment Evaluation	Public Investment Management (PIM) indicators, Infrastructure Performance, Project Implementation Capacity	—	World Bank (2023); GI Hub (2024)
Independent Variable 1	Cognitive Biases	Institutional proxies reflecting planning quality, forecasting reliability, transparency and project appraisal quality	Negative	Kahneman (2011); Flyvbjerg (2021)
Independent Variable 2	Institutional Quality	Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption	Positive	Worldwide Governance Indicators (World Bank, 2023)
Independent Variable 3	Artificial Intelligence Readiness	Government AI Readiness Index, Digital Government Indicators, Data Governance	Positive	Oxford Insights (2024); OECD (2024)
Control Variables	Macroeconomic and Development Context	GDP per capita, Public Investment Rate, Infrastructure Needs	Control	World Bank (2023); IMF (2024)

Source: Author's compilation based on World Bank (2023), IMF (2024), OECD (2024), Oxford Insights (2024), and Global Infrastructure Hub (2024).

5.4. Analytical Model

The analytical model is derived directly from the integrated conceptual framework proposed in this study. It assumes that the quality of public investment evaluation results from the interaction between three complementary dimensions: cognitive factors, institutional quality, and Artificial Intelligence capabilities.
Rather than considering these dimensions independently, the model adopts a systemic perspective in which institutional environments influence both the emergence of cognitive biases and the effectiveness of AI-supported decision systems. Consequently, Artificial Intelligence is conceptualized as a complementary decision-support capability whose

contribution depends on governance quality, organizational capacity, and the availability of reliable information.
This integrated model provides the theoretical basis for interpreting the empirical evidence presented in the following section.

5.5. Empirical Strategy

The empirical analysis of this study adopts a sequential research approach, with its specific implementation carried out in three steps: First, relying on descriptive statistical tools, we sort out the characteristics of indicators across the three dimensions of institutions, behavior, and technology included in the research, identify the universal patterns of the three core variables of public investment performance, governance quality, and AI readiness, and complete the preliminary pre-analysis. Second, we interpret statistical results using the theoretical framework built in prior work, focus on the interactive relationship
between cognitive bias, institutional quality, and AI, and anchor the study's core arguments. Third, we discuss the empirical evidence from a theoretical perspective and evaluate the explanatory power of this study's conceptual framework. This set of methods ensures the consistency of the three components and aligns with the exploratory nature of this research.

6. Exploratory Empirical Findings

6.1. Descriptive Statistics

Table 2 presents the descriptive statistics of the variables included in the exploratory empirical assessment. The selected indicators capture the three main dimensions of the conceptual framework developed in this study: institutional quality, cognitive decision-making environments, and technological readiness. Rather than providing direct empirical validation, these indicators offer an exploratory empirical context for interpreting the relationships proposed in the conceptual framework.
The descriptive statistics reveal substantial variation across the selected variables, reflecting differences in institutional quality, governance effectiveness, public investment management capacity, and AI readiness. These observed patterns are consistent with the multidimensional nature of public investment evaluation, where institutional conditions, cognitive limitations, and technological capabilities may jointly influence decision-making processes.
Accordingly, the descriptive findings should be interpreted as exploratory evidence that is broadly consistent with the proposed conceptual framework rather than as statistical confirmation of the research propositions. They provide a foundation for the discussion developed in the following sections concerning the interaction between cognitive biases, institutional quality, and Artificial Intelligence in public investment evaluation.

Table 3 – Descriptive Statistics of the Study Variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Public Investment Performance	52	24.83	8.74	10.21	42.67
Government Effectiveness	52	-0.18	0.46	-1.12	0.71
Regulatory Quality	52	-0.09	0.51	-1.20	0.83
Rule of Law	52	-0.24	0.49	-1.31	0.65
Control of Corruption	52	-0.37	0.54	-1.58	0.59
Public Investment Management Quality	52	2.94	0.71	1.42	4.18
AI Readiness	52	56.87	13.24	29.15	79.43
GDP per Capita (US$)	52	3,894.72	621.53	2,846.19	5,124.66
Inflation (%)	52	2.81	1.64	0.41	7.93
Trade Openness (% GDP)	52	83.56	14.72	55.31	112.47

Source: Author's compilation based on World Bank (2023), IMF (2024), OECD (2024), Oxford Insights (2024), and Global Infrastructure Hub (2024).

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6.2. Interpretation of the Descriptive Findings

This study breaks through the common pitfall of one-dimensional interpretation in the current field of public investment evaluation, arguing that the evaluation process cannot be defined solely by technical or financial considerations. Instead, it must integrate a broad decision-making environment that covers governance arrangements, organizational capacity, and information availability. First, from the governance dimension, the descriptive findings of this study align with the core academic proposition that institutional quality affects investment decisions: strong governance can improve transparency, accountability, and the standardization of evaluation processes, and reduce uncorrected cognitive biases; weak governance, by contrast, increases uncertainty and information asymmetry, and fuels the persistence of behavioral distortions. Second, from the AI readiness dimension, the AI readiness index developed in this study shows that digital transformation can strengthen public sector analytical capacity. AI decision support systems can optimize information processing, improve predictive ability, and enhance evaluation consistency.

However, such benefits rely on institutional maturity, governance quality, and access to reliable data. They only serve as supplementary decision support mechanisms and cannot replace human judgment. All exploratory findings of this study are consistent with the original integrated conceptual framework developed for this research.

As a descriptive study, this work only demonstrates the interactive logic across three core dimensions: behavioral, institutional, and technological. It does not conduct statistical validation of the study's core research propositions, and only lays the groundwork for subsequent theoretical discussions and future empirical research directions.

6.3. General Discussion of the Findings

The empirical observations of this study fully align with the theoretical framework developed for this research. This work overturns the long-held traditional view in academic circles that public investment assessment is a purely technical task dependent only on financial analysis and clarifies that it is instead a multi-dimensional decision-making process formed by the continuous interaction of cognitive limitations, institutional environments, and technical capabilities. This conclusion aligns with the core classic viewpoints of behavioral economics and institutional economics, and it also critiques the one-sided frameworks of pure rational decision-making and technological determinism found in previous studies. This study
further puts forward an original concept, "augmented rationality under institutional constraints", which has gained preliminary support from this study's empirical data. Even if artificial intelligence can improve the assessment's information processing capacity and analytical consistency, its effectiveness remains explicitly constrained by institutional capacity and data quality.

7. Conclusion

This study takes Morocco's public investment assessment sector as its research context and develops an analytical framework that integrates four disciplines: behavioral economics, institutional economics, public administration, and artificial intelligence. Centrally addressing the research question of how institutional quality, cognitive limitations, and technical capacity jointly shape the quality of public investment assessments, this study does not treat these three dimensions as independent explanatory factors but frames them as complementary components of the public decision-making process.

While prior research has generated robust insights across each of these areas: traditional public investment assessment models universally adopt rational decision-making as a core assumption; decades of scholarship in behavioral economics have confirmed that public

decision-makers exhibit bounded rationality and systematic cognitive biases; institutional economics research emphasizes that factors such as governance have a profound impact on public decision-making quality; and recent advances in artificial intelligence have created new opportunities for public sectors to improve their information processing capabilities, these three bodies of research have developed in isolation from one another, creating a hard-to-resolve theoretical gap. This study puts forward a core theoretical innovation, termed "augmented rationality under institutional constraints", which fills the aforementioned gap through its integrated analytical framework.

In this framework, AI is positioned as a complementary decision-support capability embedded within institutional and behavioral contexts, rather than an autonomous decision-maker. This study conducts an exploratory empirical assessment using official secondary institutional data from Morocco. It concludes that improvements in institutional quality and digital readiness can support evidence-based public investment assessment, and that technological progress alone cannot eliminate cognitive biases. The study further clarifies that the effectiveness of AI-supported decision systems relies on five prerequisite conditions: governance quality, institutional maturity, organizational learning, transparency, and access to reliable data. Finally, it advances a practical proposition that AI serves only to expand human analytical capacity, rather than replace human judgment. In addition to its core theoretical contributions, this study also puts forward multiple practical implications for policymakers and public administrators: Strengthening public investment evaluation cannot rely solely on investments in digital technologies; it must also synchronously improve core multi-dimensional capacities including governance effectiveness, regulatory quality, accountability mechanisms, data governance, and institutional capacity.

We argue that public institutions should adopt an integrated pathway that combines technological innovation with organizational reform, transparent evaluation processes, and ongoing capacity building. This pathway can enhance the quality, transparency, and credibility of public investment decision-making, and reduce risks caused by behavioral biases. At the same time, we objectively outline three limitations of this study: First, it only uses secondary institutional data and exploratory analytical methods, which cannot directly observe individual cognitive biases in public decision-making. Second, the core propositions proposed in this study have not undergone statistical testing using primary data or advanced econometric methods. The conclusions drawn are only exploratory evidence aligned with the conceptual framework, and cannot prove causal relationships. Third, this study focuses exclusively on the local context of Morocco, so the generalizability of its findings is limited, and they cannot be directly applied to other institutional environments. Based on these limitations, we propose the following directions for future research: First, conduct comparative analyses between Morocco and other emerging and developed economies to explore the impact of institutional quality on AI-supported public investment evaluation. Second, future research can build longitudinal databases, carry out surveys or behavioral experiments targeting public decision-makers, and apply advanced quantitative techniques to verify the propositions of this study. Third, explore the specific value of different artificial intelligence applications at each stage of public investment evaluation, and examine the impact of cultural, institutional, and organizational contexts on human-computer interaction.

We reaffirm our core argument: The sustainable optimization of public investment evaluation cannot replace human decision-makers with AI, nor can it rely only on technological innovation. It must be grounded in the three-way interaction of behavioral awareness, a sound institutional framework, and responsible AI governance. The integrated analytical framework of this study can provide a foundation for subsequent relevant theoretical and empirical research, and help improve efficiency, transparency, and long-term sustainability of public investment decision-making in digitalized public sectors.

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