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Quantitative Examination of the Proposed Policy-Making Model for Iran's Electric Energy in the New Silk Road

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A B S T R A C T

The present study aimed to design a policy-making model for Iran's electric energy sector within the context of the New Silk Road. Accordingly, the research is classified as applied in terms of purpose and was conducted using a mixed-method (qualitative–quantitative) approach for data collection. In the qualitative phase, a survey-based method grounded in structural equation modeling (SEM) was used to design the model. The statistical population consisted of managers, heads, and employees of the energy sector in 2023. Using a random sampling method, a sample of 330 participants was selected. Research findings were obtained through a questionnaire and analyzed using structural equation modeling in PLS software. Based on the results, the policy-making model for Iran's electric energy sector within the New Silk Road framework consists of six dimensions: external strategies, internal strategies, intervening factors, causal factors, contextual factors, and outcomes, which demonstrated an acceptable model fit with a value of 0.941.

Keywords: *policy-making, electric energy, New Silk Road*

1. Introduction

The Belt and Road Initiative (BRI), introduced by China in 2013, has emerged as one of the most ambitious geo-economic and geo-strategic development frameworks of the twenty-first century. Designed to revive and modernize the historical Silk Road, the initiative seeks to enhance connectivity, expand international trade, and restructure global energy and infrastructure networks. The New Silk Road encompasses a complex architecture of land routes, maritime corridors, digital infrastructures, and energy partnerships, forming a multi-dimensional platform that integrates economic, political, cultural, technological, and environmental considerations (Dani, 1992). As scholars have noted, the historical Silk Road facilitated extensive cultural and commercial exchange, contributing significantly to the evolution of human civilization, and its contemporary reinvention represents a continuation of that

legacy under new geopolitical conditions (Bucsky, 2020; Fasslabend, 2015). The growing strategic, economic, and technological interdependence between Asia, the Middle East, and Europe has positioned the New Silk Road as a transformational network with profound implications for regional development, energy governance, and international relations.

In recent years, the role of energy—particularly electricity—has become central to the BRI's operationalization, given the increasing global emphasis on clean energy transitions, cross-border power trade, and the development of renewable energy corridors. China's vision for a "New Energy Silk Road" emphasizes diversified energy cooperation, renewable integration, regional electricity market design, and infrastructure interoperability across partner countries (Qian, 2023). The Belt and Road's energy agenda also increasingly incorporates agricultural-based renewable sources and distributed energy systems, which can support long-term sustainability and resilience across partner economies (Ji et al., 2023). For countries located along the BRI corridors, electricity cooperation is not only an economic opportunity but also a strategic necessity to ensure energy security, manage demand fluctuations, and modernize outdated infrastructure.

Iran, positioned at the crossroads of West, Central, and South Asia, holds a unique historical and geopolitical status in relation to the Silk Road. Its geographic location provides natural corridors linking China to Europe, the Persian Gulf, and the Eastern Mediterranean. Scholars argue that Iran's geo-economic role is highly relevant to the New Silk Road due to its energy resources, transit potential, and historical linkages with Asian powers (Akyener, 2017; Amirahmadian & Salehi Dowlat-Abad, 2016). Additionally, Iran's substantial natural gas reserves, strategic maritime access, and developed electricity grid position the country as a potential regional hub for energy exchange within the BRI framework. Despite this potential, structural, political, and institutional challenges—such as sanctions, limited foreign investment, and regional competition—have constrained Iran's full engagement (Rezapour & Simbar, 2018; Shariati-Nia & Azizi, 2017).

Nevertheless, the intensifying cooperation between Iran and China—especially in the context of the 25-year strategic partnership—has generated new momentum for deeper collaboration in energy policy, infrastructure development, and electricity market integration. China's growing energy demand, its emphasis on diversified energy imports, and its search for stable regional partners align with Iran's strategic objective of enhancing electricity export capacity and upgrading domestic energy infrastructure (Madani, 2022). The shift toward geo-economic explanations of the BRI underscores that energy flows, investment patterns, and trade corridors are increasingly shaped by economic incentives rather than purely geopolitical motives. Thus, Iran's electricity sector can play an instrumental role in shaping the contours of its long-term participation in the BRI.

At the same time, global demand for electricity continues to rise, driven by urbanization, digitalization, and the spread of smart electrical appliances. Even household consumption dynamics have become a subject of scholarly investigation, revealing complex patterns of social comparison and technology adoption that affect national electricity planning (Park & Yun, 2024). For BRI countries, such trends intensify the need for coordinated electricity policies that integrate domestic supply-demand management with cross-border energy exchange systems. The development of the Digital Silk Road adds further complexity by introducing new technological standards, cybersecurity considerations, and digital infrastructures that directly affect electricity grid governance and smart energy networks (Ly, 2020). Energy storage innovations are also important to this emerging paradigm, as biologically synthesized electrolytes and other new technologies are redefining what sustainable electricity systems may look like in the near future (Wilhelmsen et al., 2023).

The Maritime Silk Road, another major component of the BRI, also plays a significant role in energy logistics by facilitating the movement of goods, supporting port electrification, and shaping new transport-energy interfaces. Its implications for transport management and electricity consumption patterns are now widely discussed in the literature (Lam et al., 2018). Meanwhile, at the continental scale, research highlights that the balance of interests among states participating in the Silk Road Economic Belt (SREB) remains delicate, requiring careful alignment of energy priorities, regulatory frameworks, and national development strategies (Silin et al., 2018). This balancing act impacts how countries—particularly energy-rich states such as Iran—design domestic policies that align with international expectations and cross-border obligations.

Other studies emphasize that the BRI's infrastructure development creates long-term opportunities for regional growth, especially when combined with local energy projects, institutional reforms, and integrated planning strategies (Erschbamer et al., 2020). The development of

electricity markets along BRI corridors involves both strategic competition and mutual dependency. For example, China's expanding investment across Eurasia and its rising interest in electricity grid interconnection projects underscore a broader shift toward transnational energy governance. Iran's relatively small share of BRI electricity-related investments highlights the need for targeted policy development and strategic planning to enhance its participation (Bucsky, 2020). This context reinforces the importance of designing a coherent and evidence-based national electricity policy aligned with New Silk Road dynamics.

On the technological front, increasing integration of renewable energy creates both opportunities and complexities. New energy sources, when incorporated into national grids, introduce variability and instability that require updated regulations, smart-grid technologies, and sophisticated demand-response systems. Challenges such as harmonic distortion, grid balancing, and the integration of electronic controls have become major concerns for countries advancing renewable infrastructure (Kaur & Bath, 2025). The BRI's emphasis on green development and ecological sustainability adds further urgency to adopting advanced electricity-management policies that promote efficiency, reliability, and resilience across partner countries. Likewise, consumer behavior in renewable electricity markets is increasingly studied through experimental and behavioral economics approaches to understand purchasing decisions, policy compliance, and market incentives (Wei et al., 2025).

The political marketing dimension of the BRI adds another layer of complexity, as powerful narratives are constructed to advance China's global leadership and influence international energy governance (Fasslabend, 2015; Rolland, 2015). For some observers, the Silk Road functions as a symbolic brand representing China's pursuit of economic expansion, infrastructural dominance, and soft power projection. For others, the initiative represents a cooperative platform aimed at mutual development. In either case, the role of electricity cooperation within the BRI cannot be separated from broader political messaging and international relations dynamics.

From Iran's perspective, participation in the BRI requires reconciling domestic energy policies with broader structural, economic, and political conditions. Iran faces substantial obstacles including economic instability, international sanctions, regional rivalries, administrative inefficiencies, and investor distrust. Yet, as several studies note, Iran retains significant opportunities to leverage its strategic advantages, including its geographic location, energy resources, scientific capacity, and historical ties with China (Akyener, 2017; Rezapour & Simbar, 2018). The development of a modern, export-oriented electricity policy aligned with the BRI can strengthen Iran's regional influence, enhance national income through electricity exports, and facilitate integration into transnational energy markets. Therefore, the aim of this study is to design a comprehensive policy-making model for Iran's electric energy sector aligned with the strategic framework of the New Silk Road.

2. Methods and Materials

The present study aimed to design a policy-making model for Iran's electric energy sector within the framework of the New Silk Road. Accordingly, from the perspective of purpose, this research is applied, and in terms of data collection method, it was conducted using a mixed-method approach (qualitative–quantitative). In the qualitative phase, grounded theory was used to design the model, and in the quantitative phase, a survey-based method grounded in structural equation modeling was applied to validate the extracted model.

This research is interpretivist in terms of paradigm. Unlike the functionalist paradigm, which seeks causal analysis, the interpretive paradigm focuses on the exploration of meaning. Because this study examines various dimensions of the New Silk Road, regionalism, and their related concepts and meanings, and subsequently develops an electric energy policy for Iran, it is considered interpretive. The results of the present study are developmental and applied in nature, as they can be used by policymakers in the field of national energy management, including the Ministry of Energy, Ministry of Petroleum, Supreme Energy Council, and the Research Center of the Islamic Consultative Assembly. Moreover, this research is inductive in approach. In this study, the data derived from interviews lead to the overall research model through coding processes. The research strategy is also based on grounded theory. The research horizon is cross-sectional, indicating the collection of data regarding one or several characteristics at a specific point in time. Ultimately, interviews were used to collect data for this study.

In the qualitative phase, to collect data for coding and constructing the research model using the grounded theory method, in-depth interviews were conducted with experts in the energy sector. The statistical population included senior

managers, experts, and specialists in the national energy sector. Thirty experts were interviewed using purposive sampling. The selected experts were fully familiar with the New Silk Road project and its operational processes and were also knowledgeable about the electric power industry at a strategic level. Participants possessed domain-specific knowledge relating to the research topic, a minimum of five years of executive experience in senior and managerial positions, and at least a master's degree in fields related to energy sector management. In-depth interviews continued until theoretical saturation and the consolidation of viewpoints were achieved. The statistical population of the quantitative phase included managers, heads, and employees of the energy sector in 2023, from which 330 individuals were selected using simple random sampling and based on the Morgan table.

Data collection methods included library research, in-depth interviews with energy-sector experts, note-taking, and questionnaires. It should be noted that a researcher-made questionnaire was used for model validation.

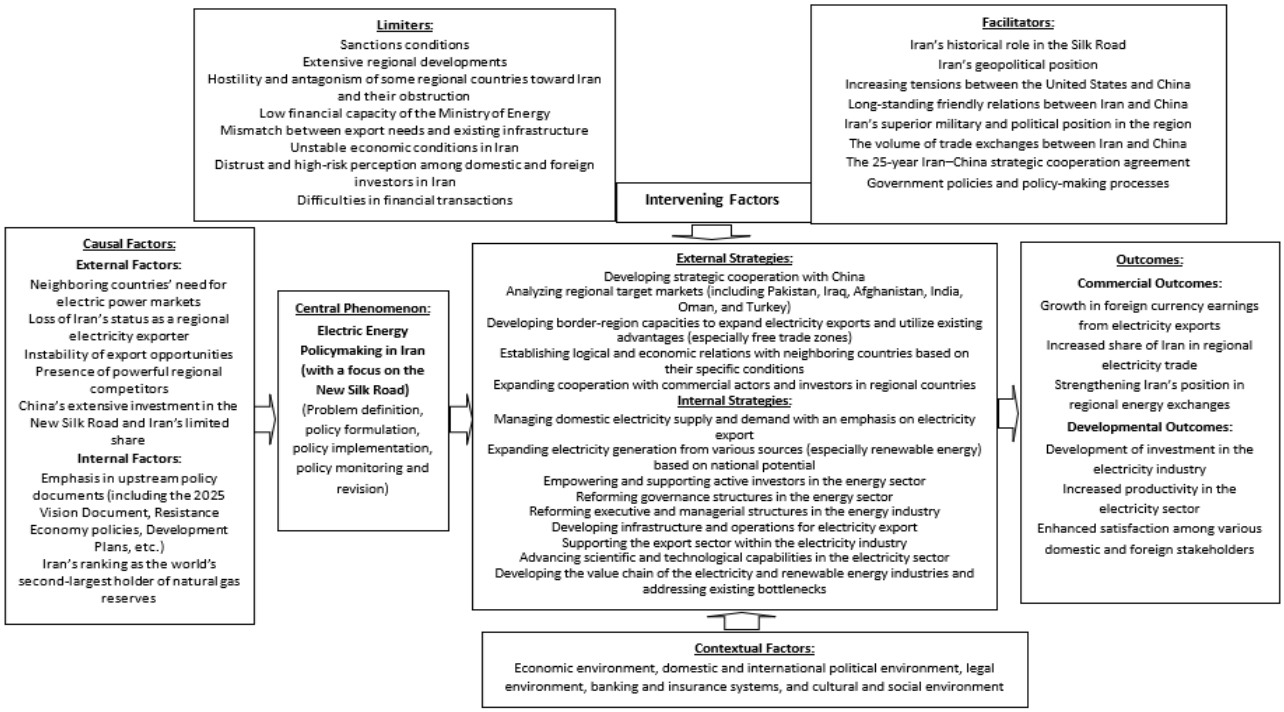
All in-depth interviews in this study were conducted by the researcher, enabling them to transfer insights from one interview to subsequent ones. Interviews continued until theoretical saturation was reached. Each interview lasted between 45 and 60 minutes. In the quantitative phase, model validation was carried out using quantitative validation tests such as convergent and discriminant validity and Cronbach's alpha, employing SmartPLS software.

3. Findings and Results

After analyzing the interview transcripts with experts, the codes related to policy-making strategies for Iran's electric energy sector in the New Silk Road framework were identified. Based on the findings, 73 initial codes were identified and categorized into two groups: internal strategies and external strategies. In addition to strategies, the participating experts identified factors influencing the policy-making strategies for Iran's electric energy sector in the New Silk Road. These factors included 45 items categorized into three groups: causal factors, contextual factors, and intervening factors. The consequences of policy-making for Iran's electric energy sector in the New Silk Road were also identified by the participating experts. These consequences represent the outcomes of Iran's effective role in the electric energy market of the New Silk Road.

Figure 1

The Paradigmatic Model of Policy-Making for Iran's Electric Energy Sector in the New Silk Road



After completing open and axial coding, the components of the electric energy policy-making model for Iran—centered on the New Silk Road—were identified. To design the paradigmatic model, the central category was identified, followed by determining the relationships among variables based on the structure of Strauss and Corbin's (1998) paradigmatic model.

To analyze data obtained from the interviews using grounded theory, three stages of open coding, axial coding, and selective coding were completed, leading to the design of the paradigmatic model of policy-making for Iran's electric energy sector within the New Silk Road. After finalizing the research model, its validity and reliability were assessed. In this study, based on Merriam's (2009) perspective, internal validity in the qualitative phase was ensured through triangulation and member checking. In triangulation, multiple sources of data or multiple methods are used to confirm emerging data. In member checking, respondents are asked whether the results are acceptable to them. To validate the grounded theory findings, opinions were elicited from three experts, and after minor revisions, the results were confirmed.

Finally, confirmatory factor analysis (CFA) was used to validate the identified qualitative model. CFA is one of the oldest statistical methods for examining the relationships between latent variables (main variables) and observed variables and is divided into exploratory factor analysis and confirmatory factor analysis. The results of the quantitative phase, based on confirmatory factor analysis, are shown in Figure (2). This figure displays the multilevel confirmatory factor analysis model and structural equations with standardized coefficient estimates, indicating that the New Silk Road framework consists of six dimensions: external strategies, internal strategies, intervening factors, causal factors, contextual factors, and consequences. Figure (2) tests all measurement equations (factor loadings and path coefficients) using the t-statistic. According to this model, the factor loadings are significant at the 95% confidence level. The coefficient of determination (R^2) and adjusted coefficient of determination for the research dimensions are presented in Table (1), and those for the research components are presented in Table (2). According to Henseler et al. (2019), the range for R^2 and adjusted R^2 is categorized as weak (0.19), moderate (0.33), and strong (0.60). The findings in Tables (1) and (2) indicate that all dimensions of the model were assessed as moderate to strong.

Figure 2

Model with Standardized Coefficient Estimates

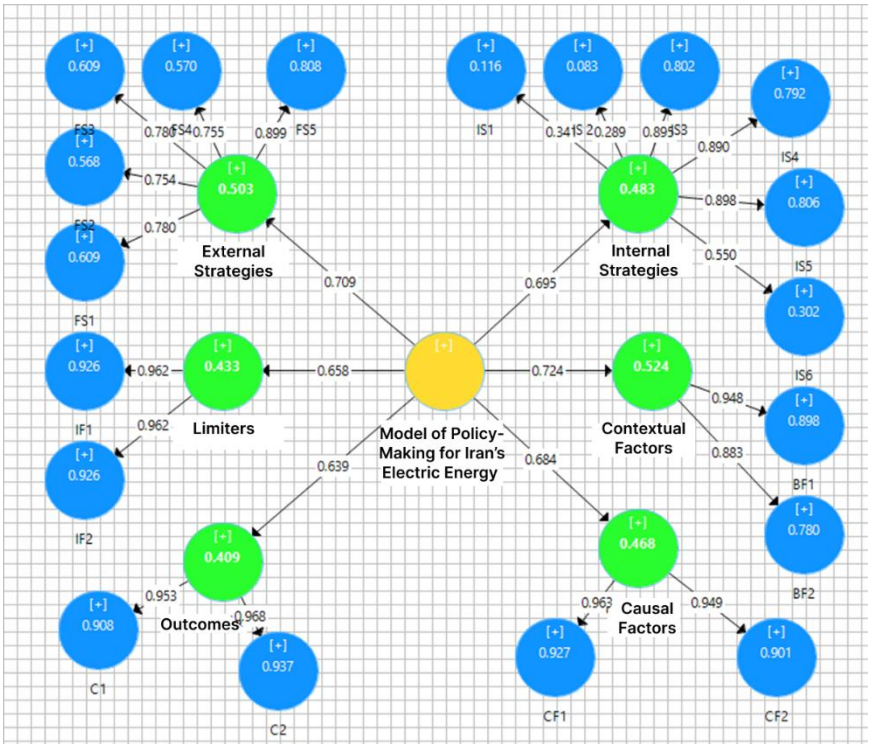


Figure 3

Model with Significance Coefficient Estimates

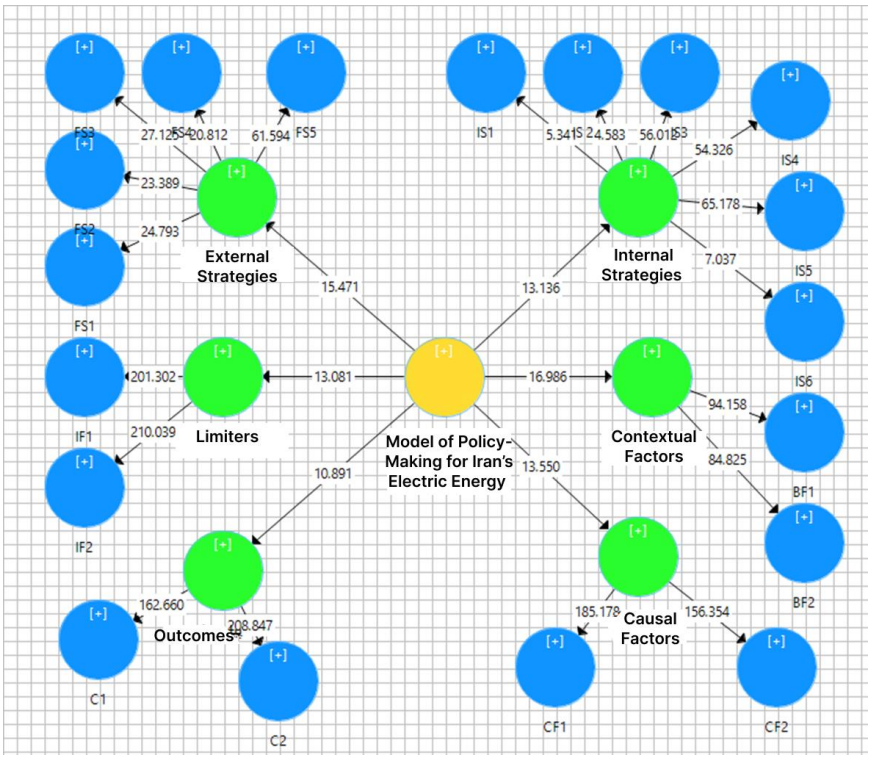


Table 1

Examination of R-Squared and Adjusted R-Squared Indices of Research Dimensions

Dimension	R-Squared (R)	Adjusted R-Squared (R^2)
External Strategies	0.503	0.500
Internal Strategies	0.483	0.481
Contextual Factors	0.524	0.522
Causal Factors	0.468	0.465
Intervening Factors	0.433	0.430
Outcomes	0.409	0.406

Table 2

Examination of R-Squared and Adjusted R-Squared Indices of Research Components

Component	R-Squared (R)	Adjusted R-Squared (R^2)
BF1	0.898	0.897
BF2	0.780	0.779
C1	0.908	0.907
C2	0.937	0.937
CF1	0.927	0.927
CF2	0.901	0.901
FS1	0.609	0.607
FS2	0.568	0.566
FS3	0.609	0.607
FS4	0.570	0.568
FS5	0.808	0.807
IF1	0.926	0.926
IF2	0.926	0.926

IS2	0.083	0.078
IS1	0.456	0.567
IS3	0.802	0.801
IS4	0.792	0.791
IS5	0.806	0.805
IS6	0.334	0.456

Table 3

Examination of Validity and Reliability Indices of Model Dimensions

Dimension	Cronbach's Alpha	Rho Coefficient	Composite Reliability	Average Variance Extracted (AVE)
External Strategies	0.889	0.890	0.909	0.501
Internal Strategies	0.859	0.887	0.892	0.524
Contextual Factors	0.816	0.859	0.872	0.552
Causal Factors	0.894	0.906	0.921	0.665
Intervening Factors	0.914	0.915	0.940	0.796
Outcomes	0.868	0.907	0.908	0.639
Electric Energy Policy-Making Model	0.941	0.942	0.945	0.283

Evaluation of the validity and reliability indices of the model dimensions is presented in Table (3), and the evaluation of the validity and reliability indices of the model components is presented in Table (4). Based on Taber (2018), when the Cronbach's alpha of each construct exceeds 0.60, the construct is considered to have acceptable reliability. According to the results in Tables (3) and (4), since all Cronbach's alpha coefficients exceed 0.60, it can be asserted that all dimensions of the model possess acceptable reliability.

According to Bagozzi and Yi (1994), when composite reliability exceeds 0.60, the construct has acceptable reliability. Based on the results of these tables, the composite reliability of all model dimensions exceeds 0.60; therefore, they all possess adequate reliability.

Joseph Hair et al. (2017) and Dijkstra and Henseler (2015) argue that Rho coefficients above 0.70 indicate acceptable reliability. Accordingly, the results demonstrate that all six dimensions of the electric energy policy-making model for Iran in the New Silk Road are confirmed.

According to Kline et al. (2015), the average variance extracted (AVE) above 0.50 is considered acceptable. Based on the results in Table (4), the AVE values for all dimensions exceed this threshold and are thus confirmed.

Table 4

Examination of Validity and Reliability Indices of Model Components

Component	Cronbach's Alpha	Rho Coefficient	Composite Reliability	Average Variance Extracted (AVE)
BF1	0.885	0.886	0.929	0.814
BF2	0.601	0.712	0.761	0.516
C1	0.638	0.808	0.803	0.604
C2	0.858	0.859	0.914	0.780
CF1	0.873	0.873	0.922	0.797
CF2	0.732	0.783	0.849	0.656
FS1	0.852	0.852	0.931	0.871
FS2	0.829	0.829	0.921	0.854
FS3	0.832	0.834	0.922	0.856
FS4	0.818	0.818	0.916	0.846
FS5	0.642	0.349	0.751	0.602
IF1	0.843	0.843	0.927	0.864
IF2	0.830	0.830	0.922	0.855
IS2	0.818	0.821	0.916	0.846
IS1	0.833	0.857	0.922	0.856
IS3	0.859	0.859	0.934	0.876
IS4	0.852	0.853	0.931	0.871
IS5	0.659	0.728	0.710	0.564
IS6	0.801	0.803	0.909	0.834

The evaluation of the Fornell–Larcker index for assessing convergent validity of the research dimensions is shown in Table (5). Joseph et al. (2016) argue that when the diagonal values in the Fornell–Larcker table are greater than their corresponding sub-values, the model constructs possess adequate validity. Based on the findings presented in Table (5), all model dimensions are confirmed in terms of convergent validity.

Table 5

Evaluation of the Fornell–Larcker Index for Convergent Validity of Research Dimensions

	External Strategies	Internal Strategies	Contextual Factors	Causal Factors	Intervening Factors	Outcomes
External Strategies	0.762					
Internal Strategies	0.552	0.775				
Contextual Factors	0.559	0.662	0.902			
Causal Factors	0.445	0.690	0.287	0.883		
Intervening Factors	0.757	0.362	0.283	0.365	0.924	
Outcomes	0.463	0.301	0.278	0.343	0.462	0.782

4. Discussion and Conclusion

The findings of this study provide a comprehensive understanding of the policy-making dimensions that shape Iran's participation in the New Silk Road's electric energy framework. The results indicated that the proposed model consists of six interrelated components—external strategies, internal strategies, causal factors, contextual factors, intervening factors, and outcomes—each of which contributes meaningfully to Iran's strategic positioning in the regional electricity market. The structural equation modeling analysis confirmed the strength and stability of the relationships within the model, demonstrating that both strategic and environmental factors significantly influence Iran's potential to enhance its electricity policy performance within the context of the Belt and Road Initiative (BRI). These results align with the broader academic consensus that effective energy policy-making under complex regional and global conditions requires multilayered frameworks that integrate geopolitical, economic, technological, and social determinants.

A key finding of this research is the centrality of external strategies—particularly strategic cooperation with China, expansion of regional electricity markets, and the development of border-region infrastructure—in shaping Iran's ability to participate effectively in the New Silk Road. This finding is consistent with arguments made in recent scholarship that emphasize the BRI's role as a transformative platform for transnational energy governance, infrastructure interconnectivity, and cross-border power exchange (Lam et al., 2018; Qian, 2023). As the literature suggests, China has actively pursued the creation of a "New Energy Silk Road," which centers on diversified energy routes, renewable energy deployment, and cooperative electricity systems that link Asian, Middle Eastern, and European markets (Ji et al., 2023). Iran's strategic partnership with China places it in a favorable position to engage in these developments, particularly given its geographic advantages and historical ties to the Silk Road (Akyener, 2017; Amirahmadian & Salehi Dowlat-Abad, 2016). The significance of these external strategies in the model confirms the continued relevance of geopolitical alignment and international cooperation in shaping national energy policy trajectories.

The internal strategies identified in the model likewise reflect the structural and institutional requirements for strengthening Iran's domestic electricity sector. The findings demonstrate that managing internal supply and demand, investing in renewable energy development, reforming governance structures, and enhancing value chains are essential for increasing Iran's competitiveness in regional electricity markets. This corresponds with prior research emphasizing the need for domestic institutional strengthening to fully benefit from the BRI's economic and infrastructural opportunities (Rezapour & Simbar, 2018). Studies focusing on the complexities of integrating renewable energy systems further support this perspective, highlighting that increased electrification, distributed generation, and renewable penetration pose new challenges such as grid instability and harmonic distortion, necessitating new regulatory frameworks and technical capabilities (Kaur & Bath, 2025). Therefore, the model's emphasis on internal strategic development is not only theoretically grounded but also practically aligned with the technological and economic realities of modern electricity systems.

The identification of causal factors—including the electricity needs of neighboring countries, regional competition, and China's extensive investment in BRI energy infrastructure—reinforces the notion that Iran's energy policy cannot be developed in isolation. This finding resonates with previous studies that argue that regional electricity markets are shaped by shifting geopolitical rivalries, fluctuating energy demand, and competition among emerging power hubs (Bucsky, 2020; Silin et al., 2018). In particular, research highlights that despite Iran's significant energy potential, its share in China's broader BRI strategy remains limited due to structural challenges, sanctions, and competing regional actors (Madani, 2022). The consistency of these external pressures with the causal factors identified in this study underscores the need for a more proactive and strategic policy approach to electricity exports and regional electricity diplomacy.

The contextual factors identified—economic, political, legal, cultural, and financial environments—also played a significant role in shaping the feasibility and success of Iran's electricity policy-making. The findings demonstrate that national-level instability, financial transaction limitations, and investor distrust represent substantial constraints that must be addressed for Iran to leverage BRI opportunities. These results align with the argument that the BRI environment is heavily influenced by multi-scale political and regulatory frameworks that can either enable or restrict energy cooperation (Erschbamer et al., 2020; Fasslabend, 2015). Prior studies emphasize that countries with weak institutional environments face greater challenges in attracting investment and partnering effectively in large-scale infrastructural projects, an observation highly applicable to Iran's current circumstances (Rolland, 2015). By demonstrating how deeply contextual variables influence strategic choices, the study affirms the importance of adaptive, context-sensitive policy-making.

The intervening factors—including sanctions, regional instability, foreign policy hostilities, and domestic economic volatility—were found to moderate the relationship between Iran's strategies and outcomes. This relates closely to the literature describing how political and economic disruptions can hinder cross-border cooperation, reduce investor confidence, and destabilize policy implementation processes. Scholars note that countries participating in the BRI often experience significant vulnerabilities due to changing power dynamics, regional conflicts, and global economic shifts (Ly, 2020; Wilhelmsen et al., 2023). In Iran's case, these intervening conditions create additional layers of uncertainty, making long-term electricity export planning more complex. The model's identification of these intervening variables confirms their strategic importance and highlights the need for resilience-oriented policy frameworks that anticipate and mitigate such disruptions.

The results also suggest that effective policy-making in the electricity sector can produce both commercial and developmental outcomes. On the commercial side, the findings show that increased electricity exports can lead to enhanced foreign currency earnings, stronger regional market share, and improved geopolitical leverage. These findings are consistent with studies that have illustrated how cross-border electricity trade contributes to economic diversification, trade expansion, and national competitiveness (Wei et al., 2025). On the developmental side, the findings highlight the model's capacity to support investment expansion, infrastructure modernization, productivity growth, and stakeholder satisfaction. These outcomes correspond with broader scholarship arguing that well-designed energy policies can strengthen national energy security, promote technological advancement, and support long-term sustainability goals (Park & Yun, 2024; Silin et al., 2018). Together, these commercial and developmental consequences demonstrate the potential of electricity policy-making to serve as a catalyst for national transformation.

The central phenomenon identified in this study—policy-making for Iran's electric energy sector within the New Silk Road framework—was found to integrate problem definition, policy formulation, implementation, monitoring, and revision. This holistic conceptualization aligns with literature that frames the BRI not merely as an infrastructural initiative but as a dynamic, strategic environment that requires continuous adaptation and iterative policy processes (Dani, 1992; Lam et al., 2018). By confirming that policy-making must be both comprehensive and flexible, the model reflects global best practices in integrated energy planning and supports the argument that electricity governance in rapidly changing regions must incorporate feedback, evaluation, and learning mechanisms.

Moreover, the findings underscore the theoretical and methodological significance of using a grounded theory approach followed by structural equation modeling. The confirmatory factor analysis results revealed strong model reliability and validity, consistent with foundational methodological recommendations in SEM literature (Baggozi & Yi, 1988). The robustness of the model across multiple dimensions illustrates the appropriateness of

combining qualitative theory-building with quantitative model testing in complex policy environments.

Overall, the results of this research demonstrate that Iran's participation in the New Silk Road's electricity economy requires a deliberate and multidimensional policy framework. The model developed in this study provides a practical and scientifically grounded foundation for understanding the interdependencies that shape energy policy outcomes. It highlights that both internal capacity-building and external strategic alignment must be addressed simultaneously, and that contextual and intervening factors must be carefully managed to ensure policy success. These insights contribute significantly to the academic literature on energy governance, regional integration, and BRI studies, offering a theoretically coherent and practically applicable perspective on Iran's electricity policy challenges and opportunities.

This study, while comprehensive, faces several limitations that should be acknowledged. First, the qualitative phase relied on expert interviews from a specific subset of professionals within Iran's energy sector, which may limit the generalizability of the findings to broader or non-governmental stakeholders. Second, the cross-sectional nature of the research restricts the ability to assess how dynamic geopolitical or economic conditions might influence the model over time. Third, although structural equation modeling provides strong analytical validity, the findings are dependent on self-reported data, which may introduce bias. Finally, the study did not include international experts or comparative country cases, which could have enriched the perspective on Iran's role within the New Silk Road.

Future studies should consider longitudinal designs to capture the dynamic evolution of Iran's electricity policies in response to shifting geopolitical and economic conditions. Comparative regional analyses could also be conducted to understand how Iran's strategies differ from or resemble those of neighboring countries participating in the BRI. Additionally, future research could incorporate scenario modeling, risk analysis, and simulation-based approaches to explore how various political, economic, or technological disruptions might impact electricity policy outcomes. Integrating international expert viewpoints and expanding sample diversity would further enhance the robustness of subsequent studies.

Policy-makers should prioritize strengthening institutional capacities, enhancing regulatory frameworks, and improving investment environments to support electricity export growth. Strategic cooperation with China and neighboring countries should be deepened by aligning national development plans with BRI energy objectives. Furthermore, Iran should accelerate renewable energy deployment, modernize its electricity infrastructure, and strengthen value-chain integration to increase its competitiveness. Finally, adopting flexible, adaptive policy mechanisms will help manage regional uncertainties and ensure long-term resilience in the electricity sector.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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