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Using the National Innovation System Framework to Guide Innovation Policy in Developing Countries

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Abstract
The current economy is caracterised by innovation as a key driver of competitiveness and growth. In this context, the concept of National Innovation System (NIS) gaines an increasing adoption among scholars and policymakers. It is used as an analytical and steering tool to improve national innovation performance. If NIS has been widely used in developed countries, its implementation in the context of developing economies stills hampered by lots of controversies.
This paper shows how would NIS be implemented in developing countries. It offers a critical review of the NIS literature. First, the global economic context that makes NIS relevant is discussed. Then, the theoretical foundations and critiques of the concept are clarified. After, the paper cope with the implementaion of NIS on micro, meso, and macro levels and its implications for innovation policy design. A particular attention is set on developing countries.
Keywords: Knowledge; Learning; National Innovation Systems; Innovation Policy; Knowledge Economy

Resumé
L'innovation est désormais le moteur de la compétitivité et de la croissance économique. Dans ce contexte, le concept de Système National d'Innovation (SNI) est devenu un outil d'analyse et de pilotage de l'innovation de plus en plus adopté par les chercheurs et les responsables politiques. Or, si le SNI est largement utilisé pour étudier et piloter les efforts d'innovation dans les pays industrialisé, son utilisation dans le contexte des pays en développement demeure entravée par certaines controverses.
L'objectif de ce papier est de montrer comment peut-on appliquer ce concept de SNI dans les pays en développement pour améliorer la performance de leurs systèmes d'innovation.
Ce papier passe en revue la littérature du SNI. Il est structuré autour de quatre axes : le contexte de l'économie mondiale qui justifie l'intérêt du SNI ; les fondements théoriques du SNI ainsi que ses critiques ; son application aux niveaux micro, méso, et macro-économiques; et ses particularités pour la conception des politiques d'innovation dans les pays en développement.
Mots-clés : Connaissance ; Apprentissage ; Systèmes Nationaux d'Innovation ; politique d'innovation ; économie de savoir.

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Introduction

In last decades, great changes have been a permanent feature of the world economy. In the center of these, knowledge and innovation were always key drivers of competitiveness and growth. Within this trending shifts to knowledge based economy, natural resources and material capital are no longer sufficient to ensure sustainable development. So forth, the key indicator of any economy position is its capacity to produce, use and absorbe knowledge, or in another word "to innovate". From this perspective, innovation is no longer seen as an isolated output generated by firms and its R&D activities, but it is an interactive process shaped in a systemic evolution of relationsips and interactions among varied actors and instutions.

In this context, the concept of National Innovation System (NIS) has been developped as an interesting analiytical tool or framework to understand knowledge or innovation, how is it generated, duffused and used in the economy. The pioneer contributions of Freeman (1987), Lundvall (1992) and Nilson (1993) played a significant role in establishing the concept and reinforcing it. Thsese studies highlighted the fact that innovation couldn't accuerd in vacuum, they insisted on the importance of national ecosystem, where institutions, firms, universities, government organismes, financial sectors and other actors are interacting.

In this regard, the performance of innovation is not determined only by the amount of ressouces allocated to R&D, but also by the quality of relationships amid actors, their capacities to learn from each other, and particularly the quality of institutions and policies incompassing them and supporting their interactions.

Although the large diffusion of NIS as a practical framework to study innovation policies in industrialised countries, its implementation in developping economies stills submitted to many theorical and practical discussions. Compared with contexts where original litterature of innovation systems have been coined, developping countries are actually cracterised by different facts. These include technological capacities, institutional structure, finance ressources, human capital, relationships among universities, research centers and economic sector. Lots of developping economies suffer from lack of linkages among actors, limited R&D capacities, fragmented institutions, weak ressources and a quasi compelte relience on exported technologies, alongside with limited capacity to absorb new technologies and adapt the to local needs.

Given theses specificities, this paper discusses the fundamental problematic of implementing NIS framework in developping economies. To build an effective innovation system, would it be sufficient to install alike oranisations and structures of succussful innovation systems? Or that needs to reinvent the NIS concept according to the specific historic, institutional, economic and technological contexte of each developping country?

The interset of these questions rises further more from the fact that the try to reproduce any successful institutional pattern may lead to creat a set of formal structures that seem formely integrated, but in reality lack to the capacities, relationships and mecanisms of mutual learning, necessary to make them working as an integrated system of innovation.

Subsequently, the analysis of inovation systems in developping economies should not be limited only to the identification of its main actors and institutions. More light must be shed on the nature of relationships linking them, the learning processes, the knowledge flows, and the actual technologic and organisational capacities locally existing. Also, the role played by the formal and informal institutions needs to be much more understood and analysed.

In this frameworke, micro/meso/macroeconomic level analysis would offer an intersting basis to understand the functionning of innovation system. At the micro-economic level, firms and manufactring entities constitute the core propulsor of innvation process, technology absorbtion and knowledg utilisation. At the meso-economic level, clusters, networks of universities, research centers and intermediary istitutions play a vital role as knowledge flow enablers and collective learning facilitators. At macro-economic level, general policies, institutions, educational and financial regims, regulation, etc. influence the overall ecosystem of innovation and its performance.

This perspective acquires to pay a specific attention to innovation policies of developping economies. If the innovation is a systemic and interactive process, its policy couldn't be limited to increasing R&D expenditures or granting direct subsidies to innovating firms. Instead, innovation policy in developping countries must cope with the systemic missmatchs, underpin technologic and human capacities, improve linkages among universities and economic sectors, promote knowledge flows, incite mutual and interactive learning, and build institutions able to inderpin innvation permanently. Similarly, this should omit the try to blindly imitate successful policies and institutions of developped countries and give room to more respect and interest to the local and historic socio-economic specifities.

The present paper aims to understand how NIS concept could be suitable for developping economies, and show how to use it as an effective framework to guide innovation policies and improve its overall performance. To do so, the theoritical fondations of NIS, its key litterature and criticismes are firstly reviewed. Then, the main conpenents and interactions of innovation systems are analysed at micro, meso and macroeconomic levels. After, the structural and institutional features of innovation systems specific to developping economies and their impacts on inoovation policies conception and implementation are discussed.

This paper build on the fundamental premise assuming that the value of NIS concept in developing economies doesn't reside in the merely formal replicating of the institutional patterns of developed markets, but much more in its utilization as a flexible analytical framework that could be smartly adapted to the local contexts, institutions and capacities. From this perspective, it would be more conceivable to better understand the overall origins of innovation weaknesses, define the linkages among actors, the capacities to be improved, and set more consistent policies in harmony with local economic and institutional facts. Henceforth, the NIS concept must overpass its limited analytical aspect to become a practical tool to build national learning and innovation capacities, enhance competitiveness, and underpin sustainable development.

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1. Innovation in Knowledge-based Economy

This section shows how innovation overcomes traditional production factors, and discusses the issues of knowledge-based conomy and artificial Intellegence, befor stating the fundamentals ongoing changes in innovation concept.

1.1 Innovation overcomes traditional production factors

Modern economy is increasingly revolving around the mastery of knowledge and innovation rather than traditional production factors such as raw materials, labor, or geographic position. As technological progress advances, governments find it harder to shield their economies from global competition. Economists broadly agree that international competitiveness depends first on the capacity to renew activities and improve knowledge, skills, and offerings — with price and cost competition coming second. Traditional production factors are no longer sufficient to sustain growth, and strategic innovation is the main source of competitiveness (Karim, R. & Dhar, B. K. ,2025).

Schumpeter's concept of creative destruction captures how innovation drives societies to evolve continuously, creating new industries and skills while rendering others obsolete. Dematerialization — the shift of products and services from physical to digital environments — is a vivid contemporary example, making offerings more flexible, dynamic, and cost-efficient while reshaping entire industries.

So forth, value is increasingly created through production systems redesign, resources reuse and regeneration, and digital and systemic innovation. This enables markets to overcome resource scarcity and environmental limits, better than traditional factors (Karim, R. & Dhar, B. K. 2025). (See table 1). Firms no longer compete thanks to resources alone, but on their abilities to innovate continuously and reset their resources in real-time. At micro level, creating value shifts from mass production to more customized solutions and innovation networks (Prahalad, C. K. & Krishnan, M. S. 2008).

Table 1. THE ROLE OF INNOVATION IN ECONOMIC GROWTH MODELS

	TRADITIONAL GROWTH MODEL	INNOVATION-DRIVEN GROWTH MODEL
GROWTH MODEL	Growth from land, labor, capital	Growth from knowledge & innovation
	Efficiency in production	Creativity & system redesign
	Static comparative advantage	Dynamic competitive advantage
	Resource exploitation	Resource optimization & regeneration
INNOVATION ROLE	**INNOVATION AS GROWTH DRIVER**	**INNOVATION AS GROWTH INFLUENCER**
	R&D and technological innovation	Industrial diversification
	Learning-by-doing and knowledge diffusion	Technological upgrading
	AI and green technologies	Knowledge spillovers

Source: Author based on: (Karim, R., & Dhar, B. K. 2025), (Prahalad, C. K., & Krishnan, M. S. 2008), (Li, X., & Zhao, Y. 2025) and (Usman, M. 2026)

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Table 1 shows that innovation (especially technological developemt) becomes a primary driver of economic growth. Classic production factors (capital, labor) are mediated and amplified by innovation capacity. Economies with stronger innovation ecosystems achieve higher and more sustainable growth. Innovation enhances efficiency of all traditional factors.

1.2. Knowledge Economy and Artificial Intellegence

In knowledge based economy, the generation of knowledge, its diffusion and use, plays a predominant role in wealth creation, growth and employment (United Nations Economic Commission for Europe, 2002)**.** It accounts for at least approximately 7% of global GDP and expands at an annual rate of around 10%**,** significantly outpacing traditional sectors. Its importance is even more pronounced in advanced economies, where it constitutes 30-40% of GDP in western Europe and reaches nearly 50% in US. In emerging economies, it remains lower but continues to grow. About 22% of GDP in China, illustrating an ongoing transition towards a knowledge-based economic structure. Knowledge economy is built on key sectors that contribute substantially to GDP, including education (approximately 4–8%), information and communication technologies (up to 10–11%), healthcare and biotechnology (up to 19% in US), and R&D investments (2–3%).

The global economy is shifting to a knowledge- and AI (Artificial Intelligence) -driven model. Intellectual capital and AI become the primary sources of creating value. The fusion of human knowledge and AI, would lead to smarter decision-making, automation of cognitive tasks, and continuous organizational learning. In labor market, demand for creative, analytical, and lifelong learning skills would increasingly rise. Among firms, competitiveness will depend on the ability to create, share, and apply knowledge continuously (Young, R. 2024).

1.3 Fundamentals Changes in Innovation Concept

Innovation is no longer just technological or firm-based, but ecosystem-based, involving governments, academia, and society. Including a shift from innovation for economic growth to innovation as a key driver to societal transformation (climate, health, security) (Gupta, Arun; George, Gerard; Fewer, Thomas J. 2024)**.**

The traditional linear model of innovation — moving sequentially from basic research through applied research to technological development and market products — is no longer adequate for understanding modern innovation. The path from science to economic value is neither straightforward nor automatic. In the absence of actors able to absorb and apply acquired knowledge, research investment cannot be translated into innovation.

Firms and business are the natural origin and nurture of innovation. Creative products and services are increasingly generated by startups, AI, and agile ecosystems, much more than large bureaucracies. Novelties shifts from closed and centralized innovation systems to networked, fast and decentralized innovation ecosystems (Shah, R. M., & Kirchhoff, C. 2024). However, its performance is permanently shaped by its regulatory environment, access to production inputs, and interactions with research centers and knowledge organizations.

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2. Theoretical Basis : The National Innovation System

In this section is discussed the following aspects : Origins and defintion of NIS ; the definition of innovation and its types ; NIS postulates and approaches; and its critiques.

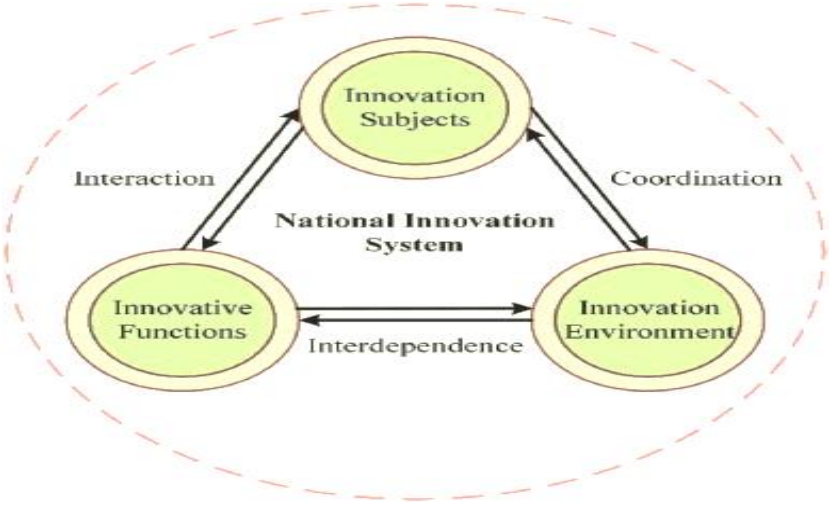
2.1 Origins and defintion of NIS

The concept of the National Innovation System (NIS) was first used by Christopher Freeman and Bengt-Åke Lundvall during the 1980s. However, its conceptual basis can be traced to earlier seminal contributions by Adam Smith, Friedrich List, Joseph Schumpeter, John Bernal, and Vannevar Bush. Initially, the NIS framework was applied primarily to industrialized economies before being progressively extended to a wider range of national contexts, including developing economies. This concept emphasizes the multitude of actors and factors contributing in technological progress and driving economic development.

The NIS approach conceptualizes innovation as a systemic and interactive process shaped by a multiplicity of factors. It posits that innovation emerges from complex interactions among heterogeneous institutions (actors and practices) across the economy. As such, it provides a comprehensive analytical framework able to capture the diverse determinants and dynamics underpinning innovation processes.

From this optic, effective innovation policy must be systemic and not fragmented. This highlights the importance of coordinating different institutional efforts (government, firms, universities), setting strategic national priorities and improving education and research systems (Dent, D. 2024). Figure 1 illustrates the National Innovation System (NIS) definition as an integrated framework composed of three (03) main elements: innovation subjects (actors), innovation environment (context), and innovative functions (activities).

Figure 1. National Innovation System (NIS) Framework



Source : https://www.sciencedirect.com/science/article/abs/pii/S0160791X24000629

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These components are interconnected through interaction (between actors and functions), coordination (between actors and the environment), and Interdependence (between functions and the environment). Overall, it shows that innovation results from dynamic relationships within a system, rather than isolated actions.

2.2 The Innovation : Definition and Types

In Oslo Manual (2018 Version), innovation is "a new or improved product or process (or combination there of) that differs significantly from previous products or processes and that has been made available to users or brought into use by the unit." (OECD & EUROSTAT, 2018). Thus, innovation is the launch of any new or significantly modified product in its essential characteristics, technical specifications or components.

This referential definition states that innovation must be new or substantially better than what existed before. It concerns not only goods, but also services and methods of production/delivery. It argues that innovation counts only if it is actually introduced or used.

In its 2005 Edition, Oslo Manual framework highlights that innovation could be applied in four distinct areas (Table 2):

Table 2 - The four types of innovation as defined in the Oslo Manual

Type of innovation	Characteristics
Product innovation	A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user-friendliness or other functional characteristics.
Process innovation	A new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
Marketing innovation	A new marketing method involving significant changes in product design and packaging, product placement and promotion, and/or in the pricing of goods and services.
Organisational innovation	A new organisational method involving changes in business practices, workplace organisation or external relations.

Source : OECD, Oslo Manual, 2005.

While this 4-types innovation classification is widely used in academia, the 2018 Edition of Oslo Manual has simplified this by merging Process, Marketing, and Organisational innovations into a single broad category called "Business Process Innovation."

Many other typologies of innovation exist, traying to explain this concept from different points of view. (See figure 2).

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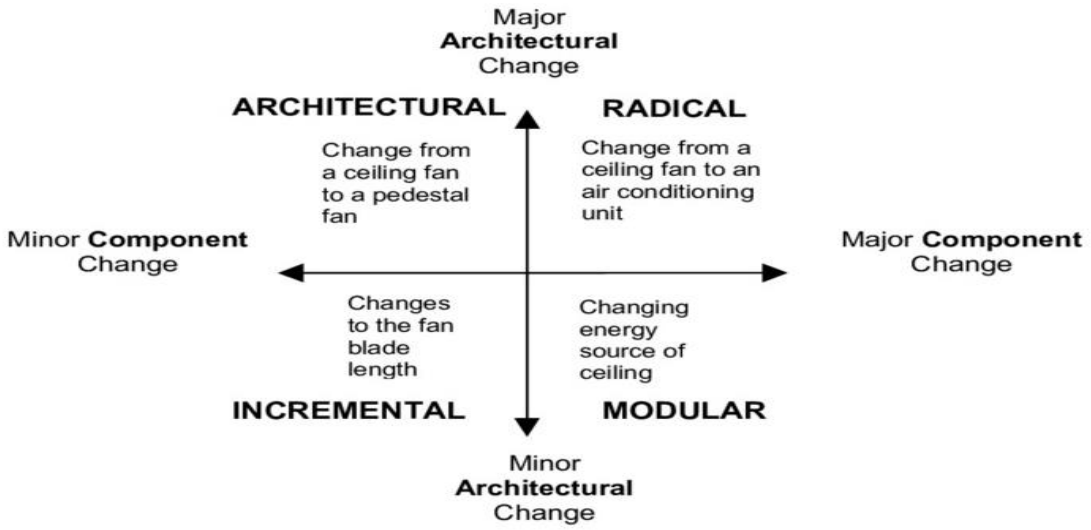
Figure 2. Innovation Typology



Source: Geoff Kaine and Megan Higson, 2006, Practice Change Research, Policy Change as Innovation, Department of Primary Industries, Victoria, New zeland

Figure 2 shows how innovations differ in degree and nature of change. It presents a typology of innovation based on two (02) dimensions (from minor to major): Component and Architectural change. It identifies four types of innovation : (1) Incremental (small improvements), with minor changes to components and architecture. (2) Modular, refering to major changes in components but with little change to the overall structure. (3) Architectural innovation, with changes in components arrangement and limited modification, and (4) Radical innovation (completely new systems) characterzied by major changes in both components and architecture.

2.3 National Innovation System postulates and derived approaches

In current innovation studies, National Innovation System – NIS approach constitutes one of the most interesting analytical frameworks. It is built on six fundamental postulates summarized in table 2.

Table 3: Fundamental Postulats of National Innovation System

Postulates	Meaninig
1. Innovation is an interactive process	Instead of considering innovation as a direct result of R&D to the market. it is seen as a result of interactive relationships among multiple actors or networks (governments, universities, firms), thorough which knowledge flows is spread.
2. Institutions role is central	Formal (laws, policies, etc.) and informal (culture, routines, etc.) institutions (« hard » like firms, and « soft » legislation) have a strong impact on innovation dynamics. The performance of innovation relies deeply on the quality of its institutions.

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3. National Context is Specific	Innovation system is specific to each nation State. It reflects its economic history and cultural heritage.
4. Learning nurtures innovation	Learning by doing, by using and/or by interacting is the key skill behind innovation. The modern economy is based on learning.
5. System elements are Interdependent	Actors of NIS (firms, universities, research centers, etc.) are interconnected. Their performances rely (directly or indirectly / weakly or strongly) on each other.
6. Governement support is vital	The role of government goes beyond regulation to act as principal reseach funding, policy designer an collaboration supporter.

Source: author based on (Freeman, C. 1987), (Lundvall, B.-Å. 1992), (Nelson, R. 1993)

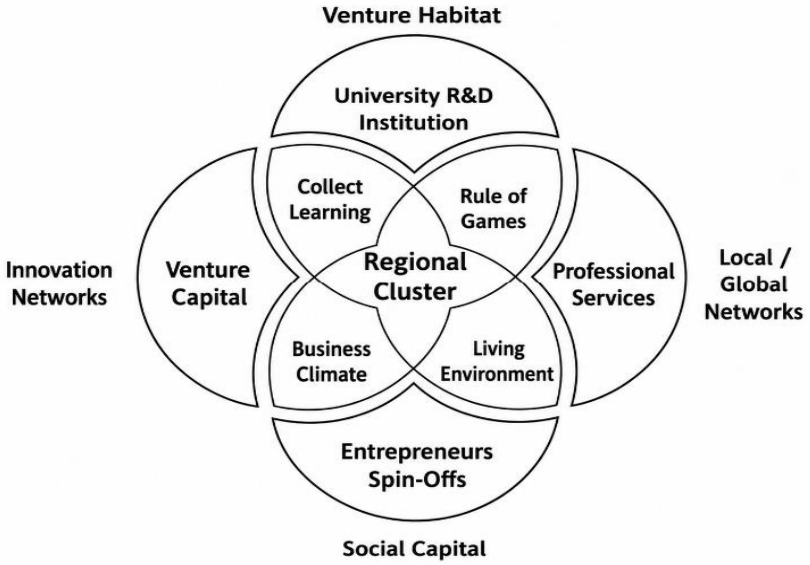
Derived perspectives of NIS approach include:

- **Regional Innovation Systems – RIS.**

From this perspective, study of innovation focuses much more on the regional/local level of innovation, instead of the national one. It analyses the role of clusters in local innovation performance, and highlights the impact of geographic proximity and local interactivity therein (Cooke, P. 2001). (see figure 3)

Ffigure 3 illustrates a RIS structured around a regional cluster supported by university & R&D institutions (knowledge creation), professional services (legal and technical), Entrepreneurs & spin-offs (bringing innovations to the market) especially financed bu venture capital.

Figure 3 : Regional Innovation System



Source : https://www.collidu.com/presentation-regional-innovation

All the actors interact within this network in a systemic and collaborative dynamics.

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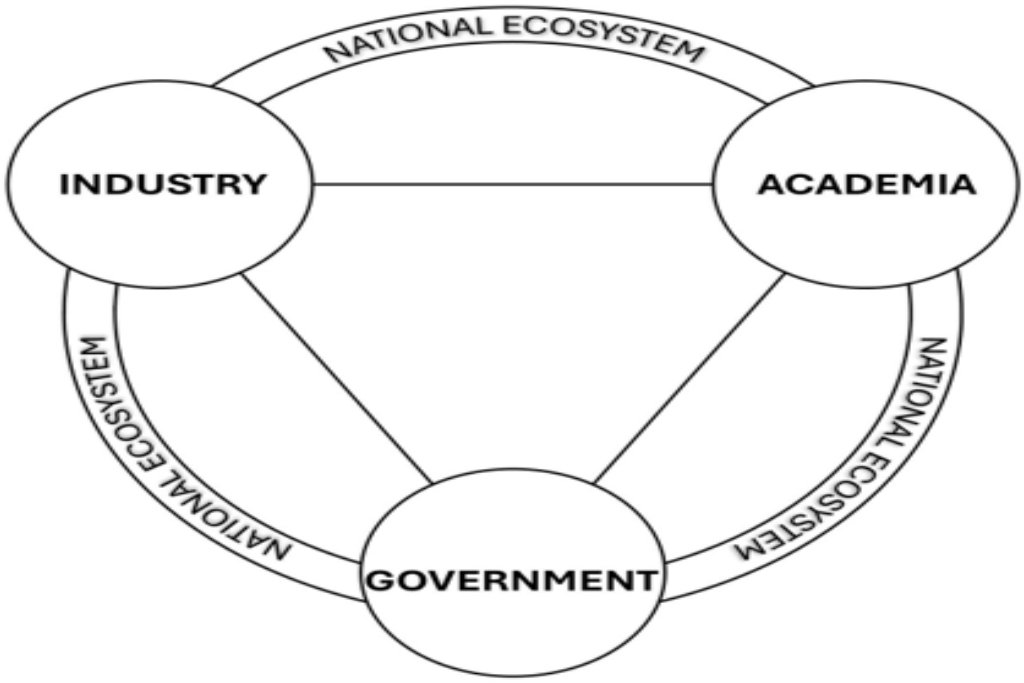
- **Triple Helix Model:** This perspective of NIS was developed in 1995 by Henry Etzkowitz and Loet Leydesdorff. It argues that interactions between universities, industries, and governments constitute the base of innovation and entrepreneurship in a today knowledge-based economy (Etzkowitz, H., & Leydesdorff, L. 2000).

Figure 4 : Regional Innovation System



Source : https://www.chloh.com/?p=51

Figure 4 illustrates the Triple Helix Model highlighting the dynamic interaction among three main actors in NIS. (1) Industries that implement innovation into the market, (2) universities to produce knowledge an develop skills, and (3) government to ensure legal and organizational support. The performance of this system relies on the intensity of interactive relationships, institutional coordination, and the resilience of overall politic framework.

- **Sectoral Innovation Systems – SIS.** This optic of innovation system is developed by Franco Malerba. It studies the innovation in its industrial dimension. It argues that each sector or industry, like cars or renewable energies, is characterized by its specific dynamics of innovation (Malerba, F. 2002). A similar perspective of Technological Innovation Systems TIS focuses on a given technology like solar energy and tries to analyze its principal actors, networks and supporting innovation processes. (See figure 5)

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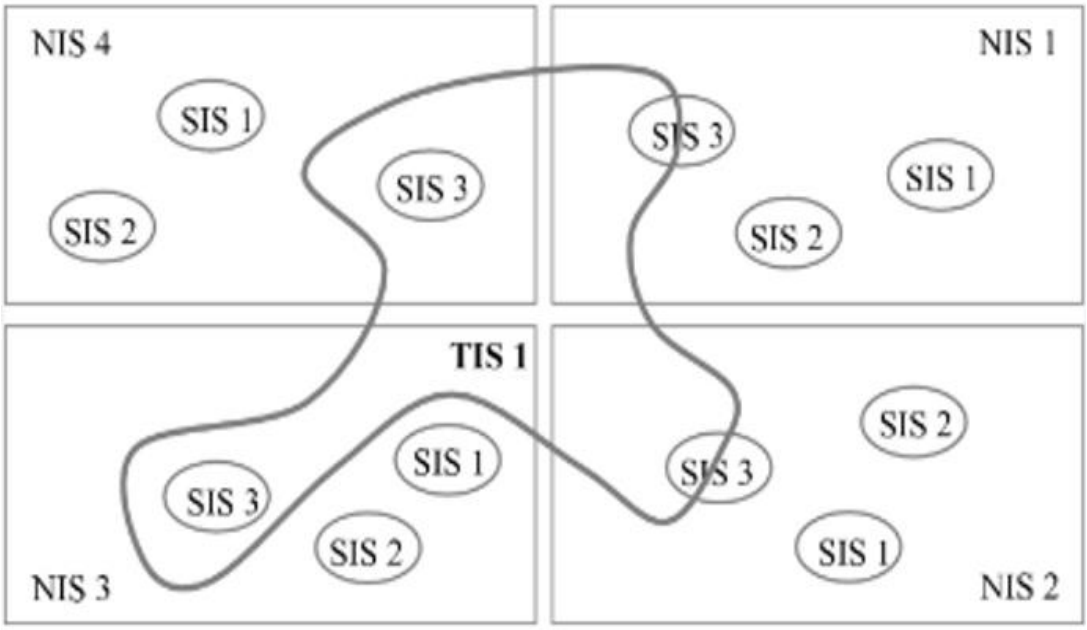
Figure 5: Sectoral and Technological Innovation Systems



Source: Ahrens, H.H.E. (2024).

This figure illustrates the interference of NIS, SIS and TIS. It highlights the transnational character of these systems. Another perspective derived from NIS approach is Innovation Ecosystems. This is a relatively recent concept. It makes an analogy between innovation system and biological one in term of interactivity among its multiple elements.

2.4 Critiques and Limitations of the NIS Concept

Despite its wide diffusion, the NIS concept faces several criticisms. In etymological terms, it combines contradictory notions : “innovation” implies change while “system” denotes stability. Operationally, no researcher — including its founders — has precisely defined the boundaries of a NIS or identified reliable measures for evaluating system interactions. The concept's deliberate flexibility makes empirical application inconsistent.

Substantively, NIS neglects social and political dimensions : it focuses on the interactive learning while overlooking income distribution conflicts and power imbalances that shape innovation processes. In developing countries, social inequalities can restrict learning opportunities and distort resources allocation.

Finally, the concept was largely developed *ex post* to describe mature innovation systems of industrialized economies. This fact does not guarantee its applicability *ex ante* as a construction guide for less developed countries.

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The Table 4 summarizes the main criticisms of the NIS approach and how they have been addressed

Table 3: Criticisms made to NIS and Responses made back

Criticisms	Responses
Ambguity and innaccuray NIS is abusively comprehensive concept. No clear defintion to the « system » and its limits.	The comprehensiveness, gives NIS more resilience to fit to different contexts (Stats, Industries, Levels)
Bias to national State level Choose the National State level to understand innovation in globalised economy, is missleading	Development of NIS includes new different level : regional (RIS), sectoral (SIS) and technological (TIS)
Limited explanatory contribution Focus is more on description than on explanation. Causal relationships among system components are analyzed to explain innovation performance.	NIS is an Analytical Framework to define strenths and weaknesses. It could be completed with quantitatives tools and economic models.
Minimized role attributed to informal actors Attention is given to formal organisations (Universities, Governments, firms)	New concepts like interactive learning, informal networks, Grassroots innovation, hvave been integrated into NIS approach.
Limited application in developing countries Originally developed in industrial countries studies, the NIS hardly reflect weak institutions, frail infrastructures and local contexts specifities.	NIS is adapted to include capacity building, technological catch-up, developmental role of state. By focusing on institutional specifities of each country.

Source : Author based on : (Lundvall, 1992 ; Edquist, 2005) (Lundvall et al., 2009 ; Altenburg, 2009) (Lundvall, 2007) (Carlsson, 2006 ; Malerba, 2002), (Godin, B. 2009)

dy its defenders.

Overall, developers, practitioners, and proponents of the NIS approach argue that these criticisms do not weaken it, but contribute to its development as a dynamic, multilevel framework.

3. Diagnosing National Innovation Capacities

The study of NIS is a hard task. To make it easier, a multilevel breakdown is often adopted. In this section, a macro/meso/microeconomic level of NIS diagnostic is disscussed. Then, the specificities of developing country are denoted.

3.1 Macro-Level Analysis: National Economy level

At Macroeconomic level, NIS aproach studies national institutions, policies, long-term technical trajectories. Main findings highlight the character of path dependency (historical accumulation) of NIS. Especially in developing regions, innovation performance is strongly shaped by historical trajectories, institutions quality and their cumulative learning (Huang, Y., Li, S., Xiang, X., & Huang, L. 2024). In recent works, composite assessment systems are proposed to integrate infrastructure, digital economy, governance, and policy coordination as diagnostic dimensions (Alabani, K., Afful Jr., B., Taale, F., et al. 2026), as well as inclusive and sustainable innovation outcomes, social

inclusion, environmental impact, and resilience (Li, X. et al. 2024). NIS macroeconomic studies often fail when the analysis is disconnected from meso and micro dynamics (Chatzinikolaou, D., & Kubus, R. 2025).

3.2 Micro-Level Analysis: Firm level

At Micro-Level analysis, NIS studies focus on innovation related efforts within firms. These include their absorptive capacities, learning capabilities, and R&D activities (Hekkert, M. et al. 2025). NIS studies emphasize and shed light on heterogeneity of firms in term of technological specialization, network position, and innovation strategies (Jeong, D. et al. 2025). The systemic approach is adopted herein through the assessment of open innovation and external sourcing practiced by firms. To do so, collaboration, partnerships, and knowledge sourcing beyond firm boundaries are closely examined and strongly encouraged (Metcalfe, J. S. 1995).

3.3 Meso-Level Analysis: Industrial level

At this level of NIS analysis, the main elements to study are networks, institutions, and knowledge flows among them. Recent contributions hightlight the the centrality of interaction structures. Studies show a strong correlation between innovation and the quality of interactions among universities, firms, and governments. Measuring the intensity and importance (Network density, Knowledge centrality, structural gaps, collaboration's externalities, etc.) (Jeong, D., Kang, T., Si, S., et al. 2025). of these interactions is not alwayse evident. However, this is a prerequisit to enhance national innovation performance. To do so, focus should be on intemediary organizations (faires and exhibitions, normalisation and standardization organizations, industrial associations, etc.) (Metaiche, M. E. 2024). In meso-level analysis, innovation system functions (Knowledge development and diffusion, market formation, legitimation) should be continuosly assessed (Hekkert, M. et al. 2025).

3.4 Specificities of Developing Country NIS

Industrialized economies have mature NIS that evolved organically over long periods, with the state playing a largely intermediary role. Developing countries lack this industrial heritage and face distinct structural challenges :

- Limited corporate interest in innovation or knowledge management, making data collection difficult and results unreliable at the macro level.
- Near-total absence of interaction between knowledge infrastructure actors, with weak learning and skills-development processes.
- Low industrial demand for scientific competencies; higher education primarily produces researchers absorbed by public administration or left unemployed.

Despite these specificities, a growing body of scholarship advocates a unified conceptual framework for comparing NIS, enabling analysis of both the diversity of systems and their shared commonalities.

4. INNOVATION POLICY STEERING IMPLICATIONS

The implications of guiding innovation policy towords more performance are different and multidimensionnal. However, the following issues should be taken in account when setting innovation policy.

4.1 The Rationale for Government Intervention

Typically, governments intervene to address market failures. Their intervention is equally essential to correct systemic dysfunctions obstructing knowledge flows : misaligned incentives, rigidity in narrowly specialized organizations, poor communication and information sharing, weak collaborative networks, and low labor mobility. Over long periods, while certain NIS elements evolve organically, others can be actively steered through good designed policy.

4.2 Prerequisites for Effective Innovation Policy

Some conditions should be gathered to set an effective innovation policy, the following are prerequisites:

4.2.1 Political Will and Strategic Coherence

Government comitement is the first prerequisite of any successful policy. Decision-makers must play a leadership role : building consensus around means and methods, designing programs based on clear priorities, aligned with national economy's strengths, and human/material capacities, and ensuring program continuity across electoral cycles. Defined objectives must be realistic, allow sufficient time for socioeconomic results to be materialized, and avoid importing practices ill-suited to the local context.

4.2.2 Governance, Coordination, and Institutional Alignment

Innovation governance is built on making decisions based on participatory diagnostics and a shared vision among public and private partners. Countries with strong innovation performance — like Finland and Sweden — tend to place a national innovation policy council directly under the highest political authorities, enabling better coordination across ministerial departments, and more effective macroeconomic knowledge management. Aligning the perspectives of different partners across industry, research, and government is essential for a consistent policy implementation.

4.3 Priority Domains of National Innovation Policy

Innovation policy covers several interconnected domains and touch different actors. The following actions need to be performed urgently and continuously :

4.3.1 Building an Innovation Culture and Diffusing Technology

Technical lag often reflects managerial weakness and inadequate incentives rather than a lack of scientific talent. Joint government-enterprise strategies must remove barriers to startup creation — especially in new technologies — and offer a supportive ecosystem for their development. It is important to balance public support for high-tech manufacturing industries with broader innovation diffusion across all economic sectors.

4.3.2 Developing Clusters and Professional Networks

Innovation policy should go beyond addressing individual firm deficiencies to encourage inter-firm interaction and public-private partnerships. Leveraging research outputs through patents, licenses, and spin-offs should be the ultimate objective. Sectoral and cross-sectoral networking measures can revitalize knowledge production and its economic valorization.

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4.3.3 Supporting Entrepreneurship and Diversifying Research

States must continuously renew their incentive approaches. Key axes include strengthening entrepreneurship and private initiative, reducing direct and indirect public subsidies, and encouraging research with both industrial and purely scientific vocations. Evaluation processes for public support programs must be designed to detect weaknesses, explain them, and propose corrective action.

4.3.4 Stimulating Sophisticated Demand

Demand is a major driver for innovation. Porter argues that the sophistication of demand — its exigency and quality — matters more than its size. Innovation policies must move beyond supply-side instruments (R&D support) toward demand-side tools: regulations, subsidies, and exemptions that encourage innovation diffusion. Public procurement is a powerful lever for directing national innovation toward the objectives defined by innovation policy.

4.4 Specific Orientations for Developing Countries

There is no universal roadmap for NIS development in developping economies. Exclusively top-down, centralized planning approaches are counterproductive: once public subsidies cease, such policies stall. Instead, governments should adopt a bottom-up enabling role that accompanies rather than directs the innovation process, encourages private initiative as the natural engine of change, and adapts to local economic specificities. This approach is more complex to implement but yields more durable results.

5. SPECIFICITIES OF NIS IMPLEMENTING IN DEVELOPPING COUNTRIES

Most of specific features related to NIS framework implementation in developping markets, could be summerized in the two (02) main aspects :

5.1 LESS RESEARCH & DEVELOPMENT, MORE LEARNING & IMITATION

In discussing NIS framework subject and its implentation in developing countries, or there issues related to steering innovation policy, several studies agree on the impossibilty of integral copy-paste of developped countries patterns. Structrural differencies between these and those economies explain this judgement. In 2011, Lundvall highlighted that innovation should neither be limited in fully original things, nor in inprecedented launched products in all markets worldwide. on the contrary, developping economies should encourage incremental innovation based on imported technology. Local efforts should focuse on mastering and adapting these new technologies. Therefore, the focuse of governments in developping countries should be on encouraging learning by doing and interacting programs rather than on R&D efforts. (Lundvall et al., 2011).

Further supporing these finding, in 2022 Khan highlighted the importance of absorptive capcities rather than technological developpment efforts in developping markets. Therfore, decision makers therein are invited to make more focuse on learning and knowledge transfeer than on increasing R&D expenditure. (Khan, 2022).

5.2 MORE INFORMAL SECTOR, LESS INTERACTION AMONG ACTORS

Form another point of view, Cassiolato and Lastres stressed that the informal sector is constituting a determinent element in developping economies. They argue that NIS are deeply impacted by informal

activities and social relationships (sicial norms, cultural values, trust, routines and customs, common cinvictions and expectations, collective learning, etc.). therefore, researchers and decision makers in developping countries are recommanded to give more importance to informal institutions as a prominent actor when implementin NIS framework (Cassiolato & Lastres, 2020).

Before, Watkins et al. In 2014 stressed on the essentiel role of informal sector especially intermediary institutions shuch incubators, accelerators, professional associations and technonological transfeer centers. Very interstingly, these help in coping with the structrual weaknesses of NISs. Their main contribution is to link and coordinate the different and variated values of each NIS actor in developping countries. (Watkins et al., 2014). Through what they call fragmented innovation systems, Dutrénit & Arza have observed the mismatch between university outputs (graduates skills and/or research) and effective needs of manufactring sectors in developping econmies (Dutrénit & Arza, 2010).

Similar findings were reveled in Hassen et al. Between 2014 and 2022 papers. A permenant lack of coordination and weak linkages between universities, socio-economic reality (especially manufacturing sectors) and governments policies. These would condamn the innovation systems performance and limit the production of knowledge susceptible to nirture maketable innovations. (Hassen, Singh, & Destro, 2022؛ Watkins, Papaioannou, Mugwagwa, & Kale, 2014).

Considering the fact that all the precedent given specificities constitute obstacles hindering the implementation of NIS framework in developping economies, some contributions call for the so called inclusive innovation considering simple innovations and improvements instead of merely technological development. (Chataway et al., 2014).

Conclusion

The NIS concept has become an important reference for innovation policymakers in both developed and developing countries. Originally conceived to challenge simplistic views of innovation, its application has too often been reduced to comparing policy components and borrowing best practices — an approach that ignores the systemic dimension of innovation: transferring an element from one system to another does not guarantee that it will retain its performance.

National innovation policies operate under conditions specific to each country — its historical heritage, economic profile, and political and social values. A sound understanding of innovation and technology diffusion mechanisms in a knowledge-based, learning economy can nonetheless help revitalize NIS by drawing on validated experience. The following orientations are recommended:

- Promote technical learning and practical skills with an entrepreneurial focus; prioritize increasing the economy's absorptive capacity for these competencies over simply expanding training programs.
- Develop effective knowledge management by distinguishing between innovation modes (use-practice-interaction vs. science-and-technology) and building the corresponding organizational capabilities, including professional networks with clients, users, suppliers, competitors, and research institutions.

- Treat innovation policy as a continuous learning process: international comparisons should inform rather than dictate; local specificities must be respected in every NIS analysis.
- Integrate with world-class research networks by developing excellence in targeted disciplines; universities and firms in developing countries must upgrade their capabilities to access global networks and markets.
- Subject all policies to multicriteria evaluation that accounts for direct and indirect impacts on the NIS within national economic priorities; external expert assessment is strongly recommended for transparency and objectivity.

References

1. Ahrens, H.H.E. (2024). Theoretical Framework. In: The Ecological Modernization of the Chemical Industry. Springer Gabler, Wiesbaden. https://doi.org/10.1007/978-3-658-45389-3_4
2. Alabani, K., Afful Jr., B., Taale, F., et al. (2026). *Assessing the performance of national innovation systems in Sub-Saharan Africa*. Discover Global Society.
3. Altenburg, T. (2009). *Building inclusive innovation systems in developing countries*. German Development Institute.
4. Archibughi, D., Howells, J., & Michie, J. (1999). Innovation Policy in a Global Economy. Cambridge University Press.
5. Archibugi, D., & Iammarino, S. (2002). The globalization of technological innovation. *Review of International Political Economy*, 9(1), 98–122.
6. Carlsson, B. (2006). Internationalization of innovation systems: A survey. Research Policy, 35(1), 56–67.
7. Cassiolato, J. E & ,.Lastres, H. M .(2020) .*Innovation systems and development: A Latin American perspective* .In The Routledge Handbook of Latin American Development. Routledge.
8. Chataway, J., Hanlin, R & ,.Kaplinsky, R .(2014) .Inclusive innovation : An architecture for policy development .*Innovation and Development*.54-33 ,(1)4 ,
9. Chatzinikolaou, D., & Kubus, R. (2025). *Macro–meso–micro framework*. Sustainability.
10. Cooke, P. (2001). Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change, 10*(4), 945–974.
11. Dent, D. (2024). Innovation policy and national innovation systems. In *The nature of scientific innovation* (Vol. II, pp. 259–286). Springer https://link.springer.com/chapter/10.1007/978-3-031-75216-2_8
12. Drucker, P. (2011). Innovation and Entrepreneurship. Routledge.
13. Dutrénit, G & ,.Arza, V .(2010) .Relations between public research organisations and industry in Latin America : A comparative analysis .*Science and Public Policy*.586-573 ,(8)37 ,
14. Edquist, C. (2005). Systems of innovation: Perspectives and challenges. In J. Fagerberg et al. (Eds.), The Oxford Handbook of Innovation. Oxford University Press.
15. Edquist, C. (2006). Systems of Innovation : Technologies, Institutions and Organizations.

Routledge.
16. Edquist, C., & Hommen, L. (2008). Small Country Innovation Systems: Globalization, Change and Policy in Asia and Europe. Edward Elgar.
17. Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research Policy, 29*(2), 109–123.
18. Freeman, C. (1987). Technology Policy and Economic Performance: Lessons from Japan. Pinter Publishers.
19. Godin, B. (2009). National innovation system: The system approach in historical perspective. *Science, Technology & Human Values*, 34(4), 476–501.
20. *Gupta, Arun; George, Gerard; Fewer, Thomas J. (2024). Venture Meets Mission: Aligning People, Purpose, and Profit to Innovate and Transform Society. Stanford: Stanford University Press*
21. Hekkert, M. et al. (2025). *Technological innovation systems review*. Environmental Innovation and Societal Transitions.
22. Huang, Y., Li, S., Xiang, X., & Huang, L. (2024). *Analyzing the configuration of the national innovation system for innovation capability*. Humanities and Social Sciences Communications. https://doi.org/10.1038/s41599-024-03792-x
23. Jennex, M.E. (2007). Knowledge Management in Modern Organizations. Idea Group Publishing.
24. Jensen, M.B., Johnson, B., Lorenz, E., & Lundvall, B.Å. (2007). Forms of knowledge and modes of innovation. Research Policy, 36(5), 680–693.
25. Jeong, D., Kang, T., Si, S., et al. (2025). *Mapping innovation networks*. arXiv.
26. Karim, R. & Dhar, B. K. (eds.) (2025). *Strategic Innovations for Circular Economy*. Hershey, PA: IGI Global.
27. Kayal, A. (2008). National innovation systems: a proposed framework for developing countries. International Journal of Entrepreneurship and Innovation Management.
28. Le Loarne, S., & Blanco, S. (2011). Management de l'innovation. Pearson France.
29. Li, X. et al. (2024). *National innovation system : Measurement of overall effectiveness*. Technology in Society. Casadella, V., & Tahi, S. (2025). *Inclusive national innovation systems*. Journal of Institutional Economics.
30. Li, X., & Zhao, Y. (2025). *Innovation-driven growth: The power of technological capability*. Journal of Innovation and Knowledge, 10(2), 100512.
31. Lundvall, B. Å., Joseph, K. J., Chaminade, C & ,.Vang, J .(2011) .*Handbook of innovation systems and developing countries : Building domestic capabilities in a global setting* .Edward Elgar Publishing.
32. Lundvall, B.-Å. (1992). *National systems of innovation: Toward a theory of innovation and interactive learning*. Pinter Publishers.

33. Lundvall, B.Å. (2005). National innovation systems – analytical concept and development tool. DRUID Tenth Anniversary Summer Conference, Copenhagen.
34. Lundvall, B.Å. (2010). National Systems of Innovation : Toward a Theory of Innovation and Interactive Learning. Anthem Press.
35. Lundvall, B.Å. (2016). The Learning Economy and the Economics of Hope. Anthem Press.
36. Malerba, F. (2002). Sectoral systems of innovation and production. *Research Policy*, 31(2), 247–264.
37. Metaiche, M. E. (2024). *Linking national innovation systems and innovation capacity*. Management and Entrepreneurship.
38. Metcalfe, J. S. (1995). *The economic foundations of technology policy*.
39. Nelson, R. (1993). National Innovation Systems: A Comparative Analysis. Oxford University Press.
40. OECD/Eurostat (2018). Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation (4th ed.). OECD Publishing.
41. Prager, J.C. (2008). Méthode de diagnostic du système d'innovation dans les régions françaises. Direction Générale des Entreprises, France.
42. Prahalad, C. K. & Krishnan, M. S. (2008). *The New Age of Innovation : Driving Co-Created Value Through Global Networks*. New York : McGraw-Hill.
43. Salmi, J., & Altbach, P.G. (2011). The Road to Academic Excellence : The Making of World-Class Research Universities. The World Bank.
44. Shah, R. M., & Kirchhoff, C. (2024). *Unit X : How the Pentagon and Silicon Valley are transforming the future of war*. Scribner.
45. United Nations Economic Commission for Europe. (2002). *Towards a knowledge-based economy: Regional assessment report*. United Nations.
46. Usman, M. (2026). *Innovation spillovers, economic growth and role of R&D*. Humanities and Social Sciences Communications**,** 13, Article 67. https://www.nature.com/articles/s41599-026-06726-x
47. World Economic Forum (2016). The Future of Jobs. WEF Geneva.
48. Young, R. (2024). *The global knowledge and AI driven economy*. Knowledge Associates International.