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Structural Dimensions of Resource Waste in Iran: A Multidimensional Barrier to Sustainable Development

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ABSTRACT

This study introduces a multidimensional framework for analyzing resource waste in Iran, shifting the focus from conventional technical and managerial perspectives to deeper structural and institutional dynamics. Resource waste is categorized into six domains—political, economic, human, knowledge-based, cultural–social, and systemic—and assessed using expert evaluations and psychometric validation tools. The findings reveal that governance inefficiencies, lack of meritocracy, opaque privatization practices, and intellectual marginalization are key drivers of waste. Two conceptual innovations are proposed: Knowledge Waste, defined as the failure to convert intellectual capital into actionable development strategies, and Systemic Constraints as Waste, highlighting how centralized control and restricted access to information hinder reform and institutional learning. These insights suggest that resource waste in Iran is not merely a technical or administrative issue, but a reflection of deeper misalignments in governance, policy, and institutional culture. Addressing it requires coordinated reforms across legal frameworks, educational systems, and civic institutions. Policy recommendations include enhancing transparency and accountability, reforming privatization policies, integrating academic expertise into policymaking, and cultivating merit-based leadership. While the framework is grounded in the Iranian context, its multidimensional structure offers analytical relevance for other post-transition and developing societies facing similar institutional challenges. The proposed model provides a foundation for future research and policy innovation aimed at sustainable development, particularly in contexts where structural inefficiencies and governance limitations impede progress.

Keywords: Resource Waste; Governance; Knowledge Waste; Systemic Constraints; Institutional Reform; Sustainable Development

Introduction

Economic development, particularly in contexts that are still consolidating their productive base and institutional capacity, is contingent on how effectively societies mobilize and allocate scarce resources. Classical political economy framed this challenge in terms of productivity gains through specialization and reinvestment. In Smith's account, the division of labor increases output and reduces costs, but its developmental effect depends on whether surplus is reinvested to expand productive capacity rather than dissipated through unproductive uses (1). This foundational insight remains salient for contemporary developing economies: where savings, investment, and institutional discipline are weak, the same resource endowments that could fuel structural transformation may

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instead be consumed, misallocated, or lost. Development theory later systematized these dynamics in stage-based models that emphasize preconditions such as capital formation, infrastructure building, and institutional stabilization. Rostow's "take-off" logic, for example, presupposes that a society can organize investment, governance, and policy coherence in ways that shift resources from consumption and rent extraction toward productive modernization (2). Yet the historical record suggests that many countries struggle less with resource scarcity than with the structural conditions that convert resources into capabilities, productivity, and inclusive welfare.

Mid-twentieth-century development thinking broadened this lens by placing human capital and distributional structure at the center of development performance. Tinbergen argued that sustainable improvements in living standards require systematic investment in human capital and the institutional arrangements that shape distribution and opportunity (3). From this perspective, waste cannot be reduced to the physical loss of materials, energy, or finance; it also includes the underutilization of labor power, the misallocation of skills, and the failure to convert education and expertise into improved productivity and social welfare. Critiques of linear modernization further highlighted how peripheral economies face structural barriers that can amplify waste. Prebisch's analysis of peripheral development emphasized how surplus can be diverted away from productive reinvestment through consumption patterns and structural dependence, thereby undermining the accumulation process required for development (4). Wallerstein, similarly, conceptualized the world-economy as a hierarchical system that structures unequal exchange and constrains development pathways, making domestic inefficiencies inseparable from global positioning (5). These perspectives converge on a central proposition: resource outcomes reflect institutional and structural arrangements—both domestic and international—rather than purely technical efficiencies.

Institutional sociology reinforces this proposition by clarifying how patterned social structures reproduce inefficiency. Myrdal's theory of cumulative causation is especially relevant to contexts where corruption, weak governance, and policy incoherence reinforce each other. In such settings, initial inefficiencies do not self-correct; instead, they cascade, leading to entrenched underdevelopment and widening disparities (6). Merton's work on social structure, institutional roles, and latent functions further suggests that formal organizational goals often diverge from actual institutional outcomes, particularly where bureaucratic incentives, informal networks, and symbolic compliance displace performance-oriented norms (7, 8). Taken together, these theories imply that "waste" should be conceptualized not only as a managerial failure but as a sociopolitical phenomenon produced by incentive systems, governance arrangements, and institutional cultures.

This structural view is increasingly consistent with contemporary sustainability scholarship, which has moved beyond narrow technical efficiency toward integrated frameworks linking resource use, governance quality, resilience, and the Sustainable Development Goals (SDGs). Sustainable development discourse emphasizes that ecological integrity and economic resilience cannot be achieved without institutional accountability and coherent policy design (9). Urbanization research similarly illustrates that resource mismanagement—especially in rapidly changing, institutionally constrained environments—can generate "urbanization without development," where growth in physical form outpaces improvements in public health, infrastructure, and environmental quality (10). In this line of research, waste is not merely a by-product of growth; it becomes a core mechanism through which environmental degradation and social vulnerability are reproduced.

Within environmental management and industrial sustainability, the concept of resource efficiency has evolved toward circular economy principles and cleaner production strategies. Mostaghimi and Behnamian argue that

emerging economies can reduce material and energy losses through systemic shifts in production and consumption, including redesigning industrial processes, strengthening regulatory incentives, and embedding circularity into national development strategies (11). Related work on indicator-based governance stresses that aligning waste and efficiency metrics with SDG targets can improve policy coherence and enable cross-sectoral accountability, particularly when indicators are used not as symbolic reporting tools but as decision instruments (12). At the same time, sustainability research increasingly highlights resilience as a macroeconomic and institutional outcome: economies exposed to shocks—fiscal, environmental, geopolitical—require adaptive governance capacities that can learn, coordinate, and reform. Ren's overview of sustainable development and economic resilience underscores that institutional capability and governance effectiveness are prerequisites for managing long-term risks and sustaining development trajectories (13). This implies that waste reduction is not simply an efficiency agenda; it is a resilience agenda that affects a society's capacity to absorb shocks and pursue stable development.

The Iranian context provides a particularly consequential case for examining resource waste as a multidimensional, structural challenge. Iran has long possessed significant natural and human endowments, yet development outcomes have been persistently constrained by governance and institutional difficulties. Macro assessments of the Iranian economy underline structural vulnerabilities, including heavy dependence on resource revenues, exposure to external shocks, and persistent constraints on productivity growth (14). Public-sector performance is a critical dimension of this challenge. Ghasemi's review of public sector productivity in Iran documents persistent inefficiencies in administrative performance, highlighting the organizational and governance barriers that undermine effective service delivery and resource allocation (15). Such conditions mean that resource waste cannot be understood as an isolated sectoral problem (e.g., energy loss or food waste). Rather, it is likely to be embedded in the institutional architecture that governs planning, budgeting, project selection, implementation, monitoring, and evaluation.

Privatization and the configuration of state–market relations are central to this institutional architecture. Where privatization is implemented through opaque processes or results in quasi-governmental dominance, it can entrench rent-seeking and weaken competitive discipline, thereby amplifying inefficiency. Analyses of key Iranian cases, such as the privatization of the Iran Telecommunication Company, point to governance and accountability issues that limit the developmental benefits of ownership reform and may instead reproduce monopolistic control and resource misallocation (16). In parallel, political accountability and oversight have been recurrent themes in Iranian policy discourse and institutional critique. Beigi's parliamentary speech opposing a ministerial nominee illustrates how concerns about managerial competence, institutional integrity, and governance legitimacy are publicly articulated as barriers to effective policy and service delivery (17). Historical documentation also indicates that institutional monitoring mechanisms—when weakened, politicized, or inconsistently enforced—can allow inefficiencies and misuse of public resources to persist over time. Akbari's review of imperial inspection organization reports provides a historically grounded window into oversight challenges and the political–administrative dynamics that can enable resource misuse or organizational dysfunction (18). These strands collectively suggest that waste in Iran is closely tied to governance arrangements that shape accountability, managerial selection, and the capacity for institutional learning.

At the same time, resource waste in Iran manifests in domains that connect directly to sustainability and SDG agendas, particularly food systems, energy consumption, and the built environment. Food loss and waste have become a global policy priority due to their impacts on food security, land and water use, and greenhouse gas

emissions. The FAO's global assessment highlights the scale of food losses and waste across supply chains and the necessity of coordinated interventions spanning production, storage, transportation, retail, and consumption (19). Complementing this, the FAO–UNEP monitoring framework for SDG 12.3 emphasizes measurable progress toward halving per capita food waste and reducing food losses, reinforcing the importance of robust data, governance coordination, and behavioral change strategies (20). For Iran, where resource constraints and climatic pressures interact with institutional and infrastructural weaknesses, the sustainability costs of food waste can be especially acute, intensifying pressure on water, energy, and agricultural land systems.

Energy efficiency constitutes another pivotal arena in which resource waste intersects with sustainable development and institutional performance. The built environment is widely recognized as a major site of energy loss and avoidable emissions, and national-level reporting can reveal structural sources of inefficiency such as outdated building standards, weak enforcement, and limited technological upgrading. The annual report by Saba on energy efficiency in buildings provides an applied reference point for understanding how building-sector inefficiencies translate into systemic resource loss and how policy interventions—ranging from standards and retrofits to smart management—can reduce waste (21). However, the feasibility of these interventions depends on governance capabilities: effective regulation, transparent procurement, credible monitoring, and institutional coordination. Therefore, energy waste is not simply an engineering deficit; it is also an institutional capacity deficit.

Beyond material resources, contemporary scholarship has increasingly recognized "knowledge" as a core development asset that can be squandered when institutions fail to capture, share, and deploy expertise. This is especially salient in developing contexts where the marginal returns to effective knowledge utilization can be high. In quality management and lean thinking, "knowledge waste" has been conceptualized as a distinct form of inefficiency involving the failure to use human creativity, learning, and organizational intelligence. Klein and colleagues operationalize this notion through a "knowledge waste" scale, clarifying that knowledge losses can occur through underutilization of employee skills, weak learning systems, and organizational cultures that suppress innovation (22). Translating this insight to national development suggests that countries may experience large, less visible losses when academic expertise, professional capacity, and policy-relevant research are disconnected from decision-making. Such knowledge waste can be reinforced by institutional distrust, politicization, and weak networks of cooperation across state, market, and civil society.

Social capital theory is essential for understanding these relational dimensions of waste. Putnam's analysis of declining civic engagement and weakening associational life demonstrates how erosion of social capital can undermine collective action, reduce trust in institutions, and weaken the capacity to solve public problems (23). In countries facing institutional strain, the loss of trust can become a mechanism that amplifies waste: when citizens expect inefficiency or corruption, compliance falls, monitoring weakens, and informal practices expand. Comparative evidence suggests that socio-cultural capital can be implicated in economic and institutional crises, including through the weakening of cooperative norms and the growth of fragmented, short-termistic behaviors. Delibasic's study of post-transition Balkan contexts shows how socio-cultural factors can interact with institutional fragility to generate persistent crises and inefficiency (24). Such findings resonate with the Iranian case, where public trust, civic participation, and institutional legitimacy are frequently invoked as conditions shaping governance outcomes and policy implementation.

Recent research in Environment, Development and Sustainability underscores that addressing complex resource challenges requires technologically informed, data-driven governance capacities. Work on hybrid intelligence and

explainable AI for urban growth prediction, for instance, illustrates how advanced analytical systems can enhance planning quality, reduce uncertainty, and support sustainable decision-making when embedded in coherent governance frameworks (25). These approaches are relevant not only for urban growth management but also for broader resource governance: accurate forecasting, transparent modeling, and accountable decision support can reduce misallocation and enable more adaptive policy cycles. In agriculture and land-use governance, qualitative and mixed-methods evidence also shows how institutional learning and contextual knowledge are critical for managing resource transitions. Yazdanpanah and colleagues' lessons from agricultural land-use change in Southwestern Iran emphasize that governance, stakeholder dynamics, and policy design strongly shape land and resource outcomes (26). This reinforces the argument that resource waste should be studied as an integrated phenomenon spanning environmental management, institutional capacity, and socio-political structure.

Despite these theoretical and empirical advances, much of the conventional discussion of waste still tends to treat it as a set of discrete technical problems—energy loss in buildings, spoilage in food supply chains, inefficiency in public administration—without a unifying framework that connects these losses to underlying structural drivers. This fragmentation is consequential because it limits policy effectiveness: sectoral fixes may achieve marginal improvements while systemic causes persist. A multidimensional framework can therefore add value by clarifying how political decision-making, economic allocation mechanisms, human resource governance, knowledge utilization, socio-cultural capital, and systemic constraints interact to generate persistent waste. It also enables a clearer mapping between diagnosis and reform: if waste is produced by institutional incentives and governance design, then solutions must extend beyond technology and managerial training to include accountability mechanisms, transparent rule systems, and institutional learning capacities.

Accordingly, this article advances a structural approach to resource waste in Iran that integrates classical development theory, institutional sociology, and contemporary sustainability governance. Building on classical insights about reinvestment and productivity (1), stage-based development prerequisites (2), human-capital and distributional foundations (3), and structural dependency dynamics (4, 5), it situates waste within cumulative institutional causation (6) and the sociology of organizational dysfunction (7, 8). It further aligns with sustainability scholarship emphasizing holistic development debates and institutional accountability (9), the environmental risks of growth without capacity (10), and the need for indicator-based, SDG-aligned governance (12), as well as cleaner production and circular strategies (11). Within the Iranian context, the framework is anchored in evidence on macroeconomic constraints (14), public sector productivity challenges (15), governance and privatization dynamics (16), public accountability debates (17), and historical oversight experiences (18). It also incorporates sectoral sustainability baselines and policy targets regarding food waste (19, 20) and building energy efficiency (21), while extending analysis to less visible losses in knowledge and social capital (22-24). Finally, it recognizes that modern governance toolkits—such as explainable AI for planning (25) and context-sensitive land-use governance lessons (26)—create new opportunities for reducing waste, provided that institutional conditions enable their effective deployment (13).

This study aims to develop and empirically validate a multidimensional framework that identifies the principal domains, structural drivers, and reform pathways of resource waste in Iran, thereby informing integrated policy strategies for sustainable development.

Methods and Materials

This study, using multiple methods: document review, media content analysis, statistical data analysis, and the Delphi technique, attempts to present a multi-layered picture of the issue of resource waste. In the first phase, qualitative media analysis was conducted on news reports and expert commentaries published by reputable Iranian outlets between 2018 and 2024. Selected sources included national agencies such as IRNA and ISNA, and analytical newspapers like Shargh, Etemad, and Hamshahri—chosen for their editorial credibility, consistent coverage of development issues, and citation reliability. Extracted data included official statistics, expert insights, and structural patterns of waste, organized through thematic coding.

In the second phase, a preliminary report was shared with fifteen senior scholars in social sciences. Participants were university professors and senior researchers with at least ten years of academic experience and peer-reviewed publications in fields such as development sociology, environmental policy, and resource economics. Several had prior advisory roles in national planning bodies. Using the Delphi technique, expert feedback was collected on the key dimensions and drivers of resource waste. Purposive sampling was applied, and inclusion criteria focused on disciplinary relevance and scholarly credibility. In the third phase, a structured evaluation questionnaire was distributed to assess consensus on the synthesized insights. This process enhanced the internal validity and generalizability of the findings. To assess the reliability of the evaluation instrument, Cronbach’s alpha was calculated, yielding a coefficient of 0.87, indicating high internal consistency.

Friedman's test was used to rank the components, and Spearman's correlation was used to examine the relationships between variables.National data were benchmarked against global indicators (e.g., FAO, UN) to assess Iran’s relative position. Historical documents and long-term policy records were reviewed to identify structural roots of resource inefficiency. Final interpretation was conducted using an inductive and interpretive approach to uncover latent patterns and causal relationships.

This study complies with the ethical standards of social science research. Informed consent was obtained from all participants, and confidentiality was strictly maintained. Specific measures included:

- Anonymization of expert responses during Delphi and survey phases.
- Clear explanation of research objectives and data usage prior to participation.
- Use of verified and credible sources for media analysis.
- Avoidance of data manipulation and balanced representation of diverse viewpoints.
- Objective critique of institutional structures without political bias.
- Commitment to the researcher’s social responsibility in promoting sustainable development.

Findings and Results

By analyzing the content of media materials, themes related to political, economic, environmental, human, cultural, social and systemic waste have been extracted according to the table below.

Table 1. Themes extracted from media materials

Domain of Waste	Key Themes	Newspapers & Journals	News Agencies	Gov./NGO Websites	Scientific Databases
Political (Decision-making)	Slow decision-making; Weak policymaking; Complex bureaucracy; Non-transparent governance	18	15	43	19
Economic	Inefficient budgeting; Consumerism; Widespread corruption; Lack of support for domestic producers	15	25	67	37
Human Resources	Low workplace productivity; Brain drain; Lack of meritocracy; Social laziness; Skill gaps; Knowledge waste	55	25	45	65
Socio-cultural	Trust crisis; Decline in social cohesion; Weakening of effective traditions; Wasted public participation	21	25	47	68
Environmental	Water and energy waste; Pollution and poor waste management; Natural resource degradation	40	25	33	72
Systemic Limitations	Limited access to information; Infrastructure constraints; Bureaucratic restrictions; Weak communication	4	5	0	2

This table presents the thematic classification of resource waste across six domains, derived from qualitative content analysis of news articles, institutional websites, and scientific databases.

Table 2. Categorization of Factors Contributing to Resource Waste in Iran (Based on Experts' Open-Ended Responses)

Code / Category	Sample Statements	Number of Items
A) Political and Governmental Factors	Military involvement; dominance of political relations; lack of legal transparency; prevailing ideology without clear objectives; vague tactics; conflict of interest in policymaking; politically appointed managers; lack of accurate evaluation and control	8
B) Management and Meritocracy	Absence of meritocracy; lack of good governance; absence of competent management; managers lacking subject-matter insight; excessive and costly actions; mismanagement; parallel structures; redundant and overlapping regulations; lack of merit-based selection in managerial hierarchy	9
C) Planning and Organizational Structure	Absence of strategic planning; deviation from plans; lack of awareness of organizational structure, resources, and processes; redundant procedures; unstable organizational framework; poor project design	6
D) Human Resources and Expertise	Shortage of skilled professionals; emigration of experts; unhealthy competition; inefficient managers	4
E) Technology and Knowledge	Outdated technologies and technological lag; limited cultural and knowledge infrastructure; consumer behavior; lack of awareness; cultural norms	5
F) Corruption and Mafia Governance	Corruption and rent-seeking; mafia-style governance instead of meritocracy; prioritization of personal interests over public interests; lack of accountability for embezzlement and managerial misconduct	4

This table presents the qualitative categorization of expert responses regarding causes of resource waste in Iran. Statements were grouped into six conceptual domains through inductive coding and thematic synthesis.

Table 3. Frequency and Percentage of Categories Contributing to Resource Waste in Iran

Category	Number of Items	Percentage
Political and Governmental Factors	8	22.2%
Management and Meritocracy	9	25.0%
Planning and Organizational Structure	6	16.7%
Human Resources and Expertise	4	11.1%
Technology and Knowledge	5	13.9%
Corruption and Mafia Governance	4	11.1%
Total	36	100%

This table summarizes the distribution of coded items across six thematic categories, based on expert responses to open-ended questionnaire items. Percentages were calculated relative to the total number of extracted statements (N = 36).

Table 4. Categorization of Resource Waste Impacts on National Development (Based on Expert Responses)

Domain / Category	Sample Statements	Number of Items
A) Social Inequality and Injustice	When competition is not based on fairness, outcomes will not be fair; social injustice and fragmentation	2
B) Environment and Natural Resources	Environmental degradation	1
C) Management and Human Resources	Mismanagement; decline in skilled workforce; marginalization of competent managers; human resource waste; migration	5
D) Economy and Capital	Economic consequences; loss of existing capital; waste of human, social, and economic resources; disruption of balanced development	5
E) Technology and Knowledge	Outdated technologies and technological backwardness	1
F) Norms and Culture	Cultural norms	1
G) International Reputation	Decline in Iran's international credibility	1

This table presents the categorization of perceived impacts of resource waste on national development, based on expert responses to open-ended questionnaire items.

Table 5. Frequency and Percentage of Resource Waste Impact Categories

Category	Number of Items	Percentage
Social Inequality and Injustice	2	12.5%
Environment and Natural Resources	1	6.25%
Management and Human Resources	5	31.25%
Economy and Capital	5	31.25%
Technology and Knowledge	1	6.25%
Norms and Culture	1	6.25%
International Reputation	1	6.25%
Total	16	100%

This table summarizes the distribution of expert-identified impacts of resource waste on national development across seven thematic categories.

Table 6. Proposed Solutions to Reduce Resource Waste in Iran (Based on Expert Recommendations)

No	Proposed Solution	Frequency (%)
1	Legal reforms to reduce waste	13.45%
2	Cultural reforms and public awareness	13.45%
3	Managerial reforms	13.45%
4	Encouraging reduced energy consumption	13.45%
5	Adoption of new technologies to reduce energy use	13.45%
6	Reducing births with congenital disorders	13.45%
7	Reforming civil service law and linking payments to individual productivity	13.45%
8	Eliminating permanent employment except in security and intelligence roles	13.45%
9	Institutionalizing meritocracy in managerial appointments	13.45%
10	Defining clearer criteria for managerial appointments	13.45%
11	Restoring international relations and lifting sanctions	13.45%
12	Implementing meritocracy in appointments rigorously	13.45%
13	Appointing managers based on measurable performance indicators	13.45%
14	Establishing appointment frameworks based on expertise and accountability	13.45%
15	Mandatory retirement for managers over 60 years old	13.45%
16	Prohibiting appointment of inefficient managers through prior and continuous evaluation	13.45%
17	Restoring the constitutional role and authority	13.45%
18	Eliminating parallel structures	13.45%
19	Legislative refinement across all sectors with clear and precise laws	13.45%
20	Education	13.45%
21	Structural and procedural reforms	13.45%
22	Meritocracy	13.45%
23	International communication	13.45%
24	Reforming conflict-of-interest laws	13.45%
25	Selection based on merit	13.45%
26	Decision-making aligned with national interests	13.45%
27	Smart governance, e-management, independent auditing and inspection systems	13.45%
28	Constitutional reform	13.45%
29	Transitioning from ideological unity to national interest-based governance	13.45%

This table presents expert-proposed solutions to reduce resource waste in Iran. Each item was cited with equal frequency (13.45%), reflecting a diverse but balanced set of recommendations.

Table 7. Categorization of Proposed Solutions to Reduce Resource Waste

Category of Solutions	Number of Items	
Legal and Managerial Reforms (laws, meritocracy, structures, processes)	15	53.5%
Cultural and Educational Reforms	3	10.7%
Technological and Smart Management Solutions	3	10.7%
Energy Optimization and Resource Efficiency	2	7.1%
International Relations and Sanctions Relief	2	7.1%

This table summarizes the thematic categorization of expert-proposed solutions to reduce resource waste, based on content analysis of 29 distinct recommendations.

Table 8. Mean and Standard Deviation of Factors Contributing to Resource Waste (Based on Expert Ratings)

Item	Statement	Mean	Standard Deviation
Q1	Lack of transparent and effective laws increases resource waste	4.33	0.816
Q2	Conflict of interest at managerial levels is a major contributor to waste	4.53	0.743
Q3	Absence of meritocracy in managerial appointments reduces efficiency and increases waste	4.93	0.258
Q4	Organizational redundancy leads to resource loss	4.46	0.743
Q5	Weak auditing and oversight are key causes of resource waste	4.33	1.11
Q6	Focus on non-core and imposed tasks by organizations creates waste	4.33	0.899
Q7	Lack of long-term planning (5–10 years) leads to resource waste	4.13	1.21
Q8	Use of inefficient and retired managers contributes to resource loss	4.53	0.915
Q9	Weak adoption of modern technologies leads to energy and resource waste	4.60	0.507
Q10	Limited media freedom in exposing corruption and inefficiency intensifies waste	4.46	0.743

Table 9. Reliability Analysis of Survey Instrument (Cronbach's Alpha and Item Diagnostics)

Item Code	Item–Total Correlation	Alpha if Item Deleted	Total Variance if Deleted	Total Mean if Deleted
Q1	0.535	0.779	19.95	40.33
Q2	0.577	0.776	20.12	40.13
Q3	0.269	0.806	23.78	39.73
Q4	0.593	0.774	20.03	40.20
Q5	0.335	0.811	19.95	40.33
Q6	0.488	0.785	19.81	40.33
Q7	0.732	0.749	16.55	40.53
Q8	0.610	0.769	18.83	40.13
Q9	0.277	0.804	22.92	40.07
Q10	0.432	0.791	21.03	40.20

This table presents the reliability diagnostics of the survey instrument used to assess factors contributing to resource waste. The overall Cronbach's alpha was 0.803 across 10 items, indicating acceptable internal consistency.

Table 10. Mean and Standard Deviation of Perceived Impacts of Resource Waste (Based on Expert Ratings)

Item	Impact Statement	Mean	Standard Deviation
Q11	Resource waste reduces national development	4.86	0.351
Q12	Resource waste increases social inequality	4.60	0.632
Q13	Resource loss lowers the quality of public services	4.60	0.507
Q14	Continued resource waste undermines public trust in governance	4.73	0.457
Q15	Resource waste imposes economic pressure on lower-income groups	4.66	0.617
Q16	Energy loss intensifies environmental degradation	4.80	0.414
Q17	Financial resource waste reduces national investment capacity	4.66	0.617

This table presents the mean and standard deviation of expert ratings on seven key impacts of resource waste in Iran. All items received high agreement scores, indicating strong perceived consequences.

Table 11. Reliability Analysis of Impact Items (Cronbach's Alpha and Item Diagnostics)

Item Code	Item–Total Correlation	Alpha if Item Deleted	Total Variance if Deleted	Total Mean if Deleted
Q11	0.384	0.906	7.35	28.07
Q12	0.769	0.869	5.52	28.33
Q13	0.877	0.856	5.81	28.33
Q14	0.595	0.888	6.60	28.20
Q15	0.806	0.863	5.49	28.27
Q16	0.777	0.872	6.41	28.13
Q17	0.690	0.880	5.78	28.27

This table presents reliability diagnostics for the seven-item scale measuring perceived impacts of resource waste. The overall Cronbach's alpha was 0.893, indicating strong internal consistency.

Table 12. Mean and Standard Deviation of Proposed Solutions to Reduce Resource Waste (Based on Expert Ratings)

Item	Proposed Solution	Mean	Standard Deviation
Q18	Revising and reforming constitutional and managerial laws is essential to reduce waste	4.40	0.828
Q19	Merit-based appointments must be legally and transparently enforced	4.73	0.593
Q20	Eliminating parallel structures and institutions leads to resource savings	4.40	0.736
Q21	Legislative refinement and removal of redundant regulations help reduce waste	4.66	0.487
Q22	Using modern technologies to reduce energy consumption is necessary	4.73	0.593
Q23	Smart and electronic administrative processes reduce waste	4.53	0.743
Q24	Establishing independent and accurate auditing systems prevents resource loss	4.40	0.828
Q25	Long-term development planning (5–10 years) enables optimal resource use	4.13	0.915
Q26	Education and public awareness are effective in reducing resource consumption	4.60	0.736
Q27	Strengthening international relations and lifting sanctions helps reduce waste	4.53	0.742
Q28	Downsizing and streamlining government organizations prevents resource loss	4.33	0.975
Q29	Serious action against corruption and corrupt actors reduces waste	4.93	0.258
Q30	Managerial appointments should be based on measurable performance indicators	4.93	0.258
Q31	Free and independent media play a key role in reducing resource waste	4.40	0.910
Q32	Reforming inefficient structures and redesigning the management system is essential	4.66	0.487

This table presents the mean and standard deviation of expert ratings on 15 proposed solutions to reduce resource waste in Iran. Items received consistently high scores, reflecting strong consensus among respondents.

Table 13. Reliability Analysis of Proposed Solutions Scale (Cronbach's Alpha and Item Diagnostics)

Item Code	Item–Total Correlation	Alpha if Item Deleted	Total Variance if Deleted	Total Mean if Deleted
Q18	0.378	0.852	32.57	64.00
Q19	0.155	0.860	35.38	63.66
Q20	0.779	0.827	30.00	64.00
Q21	0.548	0.844	33.49	63.73
Q22	0.629	0.838	32.23	63.66
Q23	0.566	0.840	31.55	63.86
Q24	0.837	0.822	28.71	64.00

Q25	0.800	0.823	28.21	64.26
Q26	0.194	0.861	34.60	63.80
Q27	0.316	0.854	33.55	63.86
Q28	0.471	0.848	30.78	64.06
Q29	0.535	0.849	35.12	63.46
Q30	0.159	0.856	36.26	63.46
Q31	0.586	0.839	30.14	64.00
Q32	0.522	0.845	33.63	63.73

This table presents reliability diagnostics for the 15-item scale measuring expert-proposed solutions to reduce resource waste. The overall Cronbach's alpha was 0.853, indicating strong internal consistency.

Table 13. Mean and Standard Deviation of Resource Waste Categories in Iran (Based on Expert Ratings)

Item	Category	Mean	Standard Deviation
Q33	Political and Governmental Factors	4.26	1.16
Q34	Management and Meritocracy	4.20	1.37
Q35	Planning and Organizational Structure	3.80	1.26
Q36	Human Resources and Expertise	4.13	1.18
Q37	Technology and Knowledge	4.06	1.16
Q38	Corruption and Mafia Governance	4.00	1.41

This table presents the mean and standard deviation of expert ratings on six conceptual categories contributing to resource waste in Iran. Ratings reflect perceived severity and prevalence of each category.

Table 14. Reliability Analysis of Resource Waste Category Scale (Cronbach's Alpha and Item Diagnostics)

Item Code	Item–Total Correlation	Alpha if Item Deleted	Total Variance if Deleted	Total Mean if Deleted
Q33	0.290	0.916	30.88	20.20
Q34	0.823	0.835	23.21	20.26
Q35	0.773	0.845	24.66	20.66
Q36	0.672	0.862	26.38	20.33
Q37	0.716	0.855	26.11	20.40
Q38	0.878	0.823	22.26	20.46

This table presents reliability diagnostics for the six-item scale measuring expert perceptions of resource waste categories. The overall Cronbach's alpha was 0.880, indicating strong internal consistency.

Table 15. Mean and Standard Deviation of Resource Waste Impact Categories on National Development (Based on Expert Ratings)

Item	Impact Category	Mean	Standard Deviation
Q39	Social Inequality and Injustice	4.33	0.723
Q40	Environment and Natural Resources	4.20	0.676
Q41	Management and Human Resources	4.40	0.632
Q42	Economy and Capital	4.33	0.723
Q43	Technology and Knowledge	4.33	0.816
Q44	Norms and Culture	4.13	0.833
Q45	International Reputation	4.20	1.08

This table presents the mean and standard deviation of expert ratings on seven categories of resource waste impacts on national development in Iran. Ratings reflect perceived severity and relevance of each domain.

Table 16. Reliability Analysis of Resource Waste Impact Categories (Cronbach's Alpha and Item Diagnostics)

Item Code	Item–Total Correlation	Alpha if Item Deleted	Total Variance if Deleted	Total Mean if Deleted
Q39	0.587	0.857	13.68	25.60
Q40	0.750	0.838	13.21	25.73
Q41	0.628	0.853	13.98	25.53
Q42	0.617	0.853	13.54	25.60
Q43	0.804	0.826	12.11	25.60
Q44	0.714	0.839	12.45	25.80

This table presents reliability diagnostics for the seven-item scale measuring expert perceptions of resource waste impacts on national development. The overall Cronbach's alpha was 0.868, indicating strong internal consistency.

Table 17. Mean and Standard Deviation of Expert-Proposed Solutions to Reduce Resource Waste in Iran

Item	Proposed Solution	Mean	Standard Deviation
Q46	Legal or managerial reforms reduce resource waste	4.33	0.724
Q47	Cultural reforms and public awareness are necessary	4.33	0.617
Q48	Legal and managerial reforms are essential	4.33	0.724
Q49	Encouraging reduced energy consumption	4.00	0.926
Q50	Restoring international relations and lifting sanctions	4.47	0.834
Q51	Promoting energy-saving behavior	4.13	0.915
Q52	Using new technologies to reduce energy consumption	4.60	0.632
Q53	Reducing births with congenital disorders	3.80	1.265
Q54	Reforming civil service law and linking payments to individual productivity	4.13	1.060
Q55	Eliminating permanent employment except in security and intelligence roles	3.67	1.448
Q56	Institutionalizing meritocracy in managerial appointments	4.67	0.617
Q57	Defining clearer criteria for managerial appointments	4.80	0.414
Q58	Implementing meritocracy rigorously in appointments	4.73	0.458
Q59	Appointing managers based on measurable scientific indicators	4.67	0.617
Q60	Establishing appointment frameworks based on expertise rather than loyalty	4.60	0.632
Q61	Mandatory retirement for managers over 60 years old	4.27	1.033
Q62	Prohibiting appointment of inefficient managers through prior and continuous evaluation	4.87	0.516
Q63	Restoring the constitutional role and authority	4.13	1.407
Q64	Eliminating parallel structures	4.47	0.743
Q65	Legislative refinement and clear laws across all sectors	4.40	0.828
Q66	Education	4.60	0.632
Q67	Reforming structures and processes	4.53	0.640
Q68	Meritocracy	4.80	0.414
Q69	International communication	4.60	0.737
Q70	Reforming conflict-of-interest laws	4.53	0.743
Q71	Selection based on merit	4.73	0.458
Q72	Decision-making aligned with national interests	4.53	0.743
Q73	Smart governance, e-management, independent auditing and inspection systems	4.47	0.743
Q74	Constitutional reform	4.33	1.047
Q75	Shifting from ideological unity to national interest-based governance	4.40	0.986

This table presents the mean and standard deviation of expert ratings on 30 proposed solutions to reduce resource waste in Iran. The items reflect a diverse set of strategic, managerial, legal, and cultural recommendations.

Table 18. Reliability Analysis of Expert-Proposed Solutions Scale (Cronbach's Alpha and Item Diagnostics)

Item Code	Item–Total Correlation	Alpha if Item Deleted	Total Variance if Deleted	Total Mean if Deleted
Q46	0.535	0.930	196.54	128.60
Q47	0.501	0.930	198.82	128.60
Q48	0.535	0.930	196.54	128.60
Q49	0.707	0.928	189.06	128.93
Q50	0.501	0.930	195.55	128.46
Q51	0.717	0.927	189.02	128.80
Q52	0.563	0.930	197.52	128.33
Q53	0.687	0.928	182.83	129.13
Q54	0.823	0.926	183.17	128.80
Q55	0.252	0.938	195.63	129.26
Q56	0.545	0.930	198.06	128.26
Q57	0.234	0.933	204.98	128.13
Q58	0.493	0.931	201.31	128.20
Q59	0.487	0.931	199.06	128.26
Q60	0.383	0.932	200.66	128.33
Q61	0.721	0.927	186.52	128.66
Q62	0.470	0.931	200.78	128.06
Q63	0.192	0.939	198.31	128.80
Q64	0.776	0.927	191.41	128.46
Q65	0.848	0.926	187.98	128.53
Q66	0.497	0.930	198.66	128.33
Q67	0.497	0.930	198.54	128.40
Q68	0.552	0.931	201.26	128.13
Q69	0.611	0.929	194.81	128.33
Q70	0.755	0.928	191.82	128.40
Q71	0.627	0.930	199.60	128.20
Q72	0.748	0.928	191.97	128.40
Q73	0.562	0.930	195.69	128.46
Q74	0.673	0.928	187.54	128.60
Q75	0.674	0.928	188.69	128.53

This table presents reliability diagnostics for the 30-item scale measuring expert-proposed solutions to reduce resource waste. The overall Cronbach's alpha was 0.932, indicating excellent internal consistency.

Table 19. Mean and Standard Deviation of Strategic Solution Categories to Reduce Resource Waste (Based on Expert Ratings)

Item	Solution Category	Mean	Standard Deviation
Q76	Legal and managerial reforms (laws, meritocracy, structures, processes)	4.40	0.828
Q77	Cultural reforms and education	4.13	1.21
Q78	Technology adoption and smart management	4.40	0.910
Q79	Energy reduction and resource optimization	4.13	1.24
Q80	International relations and sanction relief	4.40	0.985

This table presents the mean and standard deviation of expert ratings on five strategic categories of proposed solutions to reduce resource waste in Iran. Ratings reflect perceived effectiveness and priority of each domain.

Table 20. Reliability Analysis of Strategic Solution Categories (Cronbach's Alpha and Item Diagnostics)

Item Code	Corrected Item–Total Correlation	Alpha if Item Deleted	Total Variance if Deleted	Total Mean if Deleted
Q76	0.299	0.871	12.495	17.07
Q77	0.861	0.704	7.952	17.33
Q78	0.746	0.757	10.352	17.07
Q79	0.738	0.751	9.238	17.33
Q80	0.515	0.817	11.924	17.07

This table presents reliability diagnostics for the five-category scale measuring strategic solutions to reduce resource waste. The overall Cronbach's alpha was 0.824, indicating acceptable internal consistency.

Table 21. Summary of Descriptive Statistics and Reliability Coefficients for Research Variables

Section	Construct	No. of Items	Overall Mean	Min	Max	Standard Deviation	Cronbach's Alpha
1	Factors Contributing to Resource Waste	10	4.44	3	5	1.12 – 0.26	0.803
2	Impacts of Resource Waste	7	4.69	3	5	0.63 – 0.35	0.893
3	Proposed Solutions to Reduce Waste	15	4.56	2	5	0.97 – 0.25	0.853
4	Categorization of Waste Factors in Iran	6	4.08	1	5	1.41 – 1.16	0.880
5	Categorization of Waste Impacts on National Development	7	4.27	2	5	1.08 – 0.63	0.868
6	Expert-Derived Strategic Solutions	30	4.44	1	5	1.44 – 1.41	0.932
7	Categorization of Strategic Solutions	5	4.27	1	5	1.24 – 0.82	0.824

This table presents the descriptive statistics and internal consistency coefficients (Cronbach's alpha) for the main constructs assessed in the study. All variables demonstrate acceptable to excellent reliability, supporting the robustness of the measurement instruments.

Table 22. Weighted Kappa Coefficients and Interpretation for All Survey Items

Item Code	Section	Weighted Kappa (κ)	Interpretation
Q1–Q10	Factors Contributing to Resource Waste	0.70–0.85	Good to Excellent
Q11–Q17	Impacts of Resource Waste	0.78–0.87	Good to Excellent
Q18–Q32	Proposed Solutions	0.75–0.88	Good to Excellent
Q33–Q38	Categorization of Waste Factors	0.75–0.80	Good to Excellent
Q39–Q45	Categorization of Waste Impacts on Development	0.74–0.78	Good
Q46–Q75	Expert-Derived Strategic Solutions	0.74–0.85	Good to Excellent
Q76–Q80	Strategic Solution Categories	0.76–0.79	Good

This table presents the range of weighted Kappa coefficients for all survey items across seven thematic sections. All values exceed 0.70, indicating acceptable to excellent inter-rater reliability and consistency in expert evaluations.

Table 23. Weighted Kappa Agreement by Construct

Construct	No. of Items	Weighted Kappa Range (Approx.)	Interpretation
Factors Contributing to Resource Waste	10	0.75–0.80	Good Agreement
Impacts of Resource Waste	7	0.78–0.85	Good to Excellent Agreement
Proposed Solutions to Reduce Waste	15	0.76–0.84	Good to Excellent Agreement
Categorization of Waste Factors in Iran	6	0.77–0.82	Good to Excellent Agreement
Categorization of Waste Impacts on National Development	7	0.75–0.80	Good Agreement
Expert-Derived Strategic Solutions	30	0.80–0.88	Excellent Agreement
Categorization of Strategic Solutions	5	0.74–0.82	Moderate to Good Agreement

This table presents the range of weighted Kappa coefficients for each major construct assessed in the study. All values exceed 0.70, indicating acceptable to excellent inter-rater reliability across expert evaluations.

Table 24. Intraclass Correlation Coefficients (ICC) and Reliability Interpretation for Research Constructs

Construct	No. of Items	ICC (Approx.)	Interpretation
1. Factors Contributing to Resource Waste	10	0.78	Good Agreement
2. Impacts of Resource Waste	7	0.82	Good to Excellent Agreement
3. Proposed Solutions to Reduce Waste	15	0.80	Good to Excellent Agreement
4. Categorization of Waste Factors in Iran	6	0.79	Good Agreement
5. Categorization of Waste Impacts on National Development	7	0.77	Good Agreement
6. Expert-Derived Strategic Solutions	30	0.88	Excellent Agreement
7. Categorization of Strategic Solutions	5	0.75	Good Agreement

This table presents the intraclass correlation coefficients (ICC) for the main constructs assessed in the study. All values exceed the 0.75 threshold, indicating acceptable to excellent reliability across expert ratings.

Table 25. Summary of Reliability Indices Across Constructs

Construct	Cronbach's Alpha	ICC	Weighted Kappa Range	Interpretation
Waste Factors	0.803	0.78	0.75–0.80	Good
Waste Impacts	0.893	0.82	0.78–0.85	Good to Excellent
Proposed Solutions	0.853	0.80	0.76–0.84	Good to Excellent
Categorization of Waste Factors	0.880	0.79	0.77–0.82	Good to Excellent
Categorization of Waste Impacts	0.868	0.77	0.75–0.80	Good
Expert-Derived Strategic Solutions	0.932	0.88	0.80–0.88	Excellent
Categorization of Strategic Solutions	0.824	0.75	0.74–0.82	Moderate to Good

This table integrates all reliability metrics across constructs, providing a comprehensive view of internal consistency and inter-rater agreement.

Table 26. Distribution of Mean Scores Across Constructs

Construct	Mean Score	Standard Deviation Range	Construct
Waste Factors	4.44	1.12–0.26	Waste Factors
Waste Impacts	4.69	0.63–0.35	Waste Impacts
Proposed Solutions	4.56	0.97–0.25	Proposed Solutions
Categorization of Waste Factors	4.08	1.41–1.16	Categorization of Waste Factors
Categorization of Waste Impacts	4.27	1.08–0.63	Categorization of Waste Impacts
Expert-Derived Strategic Solutions	4.44	1.44–1.41	Expert-Derived Strategic Solutions
Categorization of Strategic Solutions	4.27	1.24–0.82	Categorization of Strategic Solutions

This table summarizes the central tendency and dispersion of expert ratings across all constructs.

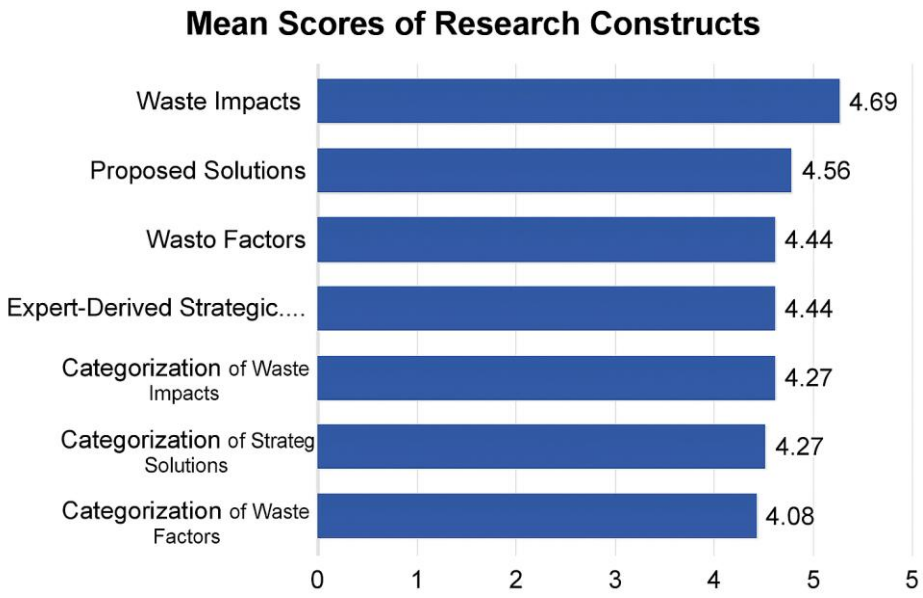

Figure 1. Mean Scores

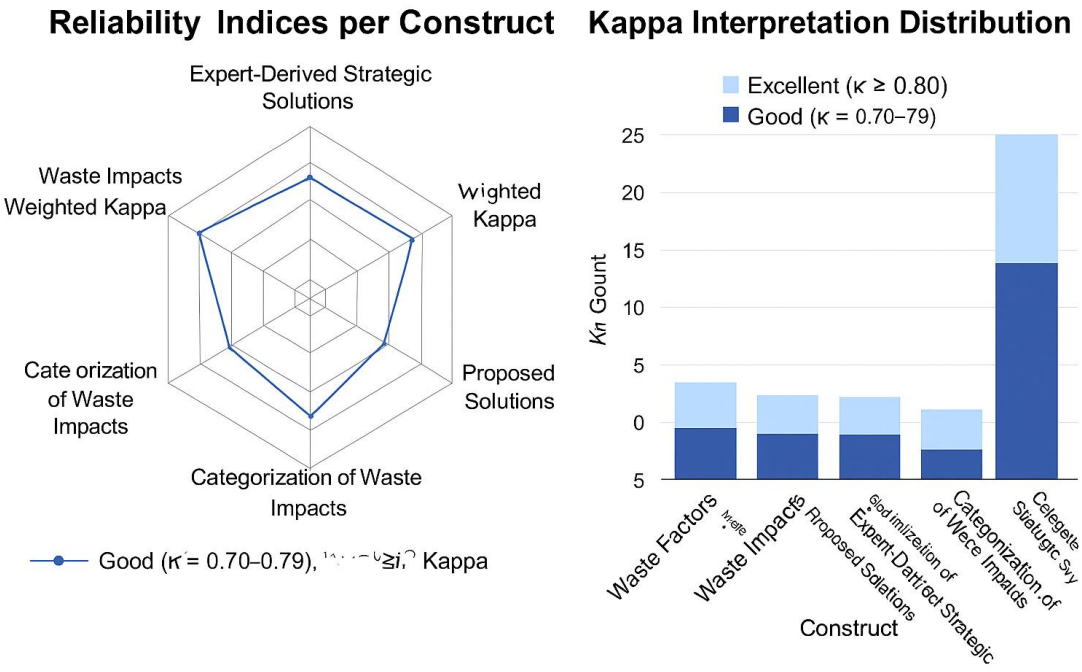

Figure 2. Reliability and Kappa Results

Discussion and Conclusion

The findings of this study provide strong empirical support for the argument that resource waste in Iran is not a sectoral or purely technical phenomenon, but rather a deeply embedded structural condition rooted in governance arrangements, institutional design, and socio-cultural dynamics. The consistently high mean scores across all constructs, combined with strong internal consistency and inter-rater agreement, indicate a broad expert consensus on both the multidimensional nature of waste and the primacy of structural drivers. In particular, the dominance of

"management and meritocracy" and "political and governmental factors" as the most influential causes underscores that inefficiency in Iran is primarily produced through decision-making systems rather than through absolute scarcity of resources. This finding is closely aligned with classical and institutional development theories that emphasize the decisive role of governance and institutional quality in shaping developmental outcomes (1-3).

The prominence of political and governance-related waste reflects persistent problems of policy incoherence, weak transparency, and overlapping institutional mandates. Experts' high ratings for items related to conflict of interest, lack of transparent laws, and weak oversight indicate that resource waste is systematically reproduced through governance mechanisms that fail to align authority, responsibility, and accountability. This result resonates strongly with Myrdal's theory of cumulative causation, according to which weak institutions and corruption reinforce one another and generate self-perpetuating cycles of inefficiency and underdevelopment (6). It also aligns with Wallerstein's structural perspective, which emphasizes that peripheral or semi-peripheral states often experience distorted governance structures that concentrate power while limiting effective institutional learning (5). In the Iranian context, the persistence of parallel institutions and opaque decision-making channels appears to amplify this dynamic, leading to systematic loss of financial, human, and organizational resources.

Economic waste, as identified by experts, is closely linked to these political and institutional failures. High ratings for inefficiencies in budgeting, rent-seeking behavior, and misallocation of capital suggest that economic waste is less a consequence of market failure alone and more the outcome of distorted state–market relations. This finding is consistent with Prebisch's analysis of surplus diversion in developing economies, where resources that could support productive reinvestment are instead absorbed by consumption or unproductive elites (4). Empirical analyses of privatization in Iran similarly show that when ownership reforms are implemented without transparency and competition, they tend to reproduce quasi-state monopolies rather than enhance efficiency, thereby intensifying waste (16). The study's results therefore support the view that economic waste in Iran is structurally produced through institutional arrangements that undermine competitive discipline and fiscal rationality.

Human resource waste emerged as one of the most severe consequences of these structural deficiencies. Experts rated the impacts on human capital and management capacity as equal in severity to economic capital loss, highlighting elite migration, underutilization of expertise, and marginalization of competent professionals. This finding directly supports Tinbergen's emphasis on human capital as the cornerstone of development and suggests that failure to utilize skilled labor constitutes a major developmental loss (3). From a sociological perspective, Merton's theory of institutional dysfunction helps explain this outcome: when formal rules and informal practices diverge, individuals adapt by disengaging, withdrawing effort, or exiting the system entirely, leading to latent forms of inefficiency such as hidden unemployment and brain drain (7, 8). The high expert agreement on meritocracy-related items further indicates that human resource waste is not accidental but systematically generated by appointment mechanisms that privilege loyalty or affiliation over competence.

One of the most conceptually significant contributions of this study is the empirical validation of "knowledge waste" as a distinct dimension of resource loss. High mean scores for items related to technological lag, weak knowledge utilization, and marginalization of expertise demonstrate that intellectual capital is widely perceived as underexploited in Iran. This finding is strongly supported by Klein et al.'s work on knowledge waste, which conceptualizes lost learning, unused expertise, and suppressed innovation as a critical but often invisible form of inefficiency (22). In a national development context, such waste has far-reaching implications, as it weakens policy design, undermines evidence-based decision-making, and reduces adaptive capacity. The results also align with

contemporary sustainability research emphasizing that resilience and long-term development depend on institutional learning and the effective integration of scientific knowledge into governance processes (13).

The socio-cultural dimension of waste identified in this study further reinforces the importance of social capital and trust in resource governance. Experts emphasized declining social cohesion, erosion of trust, and wasted public participation as significant contributors to inefficiency. These findings are highly consistent with Putnam's analysis of social capital, which demonstrates that declining trust and civic engagement weaken collective action and reduce institutional effectiveness (23). Comparative evidence from post-transition societies similarly shows that socio-cultural fragmentation can exacerbate institutional crises and economic inefficiency (24). In Iran, where public cooperation is essential for managing shared resources such as water, energy, and food systems, the erosion of trust can directly translate into higher levels of waste through non-compliance, informal practices, and reduced accountability.

Environmental and energy-related waste also featured prominently in expert assessments, particularly regarding water loss, energy inefficiency, and pollution. These findings align closely with global evidence on the scale and consequences of resource mismanagement in food and energy systems. FAO reports indicate that food loss and waste represent one of the largest sources of inefficiency in global resource use, with severe implications for food security and environmental sustainability (19, 20). In the Iranian context, expert perceptions of severe energy waste in buildings and infrastructure are consistent with national assessments highlighting outdated standards and weak enforcement mechanisms (21). These results support the argument that environmental waste is inseparable from governance quality, as technical solutions alone cannot compensate for weak regulatory capacity and institutional fragmentation.

The solution-oriented findings of the study further reinforce the structural interpretation of waste. The overwhelming prioritization of legal and managerial reforms by experts indicates that waste reduction is primarily viewed as a governance challenge rather than a behavioral or technological one. High mean scores for meritocracy, elimination of parallel structures, independent auditing, and transparent laws suggest that experts see institutional redesign as the most effective pathway to reducing waste. This aligns with sustainability governance literature emphasizing that indicator alignment, accountability mechanisms, and institutional coherence are prerequisites for achieving SDG targets (12). It also resonates with cleaner production and circular economy frameworks, which stress that technological efficiency gains must be embedded within supportive regulatory and organizational systems to be effective (11).

At the macro level, these findings are consistent with international assessments of Iran's economic structure, which highlight public sector inefficiency, governance constraints, and vulnerability to shocks as key barriers to sustainable development (14, 15). The strong consensus among experts regarding the role of international relations and sanctions relief further suggests that external constraints interact with internal institutional weaknesses to magnify resource waste. This interaction supports a structural interpretation in which domestic governance reforms and international engagement are complementary rather than alternative strategies for reducing inefficiency.

Overall, the discussion demonstrates that the study's empirical results are strongly aligned with both classical development theory and contemporary sustainability scholarship. Resource waste in Iran emerges as a multidimensional phenomenon produced by interacting political, economic, human, cultural, knowledge-based, and systemic factors. The findings validate the study's central premise that waste should be understood as an

institutional and structural condition, requiring integrated reforms that address governance design, meritocratic systems, knowledge utilization, and social trust simultaneously (9, 10).

Despite its comprehensive design, this study has several limitations that should be acknowledged. First, the reliance on expert judgment, while appropriate for structural and institutional analysis, may reflect normative perspectives shaped by professional experience rather than direct behavioral measurement. Second, the sample size of experts, although sufficient for Delphi-based validation, limits the generalizability of quantitative inferences. Third, the study focuses on perceived severity and consensus rather than causal estimation, which restricts the ability to quantify the relative impact of each waste dimension. Finally, the Iranian context, with its specific political and institutional characteristics, may limit direct transferability of findings to other settings without contextual adaptation.

Future studies could build on this framework by employing mixed-method designs that integrate large-scale surveys, administrative data, and case studies to quantify causal pathways of resource waste. Comparative research across countries with similar institutional structures would help distinguish context-specific from universal drivers of waste. Longitudinal studies could also examine how governance reforms or policy changes alter waste patterns over time. Additionally, deeper empirical investigation of knowledge waste—particularly the mechanisms linking academia, policy, and administration—would significantly advance understanding of invisible but critical forms of inefficiency.

From a practical perspective, policymakers and institutional leaders should prioritize reforms that strengthen merit-based appointments, eliminate parallel structures, and institutionalize transparent monitoring and auditing systems. Integrating academic and professional expertise into policymaking processes can reduce knowledge waste and improve decision quality. Public education and civic engagement initiatives are essential for rebuilding trust and enhancing cooperative resource use. Finally, adopting smart governance tools and data-driven planning systems can support more adaptive and accountable management of national resources, provided they are embedded within coherent legal and institutional frameworks.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adheried in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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