

Explaining a conceptual model of sustainable development and resilience based on grounded theory and its application in the physical development of Rudsar city

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Received: 10 June 2025.- Accepted: 07 September 2025

Doi: 10.71879/soij.2025.1209484

Abstract

Rudsar city confronts multifaceted challenges that threaten its sustainable future, including unchecked urban expansion, environmental deterioration, deficient sustainable infrastructure, and inadequate management of water and energy resources. These interconnected issues have precipitated widespread pollution, diminished biodiversity, exacerbated social inequality, and compromised the overall quality of life for residents. The absence of meaningful public engagement and the lack of robust disaster preparedness systems have further amplified the city's vulnerability to environmental and socioeconomic threats. This research endeavored to construct an integrated conceptual framework that synthesizes sustainable development principles with resilience strategies for Rudsar's physical development, offering actionable solutions for urban planning in an era of rapid transformation and unpredictable crises. This qualitative investigation employed a sequential-exploratory mixed-methods approach grounded in theoretical principles. Data collection was conducted through comprehensive semi-structured interviews with seventeen domain experts, strategically selected via purposive sampling. The expert panel comprised urban planning specialists, environmental engineers, municipal authorities, and community leaders, each contributing unique perspectives to the research. Individual interviews ranged from 45 to 90 minutes and were meticulously transcribed for subsequent analysis. The analytical framework utilized systematic open, axial, and selective coding procedures facilitated by Maxqda software to identify causal relationships, contextual factors, intervening conditions, strategic approaches, and consequential outcomes. Research validity was ensured through methodological rigor, triangulation of data sources, and comprehensive member verification protocols. The analytical process revealed "Integration of sustainable development and resilience principles to enhance physical development quality in Rudsar city" as the core phenomenon driving urban transformation. Causal conditions encompassed supportive policy frameworks, precise assessment of local needs, and reinforcement of socioeconomic resilience mechanisms. Contextual conditions included the development of sustainable urban infrastructure and the cultivation of institutional collaboration. Intervening conditions incorporated climate variability and economic fluctuations as external influencing factors. Strategic interventions concentrated on comprehensive policy integration and systematic environmental impact mitigation. The resulting outcomes demonstrated enhanced urban planning efficacy and strengthened physical and social resilience capacity. The research substantiated that the integration of sustainable development and resilience principles effectively reduces crisis vulnerability while ensuring balanced urban growth trajectories. The developed conceptual model provides a practical blueprint for urban administrators and policymakers in Rudsar and comparable municipalities, enhancing residents' quality of life while establishing a replicable framework for addressing sustainable development and resilience challenges within rapidly evolving environmental contexts.

Keywords: Sustainable Development; Physical Development; Rudsar, Urban Resilience; Grounded Theory

1. Introduction

Rudsar city's physical development trajectory faces formidable sustainability challenges rooted in systemic planning inadequacies. The absence of comprehensive, integrated urban development strategies has catalyzed uncontrolled sprawl, environmental degradation, and the systematic depletion of natural resources. This unconstrained expansion, executed without regard for environmental carrying capacity or resource limitations, has imposed compounding pressures on regional ecosystems and disrupted ecological equilibrium. Additionally, insufficient investment in sustainable

infrastructure—including efficient public transportation networks and comprehensive waste management systems—has intensified environmental deterioration.

These systemic deficiencies manifest as pervasive air, water, and soil contamination, coupled with escalating urban waste generation and associated complications. The continued neglect of these critical issues threatens to severely compromise citizen welfare and jeopardize public health outcomes. However, Rudsar's sustainability challenges extend far beyond infrastructure limitations. Ineffective water and energy resource stewardship represents another fundamental impediment. Excessive

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consumption patterns, implemented without sustainability considerations, have accelerated natural resource depletion and inflated operational costs. Furthermore, inadequate attention to biodiversity conservation has resulted in species loss and habitat destruction. The absence of robust monitoring and environmental impact assessment protocols for development initiatives increases the likelihood of implementing ecologically destructive projects.

Inequitable distribution of urban amenities and services, compounded by persistent social and economic disparities, has created pronounced divisions among demographic groups and diminished quality of life for substantial population segments. These inequalities constitute primary barriers to sustainable social development in Rudsar. The exclusion of public participation from urban development decision-making processes represents an additional significant obstacle.

Rudsar's geographical positioning exposes it to diverse natural hazards, including flooding, seismic activity, and landslides. The absence of early warning systems and preventive measures has substantially elevated risks of human casualties and economic losses. Infrastructure vulnerabilities encompass buildings, transportation networks, bridges, and other essential urban facilities. Moreover, insufficient citizen preparedness for natural disasters may amplify damage severity and compromise the effectiveness of emergency response and recovery operations. Collectively, the lack of efficient, comprehensive crisis management programs constitutes a critical factor in Rudsar's heightened vulnerability to natural disasters.

Beyond natural hazards, Rudsar faces considerable exposure to economic and social disruptions. The city's economic overdependence on limited sectors, particularly tourism and agriculture, creates substantial vulnerability to market fluctuations and sector-specific downturns. This dependency undermines economic diversification and reduces resilience against financial shocks. Additionally, the absence of robust social support systems has intensified poverty and inequality while diminishing the community's capacity to withstand social disruptions.

Sustainable and resilient physical development in Rudsar assumes paramount importance for long-term urban viability. Through strategic sustainable development implementation, environmental degradation can be curtailed while preserving natural resources for future generations. Sustainable development serves as a cornerstone strategy for achieving comprehensive, enduring progress in Rudsar. Enhanced resilience can significantly reduce human casualties and economic losses from natural disasters while minimizing disruption to normal civic life. Furthermore, increased resilience enables the city to better withstand economic volatility and maintain developmental capacity. Economic resilience entails reducing sectoral dependence and diversifying the urban economy. Social resilience involves establishing robust support networks and developing capacity for managing social challenges.

These networks may encompass non-governmental organizations, community groups, and other social institutions. Ultimately, building resilience in Rudsar means preparing the city to confront diverse challenges and stresses while reducing vulnerability to these threats. Inadequate attention to sustainable development in Rudsar will yield severe environmental consequences, including deforestation, pasture degradation, biodiversity loss, air and water pollution, and climatic disruption. Forest and pasture destruction reduces water retention capacity and elevates flood risks. Biodiversity loss eliminates plant and animal species while diminishing natural heritage. Air and water contamination compromises public health and increases disease prevalence. Moreover, sustainability neglect may diminish the city's tourist appeal, consequently reducing income and employment opportunities.

This economic decline contributes to poverty and social inequality. Insufficient attention to resilience building in Rudsar will produce numerous adverse consequences for residents, including heightened vulnerability to natural disasters, increased human and economic losses, and disruption of normal life patterns. Enhanced disaster vulnerability translates to greater probability of casualties, property damage, and lifestyle disruption. These disruptions may include interruptions to water, electricity, gas, and other essential services. Reduced food security means diminished access to adequate nutrition. Compromised health and wellness indicates increased morbidity and reduced life expectancy. Deteriorated quality of life reflects decreased life satisfaction and reduced overall well-being.

These challenges underscore the critical importance of developing resilience against natural disasters and socioeconomic disruptions. The primary objective of this research is to articulate an integrated conceptual model combining sustainable development and resilience principles for application in Rudsar's physical development planning. This conceptual framework was formulated considering Rudsar's unique circumstances and existing challenges, providing a foundation for transformative urban development strategies.

2. Theoretical Framework

2.1 The concept of sustainable development

The foundational concept of sustainable development emerged through the seminal "Our Common Future" report, published in 1987 by the World Commission on Environment and Development. The Brundtland Report of the same year articulated sustainable development as a paradigm that fulfills present needs while preserving the capacity of future generations to meet their own requirements. This definition encompasses environmental considerations while emphasizing the critical importance of economic and social dimensions (Abdolbaghi et al., 2024).

Sustainable development represents a conceptual evolution born from recognition of the detrimental environmental and social consequences stemming from unidimensional economic development approaches

following the Industrial Revolution. This paradigm shift reflects humanity's evolving perspective on growth and progress, seeking to establish a comprehensive framework that avoids historical developmental errors while achieving balanced, holistic advancement. Sustainable development embodies a transformative process that envisions an optimal future for human societies, wherein living conditions and resource utilization satisfy human needs without compromising the integrity, aesthetic value, and stability of life-supporting ecosystems (Zhang et al., 2024).

Central to sustainable development philosophy is the imperative to reduce resource consumption and minimize waste and pollution through fundamental alterations in production and consumption patterns. Innovation serves as a cornerstone of sustainable development, fostering alternatives to fossil fuel-dependent and chemical-intensive technologies that inflict multifaceted harm upon human health and environmental systems. Resilience capacity emerges through the establishment of economic activity centers anchored in environmentally compatible technologies and products, wherein rapid implementation of these innovations creates opportunities for planetary protection (Alshina et al., 2024).

Critical factors for achieving sustainable development encompass institutional transformation through modification of existing frameworks and creation of new structures, prioritization of human capital development with particular emphasis on women and youth empowerment, leadership initiatives that elevate developmental efforts from governance levels, the instrumental role of civil society organizations in grassroots development mobilization, recognition of fundamental human rights, integration of development processes with social and cultural infrastructures, and acknowledgment of the intrinsic relationship between developmental sustainability and collective self-confidence (Wang et al., 2024).

Collective achievement of sustainable development becomes attainable through committed, visionary leadership supported by scientific and technological advancement. This presents urban planners with opportunities to illuminate critical issues including education, growth dynamics, population management, energy systems, and governance structures while positioning health as a fundamental prerequisite for social sustainability. The interconnected framework established by UNESCO's 2030 agenda has rendered sustainable development planning increasingly complex while demonstrating the complementary benefits of integrated goals; for instance, access to clean drinking water enhances health outcomes and contributes to improved nutritional status (Tasnim et al., 2024).

Contemporary global challenges encompass economic, social, and environmental crises affecting more than one billion individuals living in absolute poverty, with escalating income inequality compounded by unsustainable consumption and production patterns that impose enormous societal costs. Achieving sustainable development necessitates coordinated global actions

promoting socioeconomic progress, growth and employment generation, and environmental protection while ensuring special consideration for vulnerable populations (Chen, 2024). Sustainable development represents a conceptual framework that depicts an idealized future liberated from persistent problems including natural resource depletion, gender inequality, and inequitable wealth distribution (Holden, 2024).

2.2. Resilience

The term "resilience" frequently appears in scholarly literature with connotations of "return to previous state," derived from the Latin root "resilio," meaning "to spring back" or "to rebound." Alternative etymological sources cite the Latin word "resalire," translated as "jumping" or "springing backward." Dictionary definitions of resilience encompass the capacity to recover or improve rapidly, buoyancy and elasticity, as well as spring-like and elastic characteristics. Among available translations, "resilience" represents the optimal linguistic choice for conveying this concept due to its semantic precision and clarity (Singh, 2024).

Resilience, functioning as a fundamental concept within sustainability discourse, refers to the capacity of systems, communities, and individuals to effectively manage challenges and crises. This concept encompasses the ability to adapt, learn, and flourish when confronting adversities. Resilience can be conceptualized as an integral component of sustainability, as resilient systems demonstrate enhanced capability to respond to environmental and social transformations while returning to stable operational states (Zhao et al., 2024).

Resilience as recovery represents the capacity of individuals or communities to restore normal or enhanced conditions following exposure to crises, challenges, and adversities. This conceptualization demonstrates that resilience extends beyond mere avoidance of failure or collapse, instead encompassing learning from experiences, adaptation to emergent conditions, and ultimately, growth and advancement (Pires et al., 2024).

Resilience as transformation denotes the capacity of individuals or communities to undergo constructive change and metamorphosis following crisis and challenge exposure. This perspective reveals that experiencing difficulties and obstacles can be converted into opportunities for learning and development. Resilience fundamentally teaches utilization of adversities as catalysts for positive change and improvement (Datola et al., 2023).

Resilience dimensions encompass multiple interconnected aspects. The social dimension addresses communities' capacity to confront challenges and incorporates robust social networks alongside active civic participation (Abbasi et al., 2019). The economic dimension pertains to economies' ability to withstand crises and encompasses economic diversification and productive capacity (Ghasemi et al., 2019). The institutional dimension refers to organizational capabilities in crisis management, requiring transparent and accountable structural

frameworks (ibid.). The psychological dimension encompasses individuals' capacity to manage stress and necessitates effective stress management competencies (Parhizgar and Jalili, 2022).

The infrastructural and technical dimension relates to the resistance capacity of physical and technological systems (Mostafavi et al., 2018; Alizadeh and Honarvar, 2018). The ecological dimension encompasses ecosystems' ability to maintain functional integrity (Mostafavi et al., 2018), while the physical-environmental dimension refers to the resistance capacity of physical structures against natural disasters (Mirzaei et al., 2019).

2.3. Urban physical development

Brookfield conceptualizes development as progress toward comprehensive welfare objectives, including poverty reduction, unemployment mitigation, and inequality diminishment, encompassing fundamental transformations in institutional and social structures (May et al., 2024). Development represents a multidimensional process characterized by fundamental alterations in social structures, public perceptions, and national institutional frameworks (Jones et al., 2024). Physical development encompasses diverse aspects within urban planning discourse, incorporating the physical expansion of residential and service sectors (Bat and Ochir et al., 2024). Tourism exerts substantial influence on physical development patterns and constitutes an inevitable reality for urban physical development in the twenty-first century (Mastfin et al., 2024).

Two contrasting approaches characterize urban physical development: the "compact city" model and "urban sprawl" paradigm, with sprawl demonstrating adverse effects on sustainable physical development (Javaheri et al., 2019). Physical development represents a multifaceted concept encompassing population distribution patterns, employment dynamics, construction volumes, transportation network development, and land use optimization (ibid.). Physical development involves the adaptation of physical organization to environmental conditions and serves as a crucial indicator of urban identity formation (Badri et al., 2020). Physical-spatial development in urban planning depends upon various criteria including topographical slope, geological composition, and terrain characteristics (Shamaei et al., 2022). Urban physical development refers to the quantitative and qualitative enhancement of land uses and physical spaces across horizontal and vertical dimensions (Asgari et al., 2021).

Integrated theories combining sustainable development and resilience have emerged with the objective of fostering sustainability while simultaneously strengthening adaptive capacity to confront challenges. These theoretical frameworks emphasize the synergistic relationship between these concepts, leading to the creation of more resilient and sustainable communities. The theory of complex systems and sustainable resilience operates on the principle that communities and ecosystems function as complex adaptive systems,

emphasizing that sustainability emerges when systems maintain flexibility and adaptability (Rezaei et al., 2021). The theory of justice in development and resilience underscores the importance of safeguarding future generations' rights through sustainable resource stewardship and enhanced community resilience. This theoretical approach positions resilience as an instrument for vulnerability reduction and adaptive capacity enhancement for future generations. The theory of circular economy and sustainable resilience emphasizes optimal, cyclical resource utilization to prevent waste generation and environmental degradation. Within this framework, sustainable development materializes through waste minimization, resource recycling, and enhanced economic productivity, while resilience focuses on the economic system's capacity to maintain functionality during crisis periods (Rezaei et al., 2021).

3. Literature Review

Zhao et al. (2024) conducted comprehensive research titled "Assessment of Urban Resilience and Its Influencing Factors: A Case Study of Yichang-Jingzhou-Jingmen-Enshi Urban Area in China." Their findings demonstrated that urban resilience in the studied regions is influenced by economic, social, infrastructural, and managerial factors, with significant variations observed among different cities within the region.

Datola (2023) published research titled "Implementation of Urban Resilience in Urban Planning: A Comprehensive Framework for Urban Resilience Assessment," concluding that effective urban resilience assessment frameworks must integrate social, economic, environmental, and physical dimensions comprehensively. Implementation requires intersectoral collaboration and diverse stakeholder participation.

Haselsberger (2017) authored "Encounters in Planning Thought: 16 Autobiographical Essays from Key Thinkers in Spatial Planning," revealing that the intellectual legacy of prominent spatial planning theorists establishes a comprehensive intellectual, institutional, and practical agenda for spatial planning spanning the next half-century. This study clarified that urban planners' commitment to continuity and adherence to sustainable principles provides a framework for developing innovative approaches in urban development and conceptual modeling through the integration of sustainable development and resilience principles.

Tabibian and Movahed (2016) developed research titled "Towards Resilient and Sustainable Cities: A Conceptual Framework," demonstrating that combining resilience and sustainability principles in urban planning can facilitate the formation of cities that simultaneously resist crises and maintain sustainable resource consumption patterns.

Pearson et al. (2013) published "Resilient Sustainable City: A Future for Development," revealing that by 2050, three-quarters of the global population will inhabit urban environments, with factors including transportation systems, consumer products, housing infrastructure, and technology playing decisive roles in urban sustainability.

This research demonstrated that an integrated approach to long-term urban planning becomes achievable through combining interdisciplinary scientific insights with practical innovations, organized around three axes: future pathways, innovation, and good governance, providing practical and conceptual insights for achieving sustainable and resilient cities.

Azadeh et al. (2019) conducted research titled "An Analysis of Urban Neighborhood Quality with Emphasis on Sustainable City Components Case Study: Housam Neighborhood, Rudsar City," revealing that Rudsar's urban neighborhood quality requires improvement when evaluated against sustainability indicators. The Housam neighborhood, despite possessing cultural and historical assets, confronts challenges in urban infrastructure and resource management.

Alizadeh et al. (2020) published "Explaining the Role of Local Management in Physical-Spatial Transformations of Villages in Rudsar County," demonstrating that local management plays a pivotal role in directing physical-spatial transformations of villages within Rudsar County. Strengthening local institutions and enhancing villager participation can contribute to achieving sustainable and balanced development in these areas.

Dadres et al. (2015) conducted research titled "Measuring Urban Planning Indicators and Their Application in Sustainable Spatial Development of Rudsar City," revealing that urban planning indicators in Rudsar maintain average conditions. Sustainable spatial development requires comprehensive revision of urban plans with emphasis on environmental protection and quality of life enhancement.

Rezaei et al. (2021) published "Assessment and Analysis of Urban Land Use Resilience (Case Study: District 22 of Tehran City)," demonstrating that land use resilience in Tehran's District 22 confronts serious challenges requiring integrated approaches in land management and urban planning to achieve greater resilience against natural and anthropogenic hazards.

The intellectual framework underlying the integrated conceptual model of sustainable development and resilience for Rudsar city's physical development is grounded in scientific concepts, fundamental theories, and integrative theoretical approaches. This framework seeks to elucidate relationships between diverse dimensions of sustainable development and resilience and their impact on Rudsar's physical development trajectory.

The foundational theory underpinning this research is urban ecology theory, which conceptualizes cities as complex, dynamic ecosystems. This theoretical framework emphasizes mutual interactions among human populations, environmental systems, and infrastructure while providing a comprehensive approach for examining sustainability and resilience dynamics. Additionally, complex systems theory has been employed to analyze the city as a dynamic, multilayered system. This theory examines how urban systems adapt and provide feedback mechanisms when confronting changes and crises, highlighting the role of flexibility and adaptability in ensuring sustainability and resilience.

Furthermore, social capital theory serves as an integrative theoretical component within this framework, addressing the role of public participation, social trust, and human networks in enhancing urban resilience and sustainability. This theory emphasizes the importance of citizen participation in urban decision-making processes and strengthening social cohesion.

Based on this intellectual framework, the integrated conceptual model of sustainable development and resilience for Rudsar city encompasses four principal dimensions: environmental, economic, social, and physical. Each dimension demonstrates mutual interaction with the others. The environmental dimension focuses on natural resource protection, pollution reduction, and sustainable environmental management. The economic dimension addresses local economy strengthening, sustainable employment opportunity creation, and economic vulnerability reduction. The social dimension emphasizes public participation, social cohesion, and quality of life improvement. The physical dimension concentrates on infrastructure strengthening, sustainable urban design, and crisis management capacity, as illustrated in Figure 1.

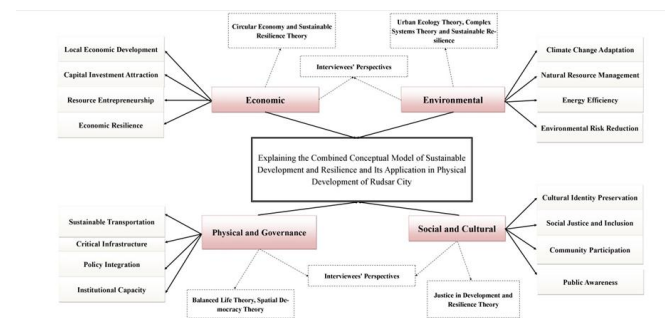


Fig.1. Conceptual model of the research.

4. Research Methodology

This qualitative investigation employs a sequential-exploratory mixed-methods approach conducted through grounded theory principles. The primary objective centers on conceptualizing and achieving comprehensive understanding of dimensions and indicators influencing sustainable development and resilience within Rudsar city's physical development framework. This research integrates theoretical (metaphysical) and empirical foundations, operating within an interpretive orientation framework guided by social constructivism principles. Through this approach, contextual, causal, and intervening conditions alongside strategies for sustainable development and resilience have been systematically identified.

Data collection employed comprehensive methodological approaches centered on conducting in-depth, semi-structured interviews with seventeen executive and academic experts possessing extensive knowledge and experience in sustainable urban development and resilience specific to Rudsar city. Participant selection utilized purposive sampling techniques, enabling researchers to identify and recruit individuals

demonstrating specialized expertise in urban planning, sustainable development, environmental management, and municipal governance relevant to research objectives. The participant cohort comprised urban planning professionals directly engaged with Rudsar city development projects, academic researchers specializing in sustainable urban development, environmental engineers experienced in Gilan Province contexts, municipal officials responsible for city planning and infrastructure development, and community leaders actively involved in local development initiatives. This diverse expert composition ensured capture of multiple perspectives and professional viewpoints during data collection, providing comprehensive understanding of complex factors influencing sustainable development and resilience within the study area.

The interview process followed a structured yet flexible methodology beginning with presentation of primary research questions designed to explore participants' understanding of sustainable development challenges and opportunities in Rudsar city. As interviews progressed and initial data analysis revealed emerging themes and concepts, supplementary questions were developed and incorporated into subsequent interview sessions to deepen exploration of specific topics and validate preliminary findings. Individual interview sessions lasted approximately 45 to 90 minutes, depending on participant availability and discussion depth. Interviews were conducted in Persian and audio-recorded with participant consent, enabling accurate transcription and detailed analysis of collected data. The sequential interview process facilitated building upon insights gained from earlier sessions, progressively refining and focusing inquiry as theoretical concepts emerged from data, aligning with the grounded theory approach employed.

Data analysis procedures commenced with systematic conversion of audio files from all seventeen interviews into detailed textual transcripts, providing the foundation for comprehensive qualitative analysis. The transcription process maintained verbatim accuracy while preserving contextual nuances and emotional undertones expressed by participants during sustainable development and resilience discussions regarding Rudsar city. Following transcription completion, analytical processes advanced through several distinct phases including initial conceptualization, where raw data was examined to identify meaningful information units and preliminary concepts. The categorization phase involved grouping related concepts into broader thematic categories reflecting common patterns and relationships within data. Subsequently, axial coding procedures established connections between categories and identified core phenomena, causal conditions, contextual conditions, mediating conditions, action strategies, and consequences emerging from participants' experiences and perspectives. This systematic coding process revealed complex interrelationships between various factors influencing sustainable urban development within the study context while establishing foundations for theoretical model development based on empirically grounded evidence.

Model design and theory presentation were executed through rigorous qualitative data analysis utilizing Maxqda software, facilitating sophisticated data management, coding organization, and pattern identification throughout analytical processes. The software enabled researchers to create visual representations of relationships between identified categories and develop theoretical models explaining phenomena under investigation.

Validity and reliability were comprehensively established through multiple evaluation criteria and verification procedures ensuring trustworthiness and credibility of findings. Validity assessment employed methodological consistency examining alignment between research methods and objectives; applicability evaluating findings transferability to similar urban contexts; multiplicity of data sources verifying information triangulation across different participant perspectives and professional backgrounds; and observance of ethical considerations ensuring participant confidentiality and informed consent throughout research processes. Reliability was established through systematic documentation of analytical procedures, inter-coder reliability checks involving multiple researchers in coding processes, and member checking procedures where selected participants reviewed preliminary findings to confirm accurate representation of their perspectives.

Additional validation measures included evaluation of data collection guidance by concepts derived from ongoing analysis, ensuring theoretical sampling principles adherence; examination of evidence and analytical notes maintaining transparent research process documentation; assessment of relationships between main categories verifying theoretical coherence and logical consistency; evaluation of identified concepts' importance and extent ensuring comprehensive phenomenon coverage; and analysis of conceptual development depth and breadth confirming theoretical saturation achievement before concluding data collection and analysis phases, thereby establishing both internal consistency and external validity of research findings.

5. Geographical Location of Rudsar City

Rudsar city serves as the administrative center of Rudsar County in eastern Gilan Province, representing a historically significant and aesthetically notable urban center with ancient foundations. Throughout its evolution, this city has been recognized by various appellations including Housam and Kotum, with its contemporary designation "Rudsar" derived from its strategic positioning between two rivers: Kiarud and Shirarud. The municipal population comprises approximately 44,678 inhabitants who are ethnically Gilaki, communicate in the Gilaki language utilizing the Bih-Pish dialect, and practice Twelver Shiite Islam. This urban center maintains cultural richness with preserved traditional customs characteristic of the Gilan region.

Rudsar city, positioned 88 kilometers east of Gilan Province between maritime and mountainous landscapes,

enjoys exceptional natural positioning. Its urban morphology represents a synthesis of historic and contemporary architectural fabrics, with significant public spaces including Mellat Park, Mosafer Park, Ithar Park, and Children's Playground. Notable historical and cultural attractions encompass Reza Shah's former private palace (adjacent to the Rudsar Governor's building), Naharkhoran Palace, the central square complex, and numerous religious shrines. The city's fish market constitutes one of its prominent and spectacular commercial centers.

Economically, Rudsar city operates primarily through agricultural sectors (rice, tea, citrus cultivation), fishing industries, handicraft production, and tourism services. The regional climate, influenced by Caspian Sea proximity, exhibits humid and temperate characteristics with substantial annual precipitation. A distinguishing feature of Rudsar city is its serene and beautiful 40-kilometer coastline, annually attracting numerous tourists. Additionally, proximate access to scenic mountainous areas such as Ashkorat establishes it as an attractive destination for nature-based tourism.

In recent years, Rudsar city has confronted challenges including heterogeneous urban development patterns, infrastructure deficiencies, and environmental pressures from tourism activities, necessitating careful planning for sustainable development and urban resilience enhancement. Administratively, Rudsar County comprises four districts: Central District, Kolachai, Chaboksar, and Rahimabad. Each district encompasses numerous villages and settlements distributed along the Caspian Sea coast and Alborz Mountain foothills. The Central District, with Rudsar city as its nucleus, functions as the administrative and political center, while Kolachai and Chaboksar districts are positioned along coastal areas and Rahimabad district is predominantly situated in foothill regions.

Historically, Rudsar city, now the county center, was recognized in ancient periods by the names "Housam" or "Hotum" and maintained considerable commercial and cultural significance throughout past centuries. Maqdisi, among the nation's earliest historians, described Housam in 375 AH as a city featuring an excellent bazaar and substantial congregational mosque situated near governmental headquarters. The nomenclature transition from Housam to Rudsar occurred during the eighth century AH under the Bih-Pish ruler, following the city's destruction by natural disasters and subsequent reconstruction.

Rudsar city's physical structure comprises diverse urban spaces including numerous parks, the fish market, and a comprehensive street network consisting of primary thoroughfares, squares, and secondary alleys. The urban fabric encompasses two distinct sections: the historic area characterized by narrow, winding alleys, and the contemporary section featuring wider streets and modern architectural developments. Urban connectivity to neighboring municipalities operates through Gilan Province's transportation network, with the primary route being Gilan's coastal highway. Public transportation within Rudsar city relies predominantly on urban taxi

services, while inter-city connections are facilitated through passenger terminals and bus and minibuses.

Rudsar city's vulnerability to flooding and landslides represents one of the most significant natural challenges confronting regional development. The city's unique geographical position between mountains and sea exposes it to floods resulting from heavy precipitation and river overflow events. Heterogeneous and inadequate infrastructure development constitutes an important physical challenge for Rudsar, creating substantial disparities in urban service quality across different areas. Tourism pressure on natural resources has generated large waste volumes, inappropriate construction practices, and coastal water pollution.

The lack of coordination among different sectors of Rudsar's urban management, absence of comprehensive crisis management plans, municipal financial resource limitations, and insufficient public awareness regarding environmental protection represent fundamental challenges to Rudsar city's physical development requiring integrated and participatory approaches for resolution.

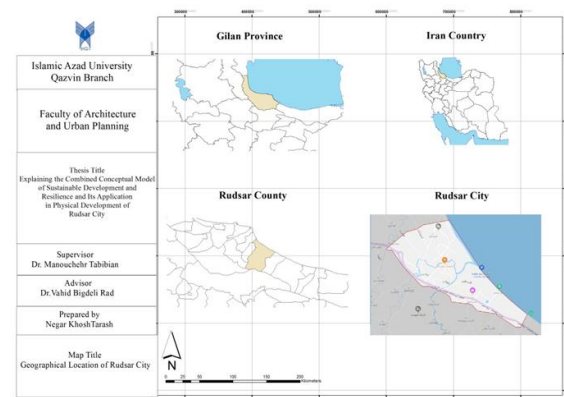


Fig. 2. Geographical location of Rudsar city

6. Results and Discussion

Strategically positioned 74 kilometers from Rasht, the provincial capital, and 184 kilometers from Tehran, Rudsar has established itself as a significant regional hub with considerable development potential. The city's natural tourism assets encompass pristine sandy beaches along the Caspian Sea coastline, expansive virgin forests, multiple waterfalls including the renowned Milash waterfall, natural springs, and traditional highland villages that exemplify authentic Gilan architecture. These natural endowments create substantial opportunities for sustainable tourism development while preserving the region's ecological integrity.

Cultural and historical attractions constitute another dimension of Rudsar's heritage portfolio, featuring ancient bridges that reflect centuries of architectural evolution, traditional houses showcasing regional construction techniques, comprehensive Gilan cultural heritage sites, and distinctive handicraft industries including silk night veils and felt-making traditions that represent intergenerational artisanal knowledge. These cultural

assets provide foundations for heritage tourism and artisanal economic development while maintaining connection to regional identity.

Agricultural capacities form a cornerstone of the city's economic foundation, with rice production contributing significantly to Gilan's annual 750,000-ton output capacity. The agricultural sector encompasses substantial tea cultivation, citrus fruit production, kiwi farming, hazelnut orchards, and livestock operations in foothill areas, all supported by fertile soil conditions, moderate humid climate, and reliable water access from the Kiaroud and Polrud river systems. This agricultural diversity provides economic stability while supporting food security objectives.

Industrial and technological opportunities have emerged through the establishment of a technology incubator center housing three knowledge-based companies and thirty technology units. Notable among these is the innovative Pars Gil Development Navigator Institute, which has produced anti-corona devices, demonstrating the region's capacity for technological innovation. Additional industrial capacity includes food processing industries and traditional handicraft sectors that bridge historical practices with contemporary market demands.

6.1. Development challenges and constraints

Despite these substantial assets, Rudsar confronts significant development obstacles that constrain its growth potential and sustainable development trajectory. Infrastructure deficiencies dominate the challenge landscape, characterized by numerous incomplete projects that drain municipal resources without delivering intended benefits. Inadequate water treatment facilities compromise public health and environmental protection, while the suspended Polrud dam project, despite achieving 80% completion, represents substantial sunk investment without operational returns. The absence of effective management for eighteen regional rivers creates flood risks and missed opportunities for integrated water resource management. Additionally, the shortage of small agricultural dams limits irrigation capacity and agricultural productivity enhancement.

Urban development issues present another category of constraints, including insufficient attraction of urban regeneration funds that could facilitate neighborhood revitalization and infrastructure modernization. The city experiences inadequate urban amenities such as parks and pavilions that contribute to quality of life, coastal parking deficiencies that impede tourism accessibility, and substandard sanitary services that affect public health and visitor experience.

Administrative and planning challenges manifest through undefined detailed urban mapping systems that hinder effective land use planning and development control. Unauthorized land use changes compromise planned development patterns, while weak implementation of comprehensive plans undermines strategic development objectives. Rural guidance schemes have achieved only 17% progress compared to the national average of 47%,

indicating significant gaps in rural development support and planning implementation.

Financial and economic barriers substantially impact development capacity through insufficient foreign investor attraction, reflecting both institutional weaknesses and inadequate investment promotion strategies. Limited financial resources for project completion result in the proliferation of incomplete infrastructure, while housing scheme financing problems constrain residential development. Banking facilities remain inadequate relative to deposit levels, limiting local access to development capital.

Environmental challenges have emerged from waste management deficiencies, including pollution problems and leachate issues that threaten groundwater and soil quality. Natural resource degradation poses risks to the ecological foundations that support both tourism and agricultural sectors, while soil erosion in vulnerable areas threatens agricultural productivity and increases flood risks.

Communication and technology infrastructure deficiencies include insufficient internet coverage that limits digital economy participation, inadequate information and communication technology (ICT) infrastructure that constrains business development, and limited access to modern technologies that reduces competitiveness in knowledge-based sectors.

Transportation and accessibility constraints encompass deteriorated intra-city road networks that impede efficient urban mobility, difficult coastal access that limits tourism potential, insufficient public transportation systems that increase private vehicle dependence, and inadequate infrastructure for tourism development that prevents realization of the sector's economic potential. These interconnected challenges collectively hinder the city's capacity for sustainable urban growth and comprehensive economic development, necessitating integrated planning approaches that address multiple constraint categories simultaneously while building upon existing assets and opportunities.

6.2. Participant demographics

The study comprised seventeen participants with a gender distribution of 53% male (9 individuals) and 47% female (8 individuals). This composition demonstrates an approximately balanced gender representation, with a slight male majority that reflects the demographic characteristics of professionals in urban planning and sustainable development fields within the regional context.

Age distribution analysis reveals three distinct cohorts among participants. The 25-35 years age group represents 24% (4 individuals), while the 35-45 years demographic constitutes the largest segment at 53% (9 individuals). Participants aged 45-55 years and above comprise 24% (4 individuals). This distribution indicates that the majority of participants belong to the professionally active middle-age range, suggesting substantial career experience while maintaining contemporary perspectives on sustainable development practices.

Educational attainment demonstrates exceptionally high academic qualifications within the participant group. Master's degree holders constitute 29% (5 individuals), while doctoral degree recipients represent 71% (12 individuals). This educational profile indicates that the research captured insights from highly qualified professionals and academics, ensuring expert-level understanding of complex sustainable development and urban resilience concepts.

Professional experience analysis reveals varied career stages among participants. Those with 1-5 years of experience represent the largest group at 41% (7 individuals), followed by participants with 5-10 years of experience at 24% (4 individuals). Participants with 10-15 years of experience comprise 18% (3 individuals), while those with 15-20 years and above constitute 18% (3 individuals). This distribution suggests that while the sample includes seasoned professionals, a significant portion consists of newer practitioners who bring contemporary training and fresh perspectives to sustainable development challenges.

The demographic analysis indicates a participant group characterized by gender balance, professional maturity concentrated in the 35-45 age range, exceptionally high educational qualifications with doctoral-level expertise predominating, and diverse professional experience ranging from emerging to senior practitioners. This composition ensures comprehensive representation of professional perspectives while maintaining academic rigor in data collection and analysis.

6.3. Grounded theory analysis results

The paradigmatic model derived from systematic data coding represents a comprehensive framework for integrating sustainable development and resilience principles within Rudsar city's physical development context. This analytical framework emerged through rigorous application of grounded theory methodology, revealing complex relationships between multiple factors that influence sustainable urban development outcomes.

The central phenomenon identified through data analysis is "integrating sustainable development and resilience

principles to enhance physical development quality while reducing urban vulnerability." This core concept represents the primary objective toward which all identified factors and strategies converge, reflecting participants' shared understanding of the fundamental challenge facing Rudsar city's development trajectory.

Causal conditions constitute the foundational elements that initiate and drive the central phenomenon. These include the establishment of supportive policy frameworks that facilitate sustainable development implementation, formulation of transparent legal structures that provide clear regulatory guidance, strengthening of socioeconomic resilience mechanisms that enhance community adaptive capacity, and expansion of citizen participation processes that ensure democratic engagement in development planning. These causal factors provide the essential groundwork for achieving sustainable and resilient urban development outcomes.

Contextual conditions function as the environmental framework within which the central phenomenon operates. Key contextual elements encompass sustainable urban infrastructure development that supports long-term functionality, recognition and incorporation of indigenous characteristics that preserve local identity and cultural heritage, and institutional synergy that promotes coordinated action across governmental and non-governmental organizations. These contextual factors establish the operational environment necessary for effective integration of sustainability and resilience principles.

Intervening conditions represent external challenges and constraints that influence the implementation of sustainable development strategies. Climate change impacts create environmental pressures that require adaptive responses, financial limitations constrain available resources for development initiatives, and social resistance may emerge from communities uncertain about proposed changes. These intervening factors require careful consideration and strategic management to prevent obstruction of development objectives.

Table 1
Findings of Open, Axial, and Selective Coding

Selective Coding	Axial Coding	Open Coding
Paradigm	Main Categories	Sub-categories
Central Phenomenon	"Integration of sustainable development and resilience principles to enhance the quality of physical development in Rudsar city and reduce its vulnerability to environmental and social hazards"	Need for sustainable physical development for Rudsar city Design and implementation of comprehensive urban development programs Strengthening urban and cultural infrastructure Attention to climate change and reducing environmental impacts Preserving cultural and social identity in development plans Increasing resilience against natural disasters Reducing energy consumption and using renewable energy Strengthening social and economic justice at city level
Causal Conditions	Existence of supportive policies and transparent laws	Formulating facilitating laws and regulations for sustainable development projects Financial support and investment from government and private sector Using new technologies for urban planning and management

	Accurate analysis of local capacities and needs	Developing educational and awareness programs about sustainable development and resilience
	Strengthening social and economic resilience	Increasing citizen participation in urban decision-making and planning Supporting local businesses and strengthening regional economy Creating communication networks and cooperation between government and private institutions
Contextual Conditions	Existence of sustainable urban infrastructure	Developing public transportation infrastructure, renewable energy and urban facilities Attention to local and cultural characteristics of the region in development design Strengthening dynamic and suitable public spaces for social interactions Access to accurate and up-to-date data for development decisions
	Synergy for improving urban programs	Creating coordination between local, national and international institutions Strengthening research and scientific studies related to sustainable development and resilience Access to sufficient financial and equipment resources
Intervening Conditions	Climate and environmental changes	Increasing natural disasters such as floods and earthquakes in Rudsar region Increasing pressure on urban infrastructure due to uncontrolled migration Financial and budgetary limitations for implementing plans Social resistance against physical changes Lack of coordination among related institutions
	Economic and financial factors	Budget shortage and financial resources for implementing sustainable and resilient development projects Need to attract foreign and domestic investment for urban projects
Strategies	Formulating integrated policies for sustainable development and resilience in physical planning	Developing integrated programs for sustainable and physical management of Rudsar city Using smart technologies for resource and infrastructure management Developing green and pedestrian-oriented neighborhoods to reduce pollution and increase social interactions Encouraging citizens to use clean and renewable energy Strengthening management capacities at local and national levels
	Planning to reduce environmental damage and waste management	Strengthening local community and stakeholder participation in sustainable and resilient development process Creating communication networks among local, regional and national stakeholders for knowledge and resource exchange Encouraging private sector investment in resilient and sustainable urban projects Designing participatory mechanisms to involve citizens in urban decision-making
Consequences	Improving urban planning quality towards sustainable development and resilience	Reducing Rudsar city's vulnerability to natural and human threats Improving physical planning processes with emphasis on optimal use of natural resources Strengthening environmental and social impact assessment tools in urban projects
	Increasing physical and social resilience in facing environmental changes	Strengthening urban infrastructure to deal with natural disasters (such as floods and earthquakes) Enhancing awareness and participation of local community in resilient development processes Creating new patterns for city physical development with emphasis on preserving local and cultural identity

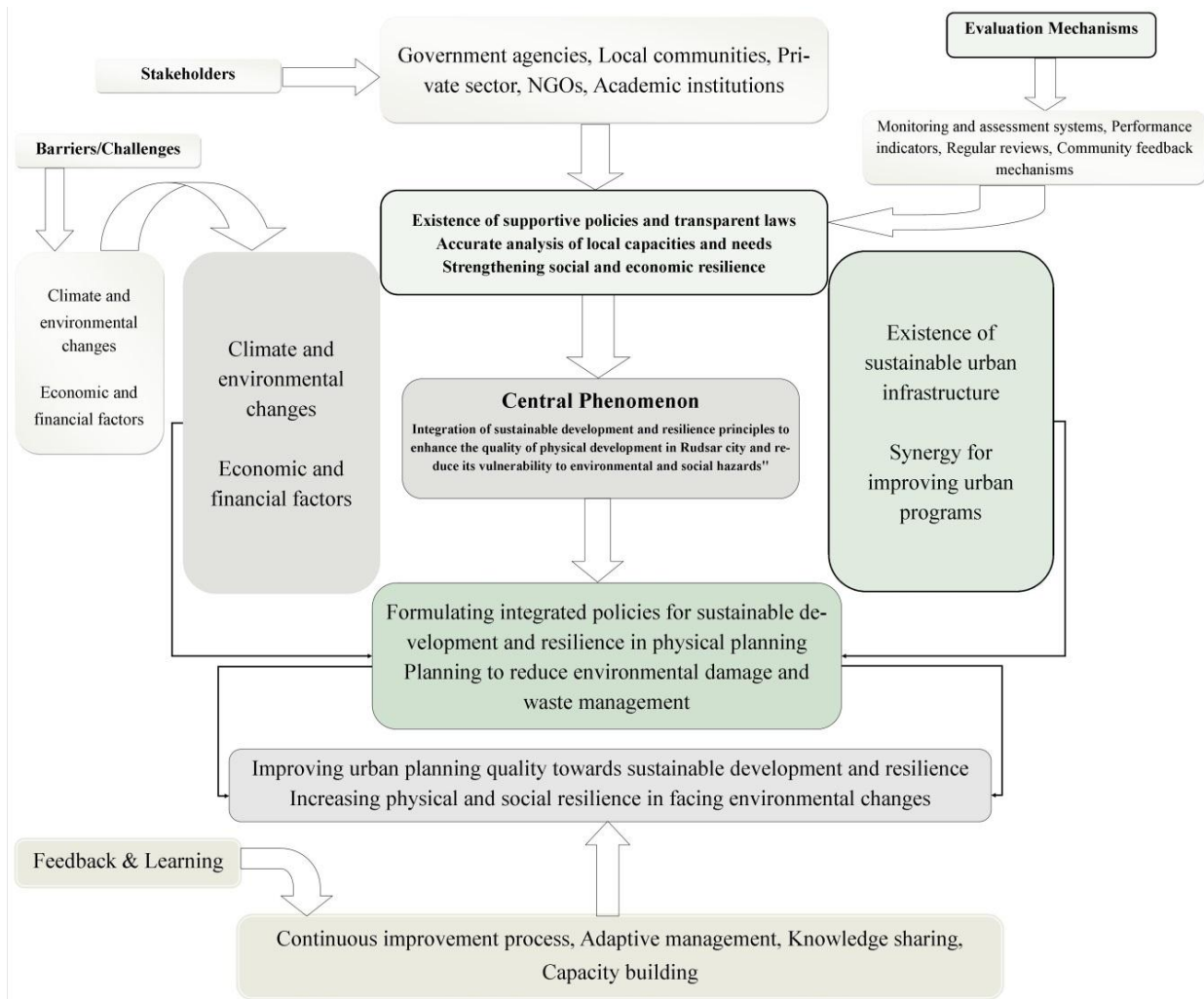


Fig. 3. Paradigmatic model of explaining the combined conceptual model of sustainable development and resilience and its application in physical development of rudsar city based on grounded theory approach

The research conducted by Azadeh et al. (2019) demonstrates direct contextual relevance to the present study through its focus on Rudsar city, specifically examining the Hosam neighborhood while addressing infrastructure challenges and resource management issues. These findings provide valuable primary data for identifying causal and contextual conditions within the grounded theory paradigmatic model employed in the current research. The methodological distinction between studies lies in their analytical approaches: whereas Azadeh's investigation concentrated on urban quality indicators, the present research endeavors to construct an integrated model combining sustainable development and resilience principles through grounded theory methodology. This comparative perspective enriches understanding of local development challenges while establishing foundations for theoretical model construction. Alizadeh et al. (2020), through their examination of villages within Rudsar County, emphasize the critical importance of local management effectiveness and community participation in development processes. Their insights contribute significantly to strategy formulation within the conceptual framework of the current research. The role of local management in physical-spatial development transformations highlighted in their study constitutes an important categorical component within the grounded theory coding process of the present investigation. This research demonstrates how grassroots governance

mechanisms influence development outcomes, providing empirical support for participatory approaches in sustainable urban planning. Dadres et al. (2015) exhibit substantial thematic alignment with the current research through their direct focus on sustainable spatial development within Rudsar city. Their findings regarding the necessity for comprehensive revision of urban planning frameworks with enhanced emphasis on environmental protection can be conceptualized as intervening conditions within the grounded theory paradigmatic model of the present study. This research establishes precedent for environmental considerations in local planning processes while identifying specific challenges that require systematic intervention strategies. Rezaei et al. (2021), despite geographical divergence from the current research focus through their examination of Tehran's District 22, maintain close thematic relevance to urban land use resilience concepts. Their conclusions emphasizing the necessity for integrated approaches in land management to address multifaceted hazards provide valuable insights for consequence formulation and strategy development within the conceptual model of the present research. The transferability of their methodological approach to different urban contexts demonstrates the universal applicability of resilience principles while acknowledging local contextual variations. Datola's investigation (2023) contributes a comprehensive framework for urban resilience assessment that

proves instrumental in identifying resilience indicators relevant to the current study. The research emphasis on inter-sectoral cooperation requirements and stakeholder participation mechanisms aligns with strategic considerations within the conceptual model of the present investigation. This international perspective provides methodological validation for participatory approaches while offering practical frameworks for resilience measurement and evaluation. Zhao et al. (2024) employ analytical methodologies for identifying factors influencing urban resilience, contributing valuable insights to the axial coding process and identification of causal and contextual conditions within the current research framework. The primary methodological distinction involves cultural-geographical context considerations that necessitate careful localization of findings to ensure applicability within Iranian urban development contexts. Their systematic approach to factor identification provides methodological guidance while highlighting the importance of contextual adaptation in cross-cultural research applications.

Tabibian and Movahed (2016) demonstrate the closest thematic affinity with the objectives of the present research through their provision of a conceptual framework integrating resilience and sustainability principles in urban planning contexts. Their theoretical framework serves as a primary comparative source for evaluating the conceptual model derived from grounded theory analysis in the current investigation. The convergence of theoretical perspectives validates the integrated approach while providing established precedent for combining sustainability and resilience concepts in urban development planning. Walker and Salt (2005) contribute essential theoretical foundations through their systemic conceptualization of resilience principles, providing comprehensive frameworks for understanding complex adaptive systems. The systemic approach presented in their seminal work enables integration of diverse dimensions of sustainable development and resilience within the conceptual model of the current research. Their theoretical contributions establish foundational principles for systems thinking approaches to urban development while providing analytical frameworks for understanding interconnections between environmental, social, and economic factors in urban resilience. The comparative analysis reveals that while previous research has addressed individual components of sustainable development and resilience in various contexts, the present study contributes unique value through its integrated theoretical approach specifically applied to Rudsar city's development challenges. The grounded theory methodology enables empirically-based model construction that incorporates local contextual factors while building upon established theoretical frameworks. This positioning allows the research to bridge gaps between theoretical conceptualization and practical application while contributing to both academic understanding and practical planning approaches for sustainable urban development in similar contexts.

7. Conclusion

The development of a conceptual model integrating sustainable development and resilience principles through grounded theory methodology has yielded a comprehensive framework for addressing physical development challenges in Rudsar city. This theoretical construct presents a systematic approach to urban problem-solving through systematic identification of causal conditions, contextual factors, intervening variables, strategic interventions, and anticipated consequences. The integration of sustainable development and resilience principles within this framework enables coordinated resource management, resilient infrastructure design, and optimal urban space utilization. Successful implementation of this model in Rudsar city

necessitates effective collaboration among local, national, and international institutions, active citizen engagement, and strategic adoption of innovative technologies. The anticipated outcomes of model implementation encompass enhanced quality of life for residents, reduced environmental degradation, and strengthened disaster resilience capacity.

The imperative for examining sustainable development and resilience integration in Rudsar city emerges from multifaceted challenges confronting the municipality across environmental, economic, and social domains. Rudsar's unique geographical positioning between mountainous terrain and maritime coastline creates exposure to natural hazards including floods and landslides, necessitating enhanced physical resilience mechanisms. The convergence of heterogeneous infrastructure development patterns, tourism-induced pressure on natural resources, and inadequate coordination among urban management sectors underscores the critical need for comprehensive, sustainable planning approaches. Climate change impacts and escalating environmental threats have intensified the urgency of formulating an integrated sustainable development and resilience model. This research examination provides foundations for practical solution development to address both current and anticipated future challenges facing Rudsar city.

The research opportunities and analytical strengths lie in providing an interdisciplinary, comprehensive approach to Rudsar city's physical development challenges. The application of grounded theory methodology has facilitated extraction of an indigenous theoretical model specifically adapted to local conditions while remaining grounded in empirical realities. The synthesis of sustainable development and resilience principles within a unified framework represents the primary scientific innovation of this investigation, providing comprehensive guidance for simultaneously addressing urban sustainability imperatives and vulnerability reduction objectives. The qualitative methodology employing sequential exploratory strategies has enabled thorough yet generalizable examination across multiple dimensions of the research topic. The participation of both local practitioners and academic experts throughout the research process has enhanced both scientific rigor and practical applicability of findings, establishing a replicable model for similar urban contexts. The direct applicability of research outcomes for urban managers and planning professionals constitutes a fundamental strength of this study. The central phenomenon of "explaining the integrated conceptual model of sustainable development and resilience in Rudsar city's physical development" plays a pivotal role in enhancing urban physical sustainability through strategic integration of sustainable development and resilience principles. Multiple dimensions of this phenomenon encompass contextual, causal, and intervening conditions alongside strategic interventions that directly and indirectly influence physical development outcomes.

The causal conditions underpinning this model include formulation of transparent legislative frameworks, comprehensive analysis of indigenous capacities and resources, development of integrated planning programs, and enhancement of public awareness regarding sustainability principles. Contextual conditions including standardized infrastructure development, incorporation of cultural heritage characteristics, creation of dynamic public spaces, and institutional collaboration mechanisms are essential prerequisites for model realization. Intervening conditions such as climate change impacts, financial resource constraints, unregulated migration pressures, and inadequate institutional coordination create implementation challenges requiring strategic management approaches. Primary strategic interventions encompass

sustainable infrastructure development, green neighborhood design implementation, renewable energy system adoption, crisis management capacity strengthening, and comprehensive citizen participation mechanisms. The scientific contributions of this model include provision of a comprehensive theoretical framework, advancement of urban resilience knowledge, creation of innovative research platforms, and development of sophisticated assessment methodologies. Despite substantial advantages, implementing the integrated sustainable development and resilience model confronts multiple challenges and systemic obstacles. Structural limitations within governmental institutions can impede progress and potentially halt achievement of development objectives. Social and cultural barriers, including insufficient public trust in planning processes, can diminish citizen participation effectiveness in collaborative planning initiatives. Additionally, economic constraints and limited financial resource availability represent significant factors that can disrupt model implementation and compromise long-term sustainability objectives. The conceptual model of sustainable development and resilience developed for Rudsar city demonstrates consistency with Brian Walker and David Salt's theoretical approach presented in "Resilience Thinking," as both frameworks emphasize systematic, integrated approaches to environmental, social, and economic challenges. The primary distinction lies in the current research's focus on practical application of these concepts within Rudsar city's physical development context, while Walker and Salt's work concentrates on theoretical and scientific resilience frameworks. The proposed model exhibits theoretical affinity with concepts presented in "Encounters in Planning Thought," compiled by Haselsberger, particularly regarding participatory planning approaches, attention to institutional and contextual factors, and recognition of interaction dynamics between social and physical elements in urban development processes. Furthermore, the current research findings align with conclusions presented in "Sustainable Resilient City" by Pearson et al., with both studies emphasizing integrated approach necessity, innovation prioritization, and good governance principles for achieving sustainable and resilient urban environments. The distinguishing characteristic of the current research lies in its application of grounded theory methodology to extract an indigenous model specifically adapted to Rudsar city's unique contextual conditions. The current investigation has encountered several limitations that have influenced research effectiveness and scope. First, restricted access to comprehensive, current data regarding Rudsar city's physical and infrastructure conditions has limited the precision of existing condition analysis. Second, resistance from certain urban management officials and relevant institutions in providing information and research collaboration has created challenges during data collection phases. Third, unfavorable economic conditions and financial constraints have prevented implementation of pilot research findings and examination of practical outcomes. Fourth, temporal and budgetary limitations have restricted possibilities for longitudinal studies and systematic monitoring of change processes over extended periods. Fifth, the generalizability of findings to other urban contexts, considering Rudsar's unique geographical, economic, and social characteristics, requires careful consideration and contextual adaptation. These limitations provide direction for future research endeavors that could expand upon the theoretical framework developed in this study while addressing practical implementation challenges through pilot project development, longitudinal impact assessment, and comparative analysis across similar urban contexts.

8. Recommendations and Implementation Solutions

The deployment of 200 intelligent waste collection units equipped with ultrasonic fill-level sensors and 4G connectivity represents a transformative approach to municipal waste management. These smart bins will enable automated collection scheduling based on real-time capacity monitoring, optimizing collection routes and reducing operational costs while minimizing environmental impact through reduced fuel consumption and traffic congestion. The implementation should follow a phased approach, beginning with high-traffic areas and commercial districts before expanding to residential neighborhoods.

The establishment of an automated waste sorting facility with 100-ton daily processing capacity will significantly enhance Rudsar's waste management efficiency while contributing to municipal energy independence. This facility should incorporate advanced sorting technologies including optical sorting, magnetic separation, and air classification systems to maximize material recovery rates. The integrated biogas production component will convert organic waste into renewable energy for municipal operations, creating a circular economy model that transforms waste streams into valuable resources. The facility design should include provisions for future expansion and technology upgrades to accommodate growing waste volumes and evolving processing technologies.

of neighborhood emergency response teams comprising trained volunteers across all districts of Rudsar city will create a distributed resilience network capable of rapid response to natural disasters and urban emergencies. Each team should receive comprehensive training in first aid, basic search and rescue operations, emergency communication protocols, and community coordination procedures. These teams will serve as critical links between professional emergency services and local communities, providing immediate assistance during the crucial first hours of emergency situations when formal response systems may be overwhelmed or inaccessible.

The development of strategic partnerships with universities will establish ongoing research capabilities for monitoring urban development impacts and evaluating the effectiveness of implemented solutions. These collaborations should focus on creating longitudinal studies that track key performance indicators related to sustainability, resilience, and quality of life improvements. Research partnerships will enable evidence-based policy adjustments and continuous refinement of development strategies while contributing to the broader academic understanding of sustainable urban development in coastal and mountainous contexts.

The creation of dedicated bicycle and pedestrian pathways connecting residential areas to commercial centers and recreational facilities will promote sustainable transportation while enhancing public health and social interaction opportunities. This network should incorporate universal design principles to ensure accessibility for all users, including individuals with mobility limitations. The pathway system should integrate with existing public transportation nodes to create seamless multimodal connectivity while incorporating safety features such as adequate lighting, security cameras, and emergency call stations.

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