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The Science Popularization Ecosystem Paradigm in Iran

Akram Ghadimi[1], Elahe Hejazi[2], Somayeh Karimizadeh Ardakani[3]

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Abstract

Purpose: This study designs a paradigm for Iran's science popularization ecosystem, providing a framework for fostering coherence, informing policy-making, and enabling operationalization at the national level. The ecosystem is conceptualized as a dynamic network of institutions, actors, resources, and interactions aimed at bridging the gap between science and society.

Methodology: A qualitative research design was employed, utilizing focus groups and document analysis as the primary methods.

Findlings: The proposed paradigm for Iran's science popularization ecosystem is predicated on the dynamic interactions among four key components: internal, external, environmental, and institutional. Its implementation faces significant challenges, including conceptual ambiguity, institutional fragmentation, limited financial resources, a lack of indigenous models, low public science literacy, underutilization of media platforms, and the absence of a central coordinating body to regulate and synergize the activities of various stakeholders.

Conclusion: In the absence of a shared paradigm, science popularization efforts in Iran remain fragmented and ineffective. The proposed paradigm offers both conceptual and structural coherence, establishing a necessary foundation for effective policy formulation. Its impact, however, can only be realized upon its institutionalization as a common framework and through the collective participation of all relevant actors.

Value: This study provides a comprehensive theoretical and operational framework. It addresses a critical conceptual gap in the domain of science popularization in Iran and offers a substantive basis for future strategic planning and high-level policy development.

Keywords: ***Science Popularization, Ecosystem Paradigm, Institutional Structures, Strategic Coordination, Science Policy***

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1. Associate Professor, Department of Futures Studies of Science and Technology, National Research Institute for Science Policy (NRISP), Tehran, Iran. (Corresponding Author)Email: ghadimi.nrisp@gmail.com
2. Professor, Department of Psychology, University of Tehran, Tehran, Iran.
3. Ph.D., Graduate in Sociology, Research Expert, National Research Institute for Science Policy (NRISP), Tehran, Iran.

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Extended Abstract

Introduction: Science popularization, as a fundamental pillar of scientific, cultural, and social development, plays a crucial role in bridging the gap between science and society while enhancing public trust in science (Cornelis, 1998; Olson et al., 2004). Conceptualized as a *science popularization ecosystem*, this process comprises a dynamic network of institutions, actors, resources, and interactions. By fostering synergy among social, cultural, economic, and institutional elements, it facilitates effective knowledge transfer and strengthens the bidirectional relationship between science and society (Morr, 1996; Raan & Jae, 2013).

In Iran, science popularization faces significant challenges, including the absence of a coherent theoretical and operational framework, institutional fragmentation, limited financial resources, inadequate audience analysis, and the underutilization of media platforms (Ghadimi, 2019; 2023). These shortcomings underscore the lack of a unifying paradigm to guide the science popularization ecosystem, highlighting the pressing need for a comprehensive framework to ensure coherence, synergy, and coordinated management of public outreach activities (Ghadimi, 2023). Consequently, integrating the concepts of **"paradigm"** and **"ecosystem"** offers a multi-layered perspective on science popularization and provides a foundation for effective policy formulation and strategic planning in this field.

Purpose: The aim of this study is to design and elaborate a paradigm for the science popularization ecosystem in Iran—a framework capable of transforming existing fragmented activities into a coherent and efficient system. The main research question is: What are the components and requirements of the science popularization ecosystem paradigm in Iran, and how can they contribute to the coherence, policy-making, and institutionalization of popularization activities at the national leve? (Papanelopoulou & Galan, 2009; Vesali et al., 2007).

Methodology: This study employed a qualitative, inductive approach to develop a conceptual paradigm for the science popularization ecosystem in Iran. Data were collected through two primary methods: (1) document analysis of 35 national and international policy and scientific documents, and (2) 46 semi-structured interviews with experts in science popularization, policy-making, education, media, and civil society. Participants were selected via purposive sampling to ensure diversity across institutional types and functional roles. Data analysis was conducted using thematic analysis with the support of MaxQDA software (Mayring, 2000; Elo & Kyngäs, 2008). To enhance the validity and reliability of the findings, multiple strategies were employed: data triangulation, member checking, and a three-round Delphi method involving five experts. This process culminated in an 85% consensus on the final proposed paradigm (Kressel, 2013; Flick, 2018; Lincoln & Guba, 1985).

Findings: The analysis revealed that the science popularization ecosystem paradigm in Iran comprises three principal layers: (1) institutional–structural, (2) cultural–social, and (3) technological–operational.

Institutional–Structural Layer: A key finding is that fragmented institutional structures and the absence of a central coordinating body constitute fundamental barriers. While organizations such as the Ministry of Science, Research and Technology and the Academy of Sciences of Iran have undertaken various initiatives, the lack of an overarching coordinating institution has resulted in duplicated efforts

and inefficient resource allocation. Therefore, the ecosystem paradigm necessitates the establishment of a dedicated central coordinating body and a specific budgetary allocation for science popularization (Ghadimi & Hejazi, 2022).

Cultural–Social Layer: This layer identifies significant challenges, including public mistrust towards science and a predominantly instrumentalist public perception that views science primarily as technology or a utilitarian tool, rather than as an integral part of culture or daily life (Bourdieu, 1988; Nowotny, Scott, & Gibbons, 2001). Consequently, the ecosystem paradigm underscores the critical importance of fostering cultural capital and promoting civic engagement to effectively bridge the gap between scientific institutions and society.

Technological–Operational Layer: The analysis of this layer highlights the insufficient utilization of media, digital platforms, and public science education tools. The science popularization ecosystem in Iran requires a comprehensive technological transformation and the redesign of communication tools to deliver scientific content in an interactive, accessible, and audience-tailored manner (Boni, Milestone, & Vesuri, 2008).

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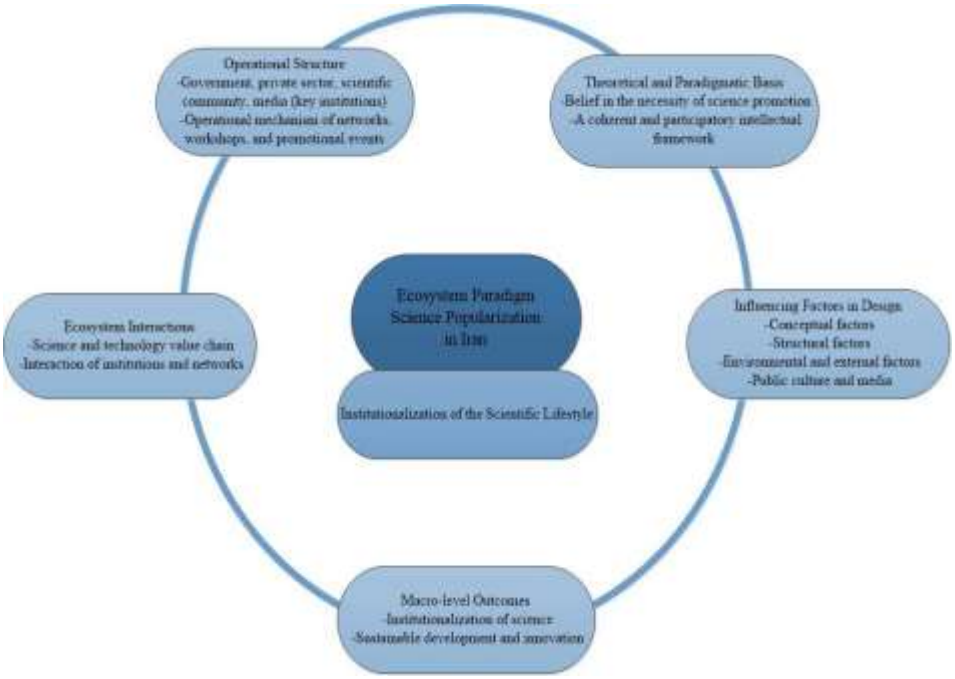
Conceptual Model

The proposed conceptual model (see Figure 1) is grounded in the aforementioned three-layer structure. This framework is theoretically informed by Kuhn's theory of scientific paradigms (1962), Adner's innovation ecosystem theory (2006), Bourdieu's theory of cultural capital (1988), and the theory of public participation in science (Bonney et al., 2008). Accordingly, the model emphasizes a networked governance approach and highlights the critical interactions among institutions and the active participation of civil society as central components.

Figure



1. Conceptual Model of the Science Popularization Ecosystem in Iran.

Conclusion: The findings of this study demonstrate that, in the absence of a shared paradigm, science popularization activities in Iran remain fragmented and largely ineffective. The proposed ecosystem paradigm addresses this gap by

establishing essential conceptual and structural coherence. This foundation creates the necessary preconditions for implementing networked governance, fostering institutional development, and enhancing collective participation among all stakeholders. The practical implementation of this framework necessitates a strategic approach involving phased actions and targeted pilot initiatives within academic and scientific institutions.

Value: This study represents the first comprehensive attempt to design an ecosystem paradigm for science popularization in Iran. Its primary contribution lies in providing a contextually grounded, policy-relevant framework that addresses the existing conceptual gap and establishes a foundation for evidence-based national policymaking and sustainable scientific development (Ghadimi & Hejazi, 2022; Kraus et al., 2025). Furthermore, the proposed paradigm holds potential for adaptation and application at the regional level.

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