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STRATEGIC MANAGEMENT EVALUATION OF U.S. INNOVATION POLICY: OPERATIONALIZING THE LIFEG FRAMEWORK

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Abstract. This study examines U.S. innovation policy through the lens of strategic management by developing and operationalizing the LIFEG Framework (Likhota Innovation Policy Effectiveness and Governance Framework) as an evaluative model for assessing the strategic management coherence of national innovation systems. Existing approaches often analyze innovation policy through isolated indicators, such as public R&D funding, institutional structures, patent activity, or commercialization outcomes, while providing limited tools for evaluating how strategic priorities, governance mechanisms, support instruments, and economic outcomes are managed as an integrated system. The proposed framework integrates five dimensions: institutional governance, public support mechanisms, commercialization capacity, strategic technological priorities, and economic performance. The study applies a mixed-method approach combining theoretical analysis with empirical assessment based on publicly available U.S. and international data, including federal R&D obligations, national R&D expenditures, R&D intensity, patent activity, agency-level strategic concentration, and comparative international innovation indicators. The findings show that the effectiveness of U.S. innovation policy depends not only on the scale of funding or individual policy instruments, but on the quality of strategic management across governance structures, support mechanisms, commercialization processes, technological priorities, and economic outcomes. The article contributes to innovation management and public administration research by introducing an operational framework for evaluating policy coherence within complex national innovation systems.

Key words: strategic management; innovation management; innovation policy; innovation governance; U.S. innovation system; policy evaluation; R&D management; commercialization capacity; technological priorities; economic performance; LIFEG Framework.

Introduction. Strategic management of innovation policy has become one of the central factors shaping technological competitiveness, long-term economic development, and the adaptive capacity of national innovation systems. In advanced economies, innovation is not determined only by market forces or isolated public support instruments; it depends on the ability of institutions to coordinate priorities, allocate resources, support commercialization, and align technological development with broader economic objectives. In this context, the evaluation of U.S. innovation policy should be understood not only as a question of public governance, but also as a problem of strategic innovation management.

The growing complexity of innovation systems has significantly expanded the analytical scope of innovation policy research. Classical economic approaches identify innovation as a major driver of structural transformation and economic growth (Schumpeter, 1934). National innovation systems theory further emphasizes the importance of institutional interaction, knowledge exchange, and systemic learning processes in shaping innovation outcomes (Freeman, 1987; Nelson, 1993; Lundvall, 2010). More recent governance-oriented approaches, including the Triple Helix framework and the entrepreneurial state perspective, highlight the active role of public institutions, universities, industry, and state coordination in technological development (Etzkowitz & Leydesdorff, 2000; Mazzucato, 2013).

Despite these theoretical advances, an important limitation remains within the existing literature. Most approaches explain the structure and functioning of innovation systems, but provide limited operational tools for evaluating innovation policy effectiveness as a multidimensional management and governance outcome. Existing studies frequently examine isolated dimensions of innovation systems, such as public R&D expenditures, institutional structures, patent activity, or commercialization processes, without integrating them into a unified evaluative framework. As a result, innovation policy effectiveness is often assessed through fragmented indicators that fail to capture the systemic interaction between governance, public support, commercialization, strategic direction, and economic performance.

This limitation is particularly significant in the case of the United States. The U.S. innovation system operates through a decentralized and multi-level governance architecture involving federal agencies, research institutions, universities, mission-oriented programs, and private-sector actors. Innovation policy in the United States is not coordinated through a single centralized authority; instead, it emerges through the interaction of differentiated institutional structures, funding mechanisms, strategic technological priorities, and commercialization channels. Consequently, evaluating policy effectiveness requires an analytical model capable of assessing not only individual instruments, but also the coherence of their interaction within the broader innovation management and governance system.

Prior research has demonstrated the importance of state regulation, institutional coordination, and strategic technological support in shaping innovation outcomes in the United States (Likhota, 2025a; Likhota, 2025b; Likhota, 2025c). Additional studies have emphasized the role of intellectual property regulation, commercialization mechanisms, and the relationship between innovation policy and economic development (Likhota, 2025d; Likhota, 2025e). However, existing approaches remain primarily descriptive and do not provide an integrated operational framework for evaluating innovation policy effectiveness across multiple governance and performance dimensions.

To address this gap, this study develops and operationalizes the LIFEG Framework (Likhota Innovation Policy Effectiveness and Governance Framework) as a strategic management and governance-based evaluation model for assessing U.S. innovation policy effectiveness. The framework integrates five analytical dimensions: institutional governance, public support mechanisms, commercialization capacity, strategic technological priorities, and economic performance. Rather than treating innovation policy as a set of isolated instruments, the framework conceptualizes effectiveness as the result of strategic management coherence among institutional, financial, commercialization, technological, and economic components of the innovation system.

The study applies a mixed-method research design combining theoretical analysis with empirical assessment based on publicly available U.S. and international data. The empirical component incorporates indicators related to federal R&D obligations, national R&D expenditures, R&D intensity, patent activity, strategic agency concentration, and comparative international innovation performance. These indicators are used to operationalize the LIFEG Framework as a multidimensional evaluative structure for analyzing innovation policy effectiveness within a complex governance environment.

The central argument of the study is that the effectiveness of U.S. innovation policy is determined not by isolated policy instruments or funding volumes alone, but by the coordinated interaction of governance structures, public support mechanisms, commercialization processes, strategic technological prioritization, and broader economic outcomes. In this respect, the study shifts the analytical focus from descriptive innovation-system analysis toward operational evaluation of strategic innovation-management coherence and performance.

The contribution of the article is threefold. First, it introduces an original strategic management and governance-based framework for evaluating innovation policy effectiveness. Second, it operationalizes the framework using empirical indicators derived from publicly available institutional and international datasets. Third, it applies the framework to the U.S. innovation system, demonstrating how innovation policy effectiveness can be evaluated through the strategic interaction of institutional coordination, public support, commercialization capacity, technological prioritization, and economic-performance outcomes.

Main text. The theoretical basis of this study is formed by innovation systems theory, governance-oriented approaches to innovation policy, and public administration research. Classical economic theory considers innovation a key driver of economic development and structural transformation (Schumpeter, 1934). The concept of national innovation systems emphasizes institutional interaction, knowledge flows, and learning processes among firms, universities, research organizations, and public authorities (Freeman, 1987; Nelson, 1993; Lundvall, 2010). Governance-oriented approaches, including the Triple Helix model and the entrepreneurial state perspective, further demonstrate the role of public institutions, universities, industry, and state coordination in shaping technological development (Etzkowitz & Leydesdorff, 2000; Mazzucato, 2013).

From the perspective of strategic management, innovation policy can be viewed as a system of coordinated managerial decisions aimed at setting priorities, allocating resources, organizing institutional interaction, supporting commercialization, and monitoring performance outcomes. This interpretation connects innovation governance with management theory, since the effectiveness of national innovation systems depends not only on institutional structure, but also on the quality of strategic coordination, resource management, and adaptive decision-making.

At the same time, these approaches are more effective at explaining the structure and functioning of innovation systems than at evaluating innovation policy effectiveness as a multidimensional management and governance outcome. Existing studies often analyze separate aspects of innovation systems, including public R&D funding, institutional design, patent activity, commercialization, or strategic technological priorities. However, the effectiveness of innovation policy depends not only on these elements separately, but also on the coherence of their interaction within the broader innovation management and governance system.

This limitation is particularly important in the case of the United States, where innovation policy operates through a decentralized and institutionally differentiated architecture involving federal agencies, research institutions, universities, mission-oriented programs, intellectual property mechanisms, and private-sector commercialization. In such a system, policy effectiveness cannot be adequately assessed through one indicator, such as R&D intensity, patent counts, or funding volume alone. A broader evaluative model is required to examine how governance, support mechanisms, commercialization capacity, strategic priorities, and economic outcomes interact.

To address this issue, the study develops the LIFEG Framework (Likhota Innovation Policy Effectiveness and Governance Framework) as a strategic management and governance-based model for evaluating innovation policy effectiveness. The framework integrates five dimensions: institutional governance, public support mechanisms, commercialization capacity, strategic technological priorities, and economic performance. Institutional governance reflects the coordination capacity and functional specialization of public institutions. Public support mechanisms include R&D funding, grants, mission-oriented programs, and other instruments supporting scientific and technological development. Commercialization capacity captures the ability of the system to transform research and technological knowledge into protected and market-relevant outputs. Strategic technological priorities reflect the capacity of public policy to direct resources toward technologically significant domains. Economic performance functions as the outcome-validation layer of the framework.

Conceptually, the evaluative logic of the framework can be represented as follows:

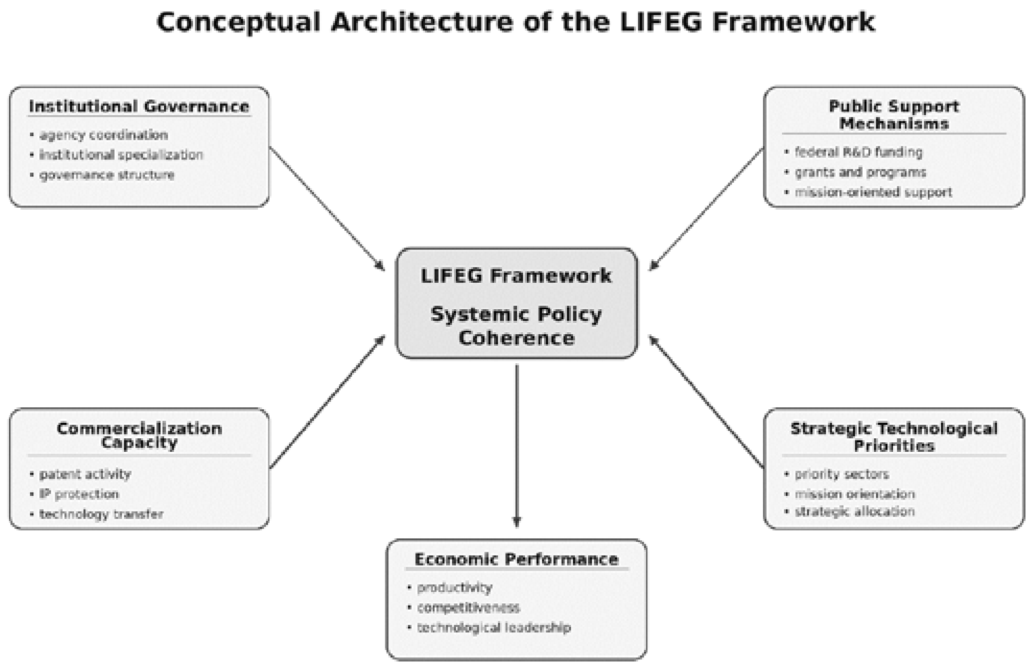
$$\mathbf{IPE = f(G \times S \times C \times T \rightarrow E)}$$

where: **IPE** is Innovation Policy Effectiveness, **G** is Institutional Governance, **S** is Public Support Mechanisms, **C** is Commercialization Capacity, **T** is Strategic Technological Priorities, and **E** is Economic Performance.

The formula does not represent an econometric equation or a weighted composite index. Rather, it illustrates the strategic management logic of the framework, according to which economic performance emerges from the coordinated management of governance structures, support mechanisms, commercialization processes, and technological priorities. The multiplicative logic of the framework emphasizes interdependence: a critical weakness in any major dimension may compromise overall policy effectiveness even when other dimensions demonstrate strong performance.

Diagram 1 presents the conceptual architecture of the LIFEG Framework and illustrates the interaction among its five analytical dimensions.

Diagram 1. LIFEG Framework as a Strategic Management Model for Evaluating U.S. Innovation Policy



Source: developed by the author

The methodological basis of this study is a mixed-method approach combining theoretical analysis, strategic management interpretation, and empirical assessment based on publicly available institutional and statistical data. The study does not construct a weighted econometric index. Instead, it operationalizes the LIFEG Framework as a strategic management evaluation tool for assessing the coherence of U.S. innovation policy across institutional, financial, commercialization, technological, and economic dimensions.

The research logic consists of four stages. First, the theoretical foundations of strategic innovation management, national innovation systems, governance-oriented innovation policy, and public administration are identified. Second, these foundations are integrated into the LIFEG Framework as a five-dimensional model of innovation policy evaluation. Third, each dimension is connected to observable indicators derived from official public datasets. Fourth, the framework is applied to the U.S. innovation system to assess how governance structures, support mechanisms, commercialization capacity, technological priorities, and economic outcomes interact within a complex national innovation system.

The United States was selected as the empirical case because of the scale, complexity, and global significance of its innovation system. U.S. innovation policy operates through a decentralized architecture involving federal agencies, universities, research institutions, private-sector actors, mission-oriented programs, intellectual property mechanisms, and commercialization channels. This makes the U.S. case suitable for evaluating innovation policy not only as a governance system, but also as a strategic management system that coordinates priorities, resources, institutional roles, and performance outcomes.

The LIFEG Framework is operationalized through five interrelated dimensions: institutional governance, public support mechanisms, commercialization capacity, strategic technological priorities, and economic performance. Institutional governance reflects the coordination capacity and functional specialization of public institutions. Public support mechanisms capture the scale and structure of R&D financing and policy-support instruments. Commercialization capacity evaluates the transformation of research and technological knowledge into protected and market-relevant outputs. Strategic technological priorities reflect the direction of public resources toward technologically significant domains. Economic performance functions as an outcome-validation layer that situates innovation policy within broader macroeconomic and competitiveness-related indicators.

The selection of indicators was based on four criteria: conceptual correspondence with the relevant LIFEG dimension; availability from official or internationally recognized public sources; relevance to the U.S. innovation system; and suitability for evaluating system-level strategic management coherence rather than isolated program-level outcomes. The empirical analysis relies primarily on data from the National Center for Science and Engineering Statistics and the National Science Foundation for R&D expenditures, federal R&D obligations, and R&D portfolio structure (NCSES, 2026a; NCSES, 2026b; National Science Board, 2025), the United States Patent and Trademark Office, the World Intellectual Property Organization, IPO & Harrity Analytics, and PitchBook-NVCA Venture Monitor for patent-related and venture-capital indicators (USPTO, 2024; WIPO, 2025; IPO & Harrity Analytics, 2025; PitchBook & NVCA, 2026), and the National Science Board, OECD, World Bank, and NIST CHIPS for America materials for international comparison, macroeconomic indicators, and strategic industrial-policy signals (National Science Board, 2025; OECD, 2024; World Bank, 2024; NIST, 2026).

Data on national R&D expenditures, R&D intensity, federal R&D obligations, and the distribution of R&D responsibilities across federal agencies are used to assess institutional governance, public support mechanisms, and strategic technological priorities. Patent-related indicators are used to evaluate commercialization capacity as a proxy for technological codification and research-to-market conversion. International R&D comparisons, GERD-to-GDP ratios, and the U.S. share of global R&D expenditures are used to support the economic-performance dimension. These indicators are interpreted as multidimensional evaluation proxies rather than as direct causal measures of macroeconomic performance.

Table 1 summarizes the operationalization logic of the LIFEG Framework and shows how each dimension is connected to empirical indicators, data sources, and strategic management evaluation roles.

Presentation of the main research material. The application of the LIFEG Framework to U.S. innovation policy demonstrates that the effectiveness of a national innovation system is determined not only by the availability of resources, institutions, or separate policy instruments, but by the quality of strategic management across interrelated dimensions. In this study, the U.S. innovation system is assessed through five LIFEG dimensions: institutional governance, public support mechanisms, commercialization capacity, strategic technological priorities, and economic performance. This approach allows innovation policy to be interpreted as a strategic management system in which institutional

Table 1

Operationalization of the LIFEG Framework as a Strategic Management Evaluation Tool

LIFEG Dimension	Operational Meaning	Main Indicators / Evidence	Primary Data Sources	Strategic Management Evaluation Role
Institutional Governance	Structure, coordination capacity, and functional specialization of public institutions involved in innovation policy.	Distribution of federal R&D obligations by agency; concentration of R&D responsibilities among major federal agencies; agency-level functional specialization; role of mission-oriented institutions.	NCSES; NSF Science and Engineering Indicators; federal agency data.	Evaluates whether innovation policy is supported by coordinated institutional management and functionally differentiated governance architecture.
Public Support Mechanisms	Financial and policy instruments that enable scientific research, technological development, and innovation activity.	National R&D expenditures; R&D intensity as a share of GDP; federal R&D obligations; business-funded and federally funded R&D as shares of GDP; federal R&D portfolio structure by type of activity.	NCSES; NSF; National Science Board; OECD Main Science and Technology Indicators.	Assesses how financial and policy-support mechanisms are managed to sustain innovation activity.
Commercia-lization Capacity	Ability of the innovation system to convert research outputs and technological knowledge into protected, transferable, and market-relevant results.	Utility patent grants; patent activity; patents in force; intellectual property protection; venture capital dynamics as a market-financing indicator of commercialization capacity.	USPTO; WIPO; IPO & Harrity Analytics; PitchBook-NVCA Venture Monitor.	Evaluates the management of research-to-market conversion and the transformation of technological activity into protected and economically usable outputs.
Strategic Technological Priorities	Directional capacity of innovation policy to concentrate institutional attention and public resources in technologically significant sectors.	Mission-oriented agency concentration; sectoral orientation of federal R&D obligations; priority domains reflected in defense, health, energy, space, basic science, industrial technology programs, and targeted semiconductor-policy instruments.	NCSES; NSF; National Science Board; NIST CHIPS for America; federal agency budget and program data.	Assesses whether innovation policy provides strategic direction and aligns resources with long-term technological priorities.
Economic Performance	Broader outcome-validation layer reflecting the macroeconomic and competitiveness-related environment associated with innovation policy.	GERD-to-GDP ratio; international GERD comparisons; U.S. share of global R&D expenditures; comparative innovation intensity.	National Science Board; OECD; World Bank; NSF/NCSES international comparison data.	Evaluates whether strategic management of governance, support, commercialization, and technological priorities is associated with strong innovation-performance outcomes.

Source: developed by the author

Note: The indicators are used as multidimensional evaluation proxies rather than as components of a weighted composite index.

coordination, resource allocation, commercialization processes, technological direction, and performance outcomes interact within a single analytical structure.

The empirical evidence confirms that the U.S. innovation system is characterized by a high degree of institutional differentiation and strategic specialization. Federal R&D obligations reached USD 194.2 billion in FY 2024, increasing by 4.4% from FY 2023, while preliminary FY 2025 data indicated a relatively stable level of USD 194.1 billion. The five largest federal agencies in the R&D portfolio – DOD, HHS, DOE, NASA, and NSF – accounted for 93% of federal R&D obligations in FY 2024, equivalent to USD 181.4 billion. DOD accounted for 50%, HHS for 25%, DOE for nearly 9%, NASA for 6%, and NSF for 4% of the federal R&D portfolio (NCSES, 2026b). From the perspective of strategic management, this structure shows that U.S. innovation policy is not managed through a single centralized authority, but through a system of specialized agencies whose missions create differentiated channels of technological development.

Public support mechanisms represent the second important layer of strategic innovation management. U.S. research and experimental development performed in 2023 totaled USD 937 billion, while the estimated total for 2024 increased to USD 993 billion (NCSES, 2026a). R&D intensity remained high, amounting to 3.37% of GDP in 2023 and an estimated 3.39% in 2024. In 2024, business-funded R&D accounted for 2.54% of GDP, while federally funded R&D accounted for 0.63% of GDP (NCSES, 2026a). These indicators show that the U.S. system combines strong private-sector innovation capacity with a stable federal support function. Strategically, this means that government intervention does not replace market mechanisms, but supports them by financing basic research, mission-oriented programs, and areas where private actors may underinvest because of uncertainty, long time horizons, or high technological risk.

Commercialization capacity is a key dimension because innovation policy cannot be considered effective if research activity does not translate into protected, transferable, and economically usable results. Public patent statistics show that the USPTO granted 324,042 patents in 2024, representing a 4% increase compared with 2023 (IPO & Harrity Analytics, 2025). In addition, WIPO data indicate that the United States had approximately 3.5 million patents in force in 2024, the second-largest active patent stock after China (WIPO, 2025). These indicators do not measure the economic value of each invention directly, but they demonstrate the scale of technological codification and the institutional capacity to protect innovation outputs. From a strategic management perspective, commercialization capacity functions as the conversion layer of the LIFEG Framework: it connects R&D investment and institutional support with market-relevant technological results.

Strategic technological priorities are reflected in the mission-oriented structure of federal R&D obligations. The concentration of R&D resources in DOD, HHS, DOE, NASA, and NSF indicates that U.S. innovation policy is managed through sectoral missions associated with defense, health, energy, space, and basic science. This does not mean that the system is centrally planned; rather, strategic direction is embedded in the functional mandates of federal agencies. The FY 2024 distribution of federal R&D obligations shows that technological prioritization occurs through resource allocation across mission-oriented institutions (NCSES, 2026b). This feature is important for management analysis because it demonstrates how the U.S. model combines decentralization with strategic selectivity.

Economic performance functions as the outcome-validation layer of the LIFEG Framework. In international comparison, the United States remained the largest R&D-performing economy in 2022, accounting for approximately 30% of global R&D expenditures, compared with 27% for China and 18% for the EU-27. In absolute terms, U.S. GERD reached USD 923.2 billion in current PPP dollars, while China reached USD 811.9 billion and the EU-27 reached USD 542.1 billion. The U.S. GERD-to-GDP ratio was 3.59%, compared with 2.56% for China, 2.11% for the EU-27, 3.13% for Germany, and 5.21% for South Korea (National Science Board, 2025). These indicators confirm the strong global position of the U.S. innovation system, while also showing that performance must be evaluated comparatively rather than in isolation.

Table 2 summarizes the empirical application of the LIFEG Framework to the U.S. innovation system and shows how the five dimensions are connected to observable indicators and strategic management interpretation.

Table 2

Empirical Application of the LIFEG Framework to the U.S. Innovation System

LIFEG Dimension	Empirical Evidence	Strategic Management Interpretation
Institutional Governance	Federal R&D obligations reached USD 194.2 billion in FY 2024. Five agencies – DOD, HHS, DOE, NASA, and NSF – accounted for 93% of the federal R&D portfolio.	The U.S. system is managed through institutional specialization and distributed agency missions rather than through a single centralized innovation authority.
Public Support Mechanisms	U.S. R&D totaled USD 937 billion in 2023 and was estimated at USD 993 billion in 2024. R&D intensity reached 3.39% of GDP in 2024.	Public support operates as an enabling mechanism that complements a predominantly business-driven R&D system.
Commercialization Capacity	The USPTO granted 324,042 patents in 2024. The United States had approximately 3.5 million patents in force in 2024.	Commercialization capacity reflects the system's ability to convert research and technological activity into protected and market-relevant outputs.
Strategic Technological Priorities	Federal R&D obligations are concentrated in agencies associated with defense, health, energy, space, and basic science missions.	Strategic priorities are embedded in mission-oriented agencies and resource allocation rather than imposed through centralized planning.
Economic Performance	The United States accounted for approximately 30% of global R&D expenditures in 2022 and recorded a GERD-to-GDP ratio of 3.59%.	Economic performance validates the broader innovation-management capacity of the system and situates the U.S. model within global competition.

Source: developed by the author based on NCSES (2026a; 2026b), IPO & Harrity Analytics (2025), WIPO (2025), and National Science Board (2025).

The results presented in Table 2 show that the U.S. innovation system demonstrates strong strategic management capacity across all five LIFEG dimensions. Institutional governance is characterized by distributed specialization, where different agencies manage different technological missions. Public support mechanisms provide stability and direction while allowing the private sector to remain the dominant driver of R&D activity. Commercialization capacity is supported by a developed intellectual property system and a high volume of patent activity. Strategic technological priorities are expressed through the concentration of R&D obligations in mission-oriented agencies. Economic performance confirms that these mechanisms are associated with a globally significant innovation system.

At the same time, the LIFEG Framework does not interpret these indicators as direct causal proof that any single policy instrument determines economic performance. Rather, the framework evaluates the coherence of the system as a whole. The U.S. case demonstrates that high innovation performance is generated by the interaction of institutional governance, resource management, commercialization mechanisms, strategic technological direction, and economic outcomes. This is the main analytical advantage of the LIFEG approach: it does not reduce innovation policy assessment to one variable, but evaluates the management coherence of the entire innovation system.

From the perspective of strategic management, the U.S. model can be described as a hybrid innovation-management system. It combines decentralized institutional authority, substantial private-sector R&D, selective federal support, strong intellectual property protection, and mission-oriented technological prioritization. The effectiveness of this model lies not in administrative centralization, but in the capacity to coordinate specialized institutions, align public and private resources, support commercialization, and maintain strategic technological direction.

The empirical application of the LIFEG Framework therefore confirms the central argument of this study: U.S. innovation policy effectiveness is determined by the strategic management of interaction among governance structures, support mechanisms, commercialization capacity, technological priorities, and economic-performance outcomes. This makes the framework useful not only for assessing the U.S. innovation system, but also for future comparative studies of national innovation systems in different institutional and economic contexts.

From a strategic management perspective, the empirical application of the LIFEG Framework should be interpreted not only as a descriptive assessment of the U.S. innovation system, but also as a diagnostic evaluation of its management strengths and potential vulnerabilities. The main analytical advantage of the framework is that it distinguishes between input indicators, conversion indicators, strategic-allocation indicators, and outcome-validation indicators. This distinction allows innovation policy to be assessed as a managed system rather than as a collection of separate statistical measures.

The U.S. case shows that the national innovation system demonstrates strong performance across several dimensions. However, the diagnostic value of the LIFEG Framework lies not only in confirming strengths, but also in identifying strategic tensions. For example, the high role of business-funded R&D indicates strong market-driven innovation capacity, while the lower share of federally funded R&D as a percentage of GDP confirms that federal support plays a selective and stabilizing role rather than a dominant financing role. Similarly, the concentration of federal R&D obligations in a small number of mission-oriented agencies reflects strategic specialization, but also shows that the direction of innovation policy depends heavily on the priorities and budgetary dynamics of these agencies.

An additional management-relevant indicator is the distribution of federal R&D obligations by type of activity. In FY 2023, 25% of federal R&D obligations were devoted to basic research, 29% to applied research, and 46% to experimental development. In absolute terms, this represented USD 47.3 billion for basic research, USD 54.3 billion for applied research, and USD 84.8 billion for experimental development (National Science Board, 2025). This structure demonstrates that federal innovation support is not limited to scientific knowledge generation, but also extends across applied and development-oriented stages of the innovation cycle. From the perspective of strategic innovation management, this indicates a portfolio-based approach in which public support is distributed across different stages of technological development.

Commercialization capacity also requires interpretation beyond patent indicators. Patent activity demonstrates the codification and legal protection of technological outputs, but it does not fully capture market transition, scaling, and private risk financing. Venture capital provides an additional market-oriented indicator of commercialization capacity because it reflects the ability of innovative firms to attract private financing for growth and technological expansion. The Q1 2026 PitchBook-NVCA Venture Monitor reported USD 267.2 billion in quarterly venture deal value and USD 347.3 billion in exit value; the same report notes that excluding the five largest deals and exits would reduce these figures by 73.2% and 86.6%, respectively (PitchBook & NVCA, 2026). This indicates both the strength and concentration risk of U.S. venture-based commercialization.

Strategic technological priorities are also increasingly visible through targeted industrial-policy instruments. The CHIPS and Science Act provided the U.S. Department of Commerce with USD 50 billion to strengthen the U.S. position in semiconductor research, development, and manufacturing. Within this structure, USD 11 billion is directed toward the domestic semiconductor R&D ecosystem, while USD 39 billion supports incentives for investment in facilities and equipment in the United States (NIST, 2026). From the LIFEG perspective, this represents a strategic-priority signal:

U.S. innovation policy remains decentralized, but it increasingly incorporates targeted industrial-policy mechanisms in areas of economic and national-security importance.

At the same time, commercialization and global competition indicators show that the U.S. innovation system faces increasing international pressure. Although the United States maintains one of the largest active patent stocks in the world and remains the leading R&D-performing economy, global patenting dynamics indicate growing competition, particularly from China. Therefore, the strategic management of U.S. innovation policy must be evaluated not only through current performance, but also through the system's ability to sustain technological leadership under changing global conditions.

Table 3 presents a LIFEG-based strategic diagnostic matrix that summarizes the main empirical signals, management interpretation, possible strategic risks, and implications for innovation-policy management.

Table 3

LIFEG-Based Strategic Diagnostic Matrix of the U.S. Innovation System

LIFEG Dimension	Empirical Signal	Strategic Management Interpretation	Potential Strategic Risk	Management Implication
Institutional Governance	Federal R&D obligations reached USD 194.2 billion in FY 2024; five agencies accounted for 93% of the federal R&D portfolio.	Innovation policy is managed through institutional specialization and mission-oriented agency structures.	High dependence on priorities and budget dynamics of a limited number of major agencies.	Maintain coordination among specialized agencies while reducing fragmentation and duplication.
Public Support Mechanisms	U.S. R&D reached USD 937 billion in 2023 and was estimated at USD 993 billion in 2024; R&D intensity reached 3.39% of GDP.	The system combines large-scale innovation investment with a strong public-private funding structure.	Public support may remain selective while private-sector priorities dominate the direction of applied innovation.	Strengthen complementarity between federal support, business R&D, and long-term national technology priorities.
R&D Portfolio Management	In FY 2023, federal R&D obligations were distributed across basic research (25%; USD 47.3 billion), applied research (29%; USD 54.3 billion), and experimental development (46%; USD 84.8 billion).	Federal support covers multiple stages of the innovation cycle, from knowledge generation to technological development.	Overconcentration in experimental development may reduce long-term exploratory capacity if basic research support weakens.	Preserve balance across basic, applied, and development-oriented R&D activities.
Commercia-lization Capacity	The USPTO granted 324,042 patents in 2024; the United States had approximately 3.5 million patents in force in 2024; Q1 2026 venture activity reached USD 267.2 billion in deal value and USD 347.3 billion in exit value but was highly concentrated among the largest deals and exits.	Patents indicate codification and legal protection, while venture capital reflects market-financing capacity and the ability of innovative firms to scale.	Patent quantity and large venture-financing volumes do not automatically guarantee broad technology diffusion, productivity impact, or balanced commercialization across sectors.	Strengthen research-to-market conversion, technology transfer, and broader commercialization channels beyond patenting and highly concentrated venture deals.

Table 1 (continuance)

Strategic Technological Priorities	Federal R&D obligations are concentrated in mission-oriented agencies; CHIPS for America directs major federal support toward semiconductor R&D, manufacturing capacity, and industrial technology priorities.	Strategic priorities are embedded both in agency missions and in targeted industrial-policy instruments.	Targeted interventions may create coordination challenges if sector-specific priorities are not aligned with the broader decentralized innovation system.	Align mission-oriented programs, industrial-policy tools, and federal R&D priorities while preserving flexibility, competition, and market responsiveness.
Economic Performance	The United States accounted for approximately 30% of global R&D expenditures in 2022 and recorded a GERD-to-GDP ratio of 3.59%.	Economic performance confirms the global strength of the U.S. innovation-management system.	Global competition, especially in patenting and technology-intensive sectors, may weaken long-term leadership if strategic adaptation slows.	Use comparative indicators to monitor leadership, resilience, and strategic competitiveness over time.

Source: developed by the author based on NCSES (2026a; 2026b), National Science Board (2025), IPO & Harrity Analytics (2025), WIPO (2025), PitchBook & NVCA (2026), and NIST (2026).

The diagnostic matrix shows that the U.S. innovation system is not simply strong because of its funding volume, patent output, or agency structure. Its strength lies in the interaction of these elements as a strategic management architecture. The LIFEG Framework makes this interaction visible by connecting institutional governance, public support, R&D portfolio management, commercialization capacity, technological prioritization, and economic-performance validation.

The most important contribution of the diagnostic matrix is that it reveals strategic tensions within the U.S. innovation system. The first tension concerns decentralization and coordination. The U.S. model benefits from distributed institutional authority, specialized agencies, universities, private-sector actors, and market-based innovation mechanisms. However, this decentralization also requires continuous coordination among agencies, funding streams, technological priorities, and commercialization channels. Without such coordination, institutional specialization may turn into fragmentation.

The second tension concerns public support and private-sector dominance. The United States demonstrates a strong business-driven R&D structure, while federal support performs a selective and stabilizing role. This hybrid structure is one of the strengths of the U.S. model, but it also creates a management challenge: public support must remain sufficiently strategic to sustain long-term technological priorities, while avoiding excessive displacement of market-based innovation incentives.

The third tension concerns commercialization capacity. Patent activity and patents in force demonstrate the codification and legal protection of technological outputs, while venture capital reflects market-oriented financing and scaling capacity. However, high patent volume and large venture-financing flows do not automatically guarantee broad technology diffusion, productivity growth, or balanced commercialization across sectors. This means that commercialization must be evaluated not only by the existence of protected inventions, but also by the system's capacity to transform knowledge into widely adopted and economically meaningful outcomes.

The fourth tension concerns targeted industrial policy within a decentralized innovation system. Instruments such as CHIPS for America demonstrate that U.S. innovation policy increasingly incorporates selective industrial-policy mechanisms in strategically important sectors. This strengthens technological direction, but it also increases the need to align targeted interventions with the broader innovation ecosystem. The management challenge is to preserve the flexibility of the decentralized U.S. model while strengthening strategic coordination in areas of national technological importance.

Thus, the LIFEG Framework does not merely summarize empirical indicators; it identifies where the innovation system is coherent and where potential bottlenecks may emerge. A system may demonstrate high R&D investment but weak commercialization; strong patent activity but limited economic translation; or developed institutional structures but insufficient cross-agency coordination. In the U.S. case, the evidence suggests a highly developed and globally significant innovation system, but also one that must continuously manage the balance between decentralization, mission-oriented support, private-sector dominance, venture-capital concentration, targeted industrial policy, and international technological competition.

The practical value of the LIFEG Framework therefore lies in its ability to support strategic innovation-management decisions. It can be used to assess whether public support is aligned with technological priorities, whether institutional specialization contributes to policy coherence, whether commercialization mechanisms convert research into usable outputs, and whether economic-performance indicators confirm the effectiveness of the system as a whole. This makes the framework applicable not only to the U.S. case, but also to comparative studies of national innovation systems in different institutional environments.

Conclusions. This study demonstrates that the evaluation of innovation policy should move beyond the tracking of isolated indicators, such as R&D expenditures, patent activity, institutional presence, or macroeconomic performance, and should instead focus on the strategic management coherence of the national innovation system. The operationalization of the LIFEG Framework confirms that innovation policy effectiveness emerges from the interaction of institutional governance, public support mechanisms, commercialization capacity, strategic technological priorities, and economic performance as an integrated management architecture.

The theoretical contribution of the study lies in shifting the analysis of innovation policy from descriptive innovation-system interpretation toward operational strategic management evaluation. While classical innovation theories, national innovation systems theory, the Triple Helix model, and the entrepreneurial state perspective explain important aspects of innovation dynamics, the LIFEG Framework provides a structured tool for assessing whether the main components of innovation policy operate coherently as a managed system. In this respect, the framework contributes to innovation management research by linking governance coordination, resource allocation, commercialization mechanisms, technological prioritization, and economic-performance validation within one analytical model.

The empirical application to the U.S. case shows that the strength of the American innovation system does not result from administrative centralization. Rather, it is based on a hybrid strategic management model that combines decentralized institutional governance, strong private-sector R&D activity, selective federal support, mission-oriented agencies, developed intellectual property protection, venture-based commercialization, and targeted industrial-policy instruments such as CHIPS for America. This confirms that the U.S. model is not purely market-driven and not centrally planned; its effectiveness depends on the ability to coordinate distributed institutions, public and private resources, commercialization channels, and strategic technological priorities.

From a practical policy-management perspective, the LIFEG Framework can be used as a diagnostic tool for identifying strengths, vulnerabilities, and bottlenecks within national innovation systems. By distinguishing between input drivers, conversion mechanisms, strategic-allocation indicators, and outcome-validation indicators, the framework allows policymakers and researchers to assess whether innovation policy functions as an integrated strategic management system. For example, a country may demonstrate high R&D funding but weak commercialization capacity, strong patent activity but insufficient economic translation, or developed institutional structures but weak cross-agency coordination. The LIFEG approach makes such imbalances visible.

At the same time, the study has several limitations. The current operationalization relies on publicly available proxy indicators and does not construct a fully weighted composite index. The proposed formula expresses conceptual interdependence among the framework's dimensions rather than an econometric model of causality. Future research may therefore extend the LIFEG Framework by developing a weighted index, applying expert-based weighting methods, conducting cross-country comparisons, or testing the framework in specific technological sectors such as artificial intelligence, semiconductors, biotechnology, clean energy, and defense-related innovation.

Overall, the LIFEG Framework offers an original strategic management evaluation model for analyzing innovation policy coherence in complex national innovation systems. Its value lies not only in describing the components of innovation policy, but in showing how these components interact, where bottlenecks may arise, and how strategic management decisions can strengthen the connection between governance, support, commercialization, technological priorities, and economic outcomes.

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