



INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT WORKING PAPER SERIES – Working Paper 3/2026

Industrial Innovation Policies in the Republic of Korea: Lessons for Developing Countries

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STEP I

This Working Paper explores how the Republic of Korea's industrial innovation policies (IIP) contributed to its rapid transformation from a low-income, resource-poor country in the 1960s into one of the world's most advanced industrial economies. Drawing on the conceptual framework of IIP proposed by Bonvillian (2024), which emphasizes deliberate government interventions in the post-research stages of innovation, this paper reinterprets the Republic of Korea's historical experience as a distinctive model of policy-driven innovation.

It argues that the Republic of Korea's success cannot be fully explained by standard industrial or science and technology (S&T) policies alone, but rather by a systemic policy mix approach that combines strategic industrial targeting, coordinated technological learning, and strong implementation capacity. Beyond the lessons identified by Bonvillian, such as regional ecosystem development, advanced manufacturing and skills formation, the Republic of Korea's experience highlights additional preconditions of particular relevance for developing countries: demand-oriented innovation, robust institutional foundations, effective policy design and implementation capabilities, and sustained political leadership.

The study concludes that late industrializers can adapt the Republic of Korea's model by embedding these systemic capabilities within mission-oriented innovation systems aligned with UNIDO's pillars of inclusive and sustainable industrial development (ISID) and with contemporary debates on digitalization and green transformation. It also notes that, as the only country to have transitioned from an official development assistance (ODA) recipient to a donor, the Republic of Korea is well positioned to share its industrial innovation policy experience with developing countries through systematic knowledge-sharing cooperation.

Division of Industrial Policy Research and Statistics
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INDUSTRIAL DEVELOPMENT ORGANIZATION

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Table of Contents

1. Introduction	6
Background	6
Objectives and methodologies	10
Structure	11
2. Industrial innovation policy: A conceptual framework	13
From industrial policy to industrial innovation policy	13
Theoretical advances and the role of directionality	16
Institutional preconditions and policy capability	16
Conditionality and policy space	18
The Republic of Korea, the United States, and different pathways towards IIP	18
3. Industrial innovation policies in the Republic of Korea	21
The 1960s: Institutional foundations	22
The 1970s: HCI drive and mission-oriented deepening	24
The 1980s: Technological self-reliance and systemic innovation	25
The 1990s: Globalization, ICT and the knowledge-based economy	26
Implications for IIP theory	27
4. Lessons for developing countries	29
Demand-driven, mission-oriented innovation	30
Institutional foundation	31
Policy capability	32
Implementation capability	33
Policy and Political Continuity	35
5. Conclusion	38
Relevance to UNIDO's ISID	41
Korea as a Knowledge Partner	43
References	46

Table of Figures

Figure 1 Gross domestic expenditures on R&D as a percentage of GDP (% 2023 or latest year).....	7
Figure 2 The Republic of Korea’s top exports by decade (1960s–1990s).....	21

List of Tables

Table 1 Development and role of S&T policies in the Republic of Korea	9
Table 2 Comparative features of IIP: United States vs. Republic of Korea	19

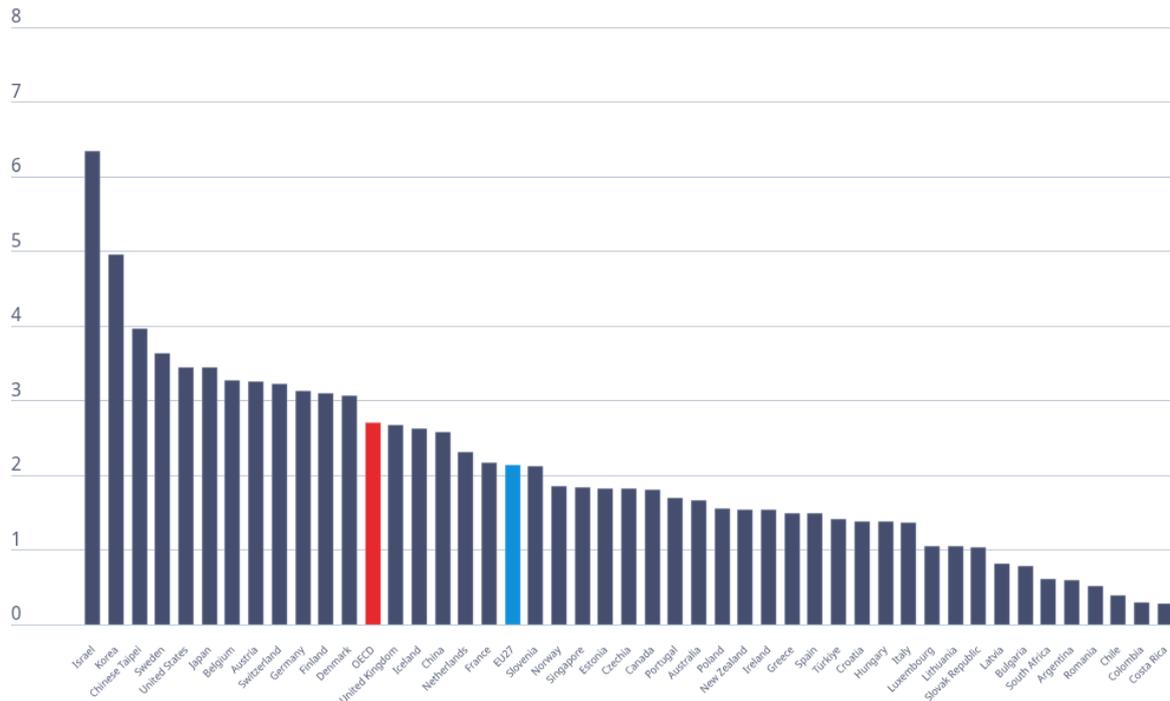
1. Introduction

Background

In recent years, the resurgence of industrial policy across both advanced and developing economies has renewed attention to the conditions under which governments can successfully drive technological transformation and structural change. The COVID-19 pandemic, climate change, geopolitical tensions, and the reconfiguration of global value chains (GVCs) have exposed the fragility of market-led innovation systems and underscored the role of purposeful state intervention in fostering industrial resilience. The post-2020 industrial innovation policies of the United States, as analysed by Bonvillian (2024), illustrate this global shift towards “mission-oriented” innovation strategies that integrate science, technology, and innovation (STI) objectives with industrial competitiveness goals.

Translating such ambitious approaches into practice remains particularly challenging for developing countries. While many governments have adopted industrial and innovation strategies, the implementation gap between design and execution continues to persist, constrained by many preconditions, including limited institutional capabilities, fragmented governance, and weak coordination between public and private sector actors (Santiago & Zagato 2024). To design effective “industrial innovation policies” that deliver inclusive and sustainable industrial development, policymakers must understand not only which policy instruments to adopt, but also how to build the institutional foundations and strengthen the implementation capabilities necessary for their success.

The Republic of Korea offers a compelling historical case. Over just a few decades, the Republic of Korea evolved from a low-income, agrarian economy into a leading exporter of high-technology products, becoming a member of the Organisation for Economic Co-operation and Development (OECD) and the G20, with one of the world’s highest research and development (R&D) intensities (4.96 per cent in 2023, see Figure). Its trajectory, anchored in deliberate state-led industrial innovation, demonstrates how coherent and adaptive policies can overcome structural disadvantages. The Republic of Korea’s experience provides an opportunity to revisit Bonvillian’s (2024) framework from the perspective of a successful late industrializer and to distil lessons for developing countries whose institutional and technological contexts differ markedly from those of the United States and other advanced countries.

Figure 1 | Gross domestic expenditures on R&D as a percentage of GDP (% 2023 or latest year)

Source: OECD, Main Science and Technology Indicators (MSTI) Database, September 2025, <https://oe.cd/msti>

The concept of IIP was introduced by William B. Bonvillian in his 2024 report for the Economic Commission for Latin America and the Caribbean (ECLAC) “Industrial Policies for the Twenty-First Century: Lessons from the United States.” Bonvillian defines IIP as deliberate government intervention in the post-research stages of innovation, including demonstration, deployment, scale-up and diffusion, aimed at bridging the persistent gap between R&D generation and industrial application. This definition distinguishes IIP from earlier paradigms:

- a) Traditional industrial policy, which focuses primarily on sectoral protection, credit allocation, and infrastructure support to promote targeted industries; and
- b) Science and technology (S&T) policy, which mainly concentrates on building research capabilities and funding public R&D institutions.

IIP integrates these two traditions by conceptualizing innovation as an end-to-end system that requires coordination across actors, technologies and financing mechanisms. Bonvillian identifies seven new approaches that characterize contemporary policy experience in the United States:

- a) top-down strategic initiatives;

- b) bottom-up regional ecosystems;
- c) demonstration projects;
- d) direct production support;
- e) supply chain resilience;
- f) coupling of basic and applied research; and
- g) regional implementation frameworks.

While these approaches are highly relevant to industrialized economies, their applicability to developing countries is conditioned by differences in institutional maturity and the global governance environment. Santiago & Zagato (2024) emphasize that many developing countries lack the policy capability in evidence generation, coordination and implementation required to operationalize such complex policy functions. Moreover, contemporary regimes for trade, investment and intellectual property rights impose additional constraints that were far less binding during the early industrialization of the Republic of Korea (UNIDO 2019; Andreoni, Chang & Labrunie 2021). Accordingly, adapting IIP to developing country contexts requires identifying the institutional enablers that underpin successful policy cycles and recognizing the external constraints that shape national policy space. The Republic of Korea's experience provides such insights.

The case of the Republic of Korea provides a rich empirical foundation for understanding how industrial innovation policies can be designed and executed under conditions of initial institutional weakness (or prematurity). The country's post-1960s industrial transformation unfolded through a sequential process of institutional development and policy learning (Jang 2011; Hwang 2011; Hong 2011; Lee 2011).

In the 1960s, the government established the Economic Planning Board (EPB) and the Ministry of Science and Technology (MOST) to align industrial objectives with technological development. Export-oriented strategies guided resource allocation, while technology transfer was promoted through turnkey manufacturing, OEM, and/or technology licensing. The Korea Institute of Science and Technology (KIST), established in 1967, played a central role in learning, absorbing, adapting and diffusing technologies to domestic companies, particularly in light industries such as textiles, footwear, food, ore, etc.

In the 1970s, the heavy and chemical industry (HCI) drive prioritized industries such as steel, shipbuilding, petrochemicals and machinery. The state mobilized public banks and conglomerates (chaebols) to invest in long-term industrial R&D, supported by government-sponsored research institutes (GRIs) such as KIMM (Korea Institute of Machinery and Materials) and KIER (Korea Institute of Energy Research), which were a spin-off of KIST.

The 1980s marked a shift towards technological self-reliance and the expansion of domestic R&D capabilities, with the establishment of national research and development programmes and the promotion of private R&D centres through tax incentives. The government also introduced evaluation and foresight mechanisms to align national R&D with industrial needs. By the 1990s, policy orientation evolved towards globalization and the knowledge-based economy. The government promoted information and communication technology (ICT), biotechnology, and regional innovation clusters, integrating the S&T system with industrial competitiveness. Jang (2011) summarizes the Republic of Korea's industrial shifts and its corresponding STI policies as follows (Table 1).

Table 1 | Development and role of S&T policies in the Republic of Korea

Period	1950s	1970s	1980s	1990s	2000s	2010–
Era	Export-Oriented	Export-led	Economic Liberalization	Democrat.	Advancement	Global Leading
Focused Industries	Light Industries	Heavy Industries	Assembly & Processing Industries	ICT	Knowledge Intensive Industries	Knowledge Service/New Convergeng/ Green Ind.
Competitive Factor	Cheap Labor	Skilled Labor	Capital Investment	Technologies	S&T Innovation	Advanced S&T Innovation
Demanding S&T HR	Skilled HR	Technical HR	Higher S&E	High Caliber S&E	Creative S&E	Creative & Convergeng S&E
Demanding Tech.	Plant Mgt.	Facility M&O	Mfg.	Core Tech.	Indigenous Tech.	Source Tech.
S&T Policy	Turn-key Capital Imports/ Tech. Learning	Internalizing Imported Tech./ Reverse Eng.	Modify Imported Tech./ Develop Domestic Tech.	Advancing Tech. Catch-up/ Large Gov. R&D Prog.	Focus on indigenous tech./ Systemize S&T Prog.	Globalize S&T/ Focus on Convergence

Source: Jang (2011), p. 3

These developments illustrate how the Republic of Korea operationalized many principles later codified in Bonvillian's IIP framework: the combination of top-down strategic direction with bottom-up implementation, the coupling research with manufacturing, and the use of public-private partnerships (PPPs) to diffuse technology. While the literature has extensively documented the Republic of Korea's industrial and technological achievements (Amsden 1989; IMF 2019), only few studies have explicitly examined these through the analytical lens of IIP. The IIP framework offers a fresh

interpretive perspective that integrates innovation system dynamics with industrial transformation processes, allowing a comparison between advanced and late-industrializing countries.

By aligning the experience of the Republic of Korea with Bonvillian's framework, this paper addresses a conceptual and policy gap in two ways. First, it demonstrates that many of the "new" industrial innovation approaches identified in the United States were incorporated in the Republic of Korea's earlier experience (1960s–1990s), albeit under distinct institutional conditions. Second, it identifies additional enabling factors, such as demand-oriented innovation, robust institutional foundations, policy and implementation capabilities, and sustained political leadership, which are particularly relevant in developing countries where institutional systems remain underdeveloped.

These complementary lessons resonate with recent UNIDO research, which emphasizes policy capability development as a prerequisite for effective industrial policymaking (UNIDO 2021; Santiago & Zagato 2024), and with broader development debates stressing the cumulative nature of productive and innovation capabilities (UNIDO 2019; Andreoni, Chang & Labrunie 2021).

Objectives and methodologies

This Working Paper aims to derive practical lessons for developing countries by revisiting the Republic of Korea's industrial and S&T policies through the analytical lens of IIP. It argues that the Republic of Korea's experience complements and extends Bonvillian's framework by highlighting an additional set of institutional and political prerequisites that enabled the effective implementation of innovation-oriented industrial policy.

Specifically, the paper aims to:

- a) Clarify the conceptual foundations of IIP as defined by Bonvillian (2024), distinguishing it from classical industrial and S&T policy approaches and situating it in relation to the Washington Consensus and the subsequent resurgence of industrial policy.
- b) Analyse the historical evolution of industrial innovation policies in the Republic of Korea between the 1960s and 1990s, prior to its emergence as a globally competitive economy, with particular emphasis on the intersection of industrial targeting, technological capability building, and institutional development.
- c) Identify the necessary and sufficient conditions for successful IIP implementation in developing countries, with a focus on strategic planning that links innovation

to industrial demand, policy intelligence, implementation capacity, and leadership continuity.

- d) Draw lessons and policy implications for developing countries, concluding with reflections on the contemporary role of the Republic of Korea as a knowledge-sharing partner and donor in South–South and triangular cooperation.

The study adopts a qualitative, historical-comparative approach, drawing primarily on:

- a) theoretical foundations from Bonvillian (2024) and Soete (2007) on the evolution from industrial to innovation policy and the emergence of IIP;
- b) empirical analyses from Jang (2011) and related studies on the Republic of Korea’s decadal S&T policies;
- c) a recent UNIDO working paper (Santiago & Zagato 2024) situating policy capability and megatrend adaptation within global industrial transformation; and
- d) complementary analyses of digital industrialization and capability accumulation (UNIDO 2019; Andreoni, Chang & Labrunie 2021).

These sources allow for triangulation between theory, historical case analysis, and contemporary policy insights. The paper relies on secondary data, policy documents, and prior empirical studies rather than new statistical estimation.

Structure

Following this introduction, Chapter 2 reviews Bonvillian’s IIP concept, situating it within broader debates on the evolution of industrial and S&T policy and on the Washington Consensus and its reinterpretation. It elaborates on the “post-research” stages of innovation and presents a comparative table contrasting the experiences of the United States and of the Republic of Korea. Chapter 3 provides an in-depth historical analysis of the Republic of Korea’s industrial innovation policies from the 1960s to the 1990s, highlighting the interplay between economic strategy, institutional development, and technology policy. Chapter 4 extracts lessons transferable to developing countries, emphasizing institutional preconditions and policy capabilities. Chapter 5 concludes with reflections on the continuing relevance of IIP for inclusive, sustainable and resilient industrial development in the Global South, including in the context of digitalization, and highlights the Republic of Korea’s contemporary role as a development partner.

The introduction underscores the rationale for reinterpreting the Republic of Korea's development trajectory through the lens of IIP. The country's experience demonstrates that innovation-driven industrialization is not merely the result of market incentives or isolated research efforts, but of strategic state capability, coordinated policy design, and adaptive learning. For developing countries aiming to achieve structural transformation under contemporary global constraints—climate imperatives, digitalization, tighter intellectual property regimes, and geopolitical fragmentation—the case of the Republic of Korea offers a rich repository of institutional and policy lessons.

This paper contributes to the literature on IIP by extending Bonvillian's framework to a late-industrializing context. It shows that effective IIP in developing countries depends not only on post-research innovation instruments, but also on a set of institutional and political preconditions—policy intelligence, implementation capacity, and political continuity—that determine the feasibility and sustainability of innovation-led industrial transformation.

2. Industrial innovation policy: A conceptual framework

Industrial policy has re-emerged globally as a strategic instrument for achieving technological competitiveness, resilience and sustainability. However, the contemporary paradigm of industrial policy differs fundamentally from its post-war predecessors. It is no longer confined to protecting infant industries or guiding investment through subsidies and tariffs; instead, it integrates S&T instruments to accelerate technological learning and industrial upgrading. This hybrid form of policy—what Bonvillian (2024) terms ‘Industrial Innovation Policy’ (IIP)—links the innovation process directly to production and deployment, positioning the state as an orchestrator of systemic change rather than merely a regulator of markets.

This chapter elaborates the theoretical underpinnings of IIP, contrasts it with traditional industrial and S&T policy approaches, and draws from Soete (2007) to trace the conceptual evolution from industrial to innovation policy. It also discusses the institutional prerequisites for effective IIP implementation, informed by UNIDO’s recent work on policy capacity and governance systems in developing economies (UNIDO 2021; Santiago & Zagato 2024). Finally, it considers constraints arising from today’s global trade and intellectual property regimes and presents a comparative table comparing the experiences in both the United States and the Republic of Korea to illustrate how similar principles operate under different institutional conditions.

From industrial policy to industrial innovation policy

Traditional industrial policy, prevalent from the 1950s through the 1980s, was largely sectoral, targeting specific industries for protection, subsidies or preferential credit. In the post-war reconstruction period, European and Asian governments adopted industrial policies to accelerate the modernization of key industries such as steel, shipbuilding and chemicals (Soete 2007). These policies were grounded in the notion of market failure, particularly the externalities associated with learning-by-doing and the coordination challenges inherent in large-scale investments. While successful in enabling late industrialization in several economies (e.g. Japan, the Republic of Korea, Taiwan, Province of China), these strategies were often criticized for fostering inefficiency and rent-seeking. As globalization and trade liberalization progressed, the scope for selective industrial support narrowed, and the Washington Consensus of the 1990s further undermined the legitimacy of interventionist approaches.

However, it is important to recognize that the Washington Consensus, as originally formulated and later revisited by its main proponent, was not uniformly hostile to all forms of state intervention. Williamson (2008) explicitly acknowledged that policies targeting innovation performance could be consistent with the principles of non-distortive policy initiatives. He recognized a legitimate role for governments in promoting enabling institutional environments for firms seeking to innovate by ensuring access to the necessary supporting infrastructure. Accordingly, in Williamson's interpretation, governments could legitimately establish institutions to provide technical education, promote the diffusion of technological knowledge, fund pre-competitive research, offer tax incentives for R&D, encourage venture capital, and support the development of industrial clusters.

This more nuanced reading suggests continuity rather than a complete rupture between earlier development-oriented industrial policies and contemporary innovation-led frameworks: what is questioned is not state involvement per se, but the form and quality of that involvement. By the late 1990s, the concept of innovation policy had emerged as a distinct domain emphasizing knowledge creation, R&D and technological capability building. Influenced by evolutionary economics (Nelson & Winter 1982) and national innovation system (NIS) theory, the focus shifted from protecting industries to fostering interactions among universities, firms and research institutions to support innovation.

Yet according to Soete (2007), innovation policy was often supply-driven, prioritizing research investment while neglecting commercialization, diffusion and demand creation. It assumed that innovations would naturally spill over into markets, thereby underestimating the institutional mechanisms required to scale technologies into production. The result was a persistent "valley of death" between scientific discovery and industrial deployment, an issue later addressed by Bonvillian through his IIP framework.

IIP, as defined by Bonvillian (2024), comprises deliberate government interventions in the post-research stages of innovation that bridge the gap between R&D and market deployment. These interventions include pilot demonstration projects, technology validation, scale-up financing, and workforce development. Unlike classical industrial policy, which focuses on individual sectors and industries, or innovation policy, which focuses on research, IIP centres on translational systems, i.e. the processes that move technologies from labs to factories.

The IIP framework recognizes that innovation does not follow a linear sequence but constitutes a systemic process requiring feedback loops among research, development, production and market learning. It integrates multiple domains, including industrial, innovation, regional and skills policy, into a coherent system focused on technological adoption and production scaling. Bonvillian identifies seven interrelated approaches underpinning the experience of the United States in 2020–2022:

- a) Top-down mission-oriented initiatives: Strategic programmes addressing grand challenges (e.g. the CHIPS and Science Act, energy transition).
- b) Bottom-up regional ecosystems: Empowering local innovation clusters through universities, small and medium enterprises (SMEs), and public–private partnerships.
- c) Demonstration projects: Large-scale pilots bridging R&D and commercial readiness (Technology Readiness Levels 5–8).
- d) Direct production support: Public procurement and manufacturing incentives to de-risk early industrialization and scaling.
- e) Supply chain resilience: Mapping and localization of critical supply chains in semiconductors, clean energy and medical equipment.
- f) Coupling of basic and applied research: Institutional linkages between science agencies (e.g. NSF, DOE) and manufacturing initiatives.
- g) Regional implementation frameworks: Coordination mechanisms aligning national objectives with subnational innovation systems.

Collectively, these approaches represent a paradigm shift from market correction to mission execution. The government’s role evolves from funding research to orchestrating systemic transitions. A complementary interpretation of this shift is found in Best (2018), who describes how the United States developed the productive and scientific infrastructure required to win the Second World War and sustain its “arsenal of democracy” thereafter. Rather than industrial policy in the narrow sense, Best characterizes this as production policy: the deliberate use of public institutions, procurement and organizational innovation to build productive capabilities and link them to scientific and technological advances. This historical experience underscores a long-standing tradition of cross-fertilization between production and S&T systems in the United States, providing a deeper historical foundation for the contemporary IIP agenda. It also highlights a key lesson for developing countries: investment in S&T and productive capabilities must be mutually reinforcing, rather than treated as separate domains.

Theoretical advances and the role of directionality

Bonvillian’s framework offers three major theoretical contributions. First, it integrates industrial and innovation policy: IIP dissolves the boundary between industrial structure and technological learning, recognizing that both evolve simultaneously. Second, it emphasizes the post-research stages, directing policy attention to technology validation, scale-up and diffusion—stages historically neglected by S&T policy. Third, it highlights institutional design, underscoring the need for agile, cross-sectoral institutions capable of “learning by doing” at the policy level. These features align with Soete’s (2007) argument that the resurgence of industrial policy should not replicate past protectionism but instead build dynamic, innovation-oriented capabilities. As Soete notes, “industrial policy has re-emerged under the guise of innovation policy,” yet its success depends on integrating competitiveness, social inclusion and environmental sustainability.

Related debates highlight the directionality of innovation and industrial policy: the notion that public interventions should not be neutral with respect to technological trajectories, but should orient innovation towards addressing societal challenges (Mazzucato 2018). Directionality implies that policy does more than “fix market failures”; it shapes markets and production systems around missions such as decarbonization, health, or inclusive digitalization. This aligns closely with IIP’s mission-oriented approach and with UNIDO’s emphasis on linking industrial development to the Sustainable Development Goals (SDGs).

In essence, IIP provides a systemic framework that redefines industrial policy for the 21st century: innovation-led, mission-oriented, and institutionally adaptive, while also focusing on the need for directionality in public support and the accompanying requirements for governance, accountability and conditionality.

Institutional preconditions and policy capability

While the conceptual logic of IIP is universal, its implementation depends heavily on institutional capability – an area where developing countries often face persistent challenges. UNIDO (2021) and Santiago and Zagato (2024) argue that effective IIP requires three interdependent capabilities:

- a) Analytical capability: the ability to generate, interpret and use evidence to design policies aligned with national objectives.
- b) Operational capability: the ability to manage programmes, coordinate stakeholders, and ensure coherence across ministries.

- c) Adaptive capability: the institutional flexibility to learn, reform and iterate based on performance feedback and evolving conditions.

The absence of these capabilities results in fragmented policymaking and weak execution, even when strategies are well designed. Consequently, IIP success in developing countries depends not only on policy content but also on the governance architecture supporting its implementation. The Republic of Korea's policy trajectory illustrates the importance of such capabilities. The Economic Planning Board (1961) and the Ministry of Science and Technology (MOST) (1967) were not merely bureaucratic units but dynamic institutions integrating planning, implementation and learning. Their evolution laid the foundation for the Republic of Korea's adaptive innovation system, offering an institutional model relevant to today's developing economies.

Bonvillian's concept of the post-research stages aligns with what UNIDO (2021) describes as the "innovation–production interface". These stages involve simultaneous technical validation, market creation, and institutional coordination. They correspond roughly to Technology Readiness Levels (TRLs) 5–8, where public intervention is critical to overcoming financing and coordination failures. For developing countries, addressing this interface requires building intermediate institutions such as technology centres, demonstration facilities, and industrial clusters that can reduce uncertainty between research and commercialization. The Republic of Korea's experience in the 1970s and 1980s illustrates how targeted public R&D institutes and corporate partnerships effectively filled this gap (Jang 2011; Hong 2011; Song 2011).

From a policy design perspective, this suggests that IIP must:

- a) combine supply-side R&D incentives with demand-side instruments (procurement, standards, user-driven innovation);
- b) foster learning-by-doing within public agencies; and
- c) institutionalize monitoring and evaluation mechanisms to enable iterative improvement.

The importance of demand-side instruments becomes particularly evident in a comparative perspective. In Latin America, weak articulation and limited use of domestic demand for innovation have contributed to low productivity growth, even in dynamic industries where technological needs were largely met through imported technologies (Crespi & Dutrénit 2014). This contrasts with East Asian experiences, where demand for local innovation—often driven by export performance requirements, localization targets and public procurement—played a central role in building capabilities.

Conditionality and policy space

A related institutional feature concerns conditionality in public support. The Republic of Korea's development strategy combined generous support (e.g. directed credit, protection) with strict performance requirements, particularly export targets and productivity improvements. This “reciprocal control mechanism” ensured that firms receiving state support were held accountable for results. Contemporary debates on mission-oriented innovation policy have renewed interest in such conditionality, highlighting the need to link public support to public value (Mazzucato 2018).

For developing countries, conditionality is relevant at two levels. Internally, it can align firm behaviour with national development objectives, provided monitoring and evaluation (M&E) systems are in place. Externally, however, conditionality can also refer to constraints imposed by international governance regimes, such as trade rules or intellectual property agreements, which may limit policy space for localization, technology transfer or local content requirements.

As UNIDO (2019) and Andreoni, Chang and Labrunie (2021) argue, opportunities for digital industrialization are strongly conditioned by these global frameworks. The notion that countries can “leapfrog” directly to advanced digital technologies without first developing basic productive capabilities often collides with the realities of intellectual property (IP), standards and data governance. This makes the sequencing of capability building, and not just the choice of technology, central to IIP design.

The Republic of Korea, the United States, and different pathways towards IIP

Although Bonvillian's framework is derived from a high-income context, the historical experience of the Republic of Korea reflects many of its principles. The key difference lies in institutional maturity and sequencing: while the United States builds on existing capabilities to renew the country's industrial competitiveness, the Republic of Korea developed those capabilities from scratch during its industrial ascent. Thus, similar IIP principles can be implemented through different institutional paths.

Table 2 compares the experiences of the United States and the Republic of Korea along four dimensions: (i) missions, (ii) institutions, (iii) policy instruments, and (iv) sequencing. In the United States, missions such as decarbonization or semiconductor resilience build on a large R&D base, robust financial markets, and established regional ecosystems. In the Republic of Korea, earlier missions, such as the HCI drive or the ICT push, were used to create these capacities and capabilities, not only to redeploy them.

For developing countries, the Republic of Korea’s sequential model–building institutions before diversification, gradually increasing technological complexity, and combining conditional support with strong performance monitoring—may provide a more pragmatic pathway than the model in the United States, which assumes the presence of existing industrial infrastructure and policy capacity.

Table 2 | Comparative features of IIP: United States vs. Republic of Korea

Dimension	United States (2020s IIP as described in Bonvillian, 2024)	Republic of Korea (1960s–1990s industrial innovation trajectory)
Mission orientation	Missions address <i>frontier</i> challenges (semiconductors, clean energy, supply-chain resilience, artificial intelligence (AI)). Build on existing scientific & industrial bases.	Missions used to <i>create</i> capacities and capabilities (HCI drive, ICT drive). Focus on industrial deepening, export competitiveness, and capability accumulation.
Institutional maturity	Mature, specialized ecosystem of science agencies (National Science Foundation (NSF), Department of Energy (DOE)), mission agencies, labs, advanced universities, and sophisticated finance.	Institutions created sequentially. State built capabilities from scratch. High centralization in early decades.
Regional ecosystems	Strong bottom-up regional clusters (tech hubs, manufacturing institutes, workforce programmes). Empowered states & local governance.	State-led creation of clusters (Industrial Complexes, Daedeok Science Town). Regional innovation centres emerged later; early model was top-down.
Post-research interventions	Demonstration, scale-up funding, manufacturing incentives—aimed at bridging TRL 5–8.	Pilot plants and GRIs performed demonstration functions; directed credit and procurement accelerated firm-level scale-up.
Public–private coordination	Public–private partnerships mediated through competitive grants, consortia and procurement. Firms already technologically capable.	Strong state–business coordination with <i>reciprocal control mechanisms</i> : state support in exchange for export/technology performance.
Role of research	Strong coupling of basic & applied research through NSF–DOE–industry mechanisms; federal labs embedded in missions.	Basic research initially limited; applied research and technology absorption prioritized. Later decades strengthened universities & National Research Foundation (NRF).
Financing model	Mix of appropriations, tax credits, loan guarantees and venture capital. Deep capital markets reduce reliance on state banks.	State-controlled finance through directed credit, policy loans, and public banks. Venture capital becomes relevant only in the 1990s.

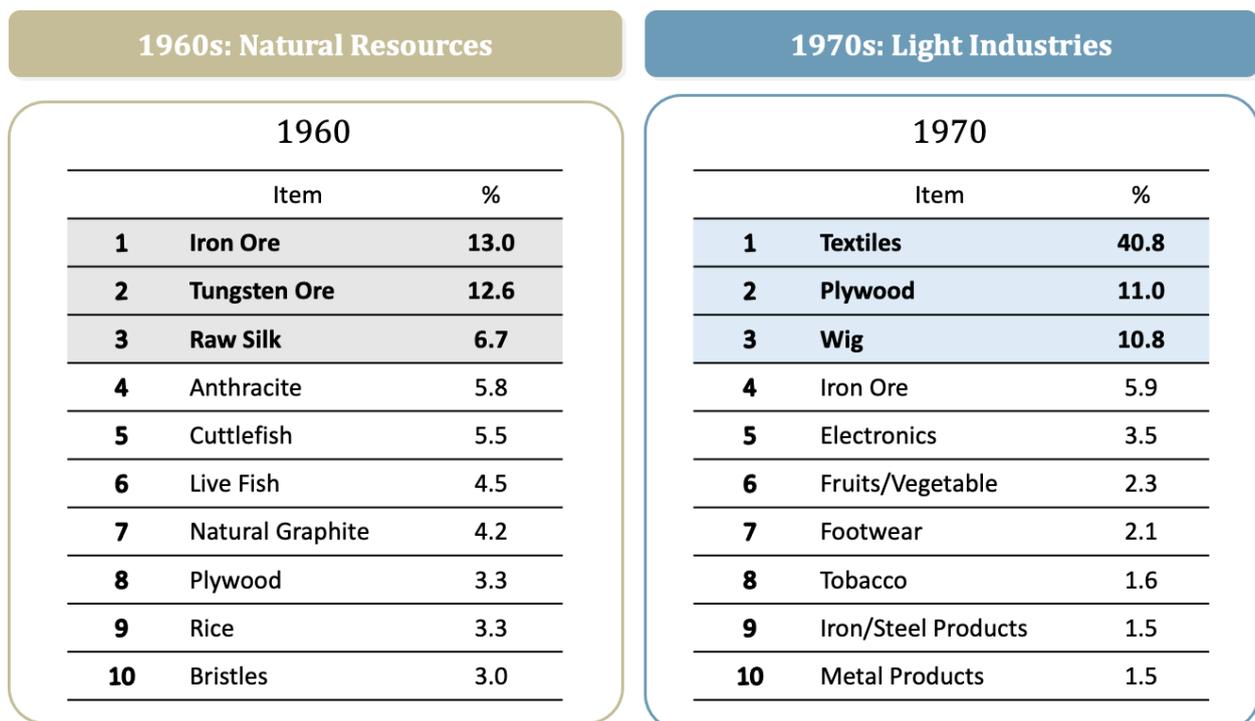
Dimension	United States (2020s IIP as described in Bonvillian, 2024)	Republic of Korea (1960s–1990s industrial innovation trajectory)
Innovation–production interface	Emphasis on reviving domestic manufacturing capability and re-shoring supply chains.	Core focus of entire development strategy: learning-by-doing, process engineering, and export-driven upgrading.
Monitoring & evaluation	Increasing focus on evidence-based policy, but fragmentation remains.	Centralized monitoring through the Economic Planning Board (EPB), MOST and other ministries; export performance and evaluations tightly linked to policy adjustments.
Political economy context	Advanced democracy; fragmented governance; policy ambition must navigate congressional politics.	Highly centralized decision-making (1960s–80s); long-horizon industrial missions supported by strong political continuity.
Policy Space (External Constraints)	Large autonomy; rule-maker in global trade and IP regimes.	Operated before strict World Trade Organization (WTO)/ Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) constraints; more freedom for selective protection, local content, export discipline.
Overall orientation	Rebuilding/renewing industrial competitiveness. “Innovation-led competitiveness.”	Building capabilities from scratch. “Industrialization through innovation.”

In sum, IIP represents a conceptual synthesis that bridges decades of industrial and innovation policy thinking. It expands the state’s role from a sectoral regulator to a systemic enabler of innovation-driven industrialization. For developing countries, it offers both inspiration and caution: the framework’s value lies not in replicating advanced economy models, but in setting a clear direction for public support in industrial development and adapting its principles through capability building, strategic learning, and policy experimentation. As the next chapter demonstrates, the historical experience of the Republic of Korea from the 1960s to 1990s provides a compelling empirical example of how such localization was achieved in practice.

3. Industrial innovation policies in the Republic of Korea

This chapter does not aim to provide a comprehensive history of the Republic of Korea's industrialization. Rather, it illustrates how core principles of IIP were operationalized across successive stages of development under conditions of initial institutional and technological immaturity. The Republic of Korea's industrial transformation from a resource-poor agrarian economy into a global innovation powerhouse is one of the most remarkable development stories of the 20th century. Between 1962 and 1999, the country's per capita income grew nearly tenfold from USD 106 in 1962 to USD 10,672 in 1999, while its industrial structure shifted from agriculture to high-technology manufacturing (see Figure 2). This transformation was not a spontaneous market process but the outcome of deliberate, adaptive and state-led IIPs.

Figure 2 | The Republic of Korea's top exports by decade (1960s–1990s)



**1980s: Light Industries;
Heavy & Chemical Industries**

1980

	Item	%
1	Textiles	28.8
2	Electronics	11.4
3	Iron/Steel Products	9.0
4	Footwear	5.2
5	Ships	3.5
6	Synthetic Fibers	3.3
7	Metal Products	2.3
8	Plywood	2.0
9	Fish	2.0
10	Electrical Goods	1.9

**1990s: Heavy & Chemical Industries;
High-tech. Industries**

1990

	Item	%
1	Textile Products	11.7
2	Semiconductor	7.0
3	Footwear	6.6
4	TV/VTR	5.6
5	Ships	4.4
6	Computers	3.9
7	Audio	3.8
8	Iron/Steel Products	3.8
9	Audio	3.6
10	Automobile	3.0

Source: KITA (Korea International Trade Association) Korea Customs Service (<https://www.kita.net>)

Decades before the term was coined by Bonvillian (2024), the Republic of Korea had already put many IIP principles into practice: mission-oriented planning, targeted technological learning, strong institutional coordination, extensive use of conditionality in public support, and iterative policy feedback. The evolution of these policies unfolded through four overlapping phases, each characterized by distinct developmental challenges, institutional responses, and innovation strategies (Jang 2011; UNIDO 2021).

The 1960s: Institutional foundations

The 1960s marked the Republic of Korea's transition from post-war recovery to industrial take-off through export-oriented industrialization. Under President Park Chung-hee's administration, economic development became central to national security and modernization. The First Five-Year Economic Development Plan (1962–1966) launched a series of interventions aimed at building industrial capability and reducing import dependence. Facing severe resource constraints, limited domestic markets, and weak technological capabilities, the government adopted exports as the primary source of demand for industrial learning. Export performance was not merely a trade objective; it served as a disciplinary and learning mechanism, compelling firms to acquire basic production, quality control and management capabilities.

The central institution was the Economic Planning Board (EPB), established in 1961 to integrate planning, budgeting and foreign borrowing within a single institutional framework. The EPB's role extended beyond economic coordination; it institutionalized a policy intelligence system—a critical IIP function—linking industrial strategy with implementation feedback. By closely monitoring export performance and macroeconomic indicators, the EPB was able to adjust policy instruments in near real time. In parallel, the government established MOST in 1967 to ensure that technological learning aligned with industrial objectives and national development goals.

A defining feature of the 1960s was the Republic of Korea's deliberate effort to develop export-oriented industrial bases in regions strategically selected under the first Five-Year Economic Plan. Notable examples include the Ulsan Industrial District, designated in 1962, and the Korea Export Industrial Park in Guro (also known as the Guro Industrial Complex) completed in 1966. These industrial complexes were later significantly expanded and became bases for regional innovation clusters.

Another feature was the Republic of Korea's deliberate effort to build technological capability alongside industrial expansion. Recognizing the limitations of private R&D and university research capabilities, the government established the Korea Institute of Science and Technology (KIST) in 1966 with support from USAID. KIST's mandate was to serve as a technology intermediary, conducting applied research and transferring results to domestic industries. As the first government-sponsored research institute (GRI), KIST focused on applied research and technology transfer, supporting domestic firms—particularly in light industries—by adapting imported technologies to local production conditions. Rather than pursuing frontier research, KIST emphasized problem-solving at the factory level, exemplifying an early form of intervention at the innovation–production interface. Subsequently, many GRIs were either spun off from or modelled on KIST in key industries such as metals, chemicals, machinery and textiles, laying the foundation for a sectoral innovation system. The Korea Advanced Institute of Science (KAIS; later KAIST) was established in 1971 as a graduate institution to supply advanced high-calibre scientists and engineers to the emerging high-tech industries in the Republic of Korea.

These institutions reflected an early recognition that industrialization and innovation must co-evolve—an idea later formalized in IIP theory (Bonvillian 2024). The Republic of Korea's approach bridged supply and demand: while the EPB prioritized industrial targeting and export performance, MOST established KIST and GRIs to focus on technological adaptation in support of these industrial objectives.

Key instruments in this decade included:

- a) Export incentives: Tax exemptions, subsidized credit and export targets for private firms, supported by rigorous monitoring;
- b) Technology transfer and licensing: Government-negotiated technology imports tied to learning requirements;
- c) Education and training programmes: Scholarships and technical schools producing engineers and technicians; and
- d) Public financing: Foreign aid and concessional loans directed towards infrastructure and machinery.

Together, these instruments created a learning-oriented industrial environment in which firms were compelled to acquire and internalize technologies through export performance. Conditionality operated through export targets and access to credit: firms that failed to meet targets risked losing bank financing, aligning private incentives with national development goals.

The 1970s: HCI drive and mission-oriented deepening

The 1970s marked a shift from light manufacturing towards mission-oriented industrial deepening through the HCI drive (1973–1979). Triggered by external shocks such as the 1973 oil crisis and geopolitical uncertainties (including the potential withdrawal of U.S. troops from Asia), the government aimed to establish national self-reliance in key industries: steel, shipbuilding, petrochemicals, non-ferrous metals and machinery.

Demand remained central, but it now took the form of state-created markets through large-scale infrastructure projects, defence procurement, and export expansion. The state assumed an entrepreneurial role, mobilizing public banks, coordinating major investment projects through close state–business collaboration, and establishing specialized agencies to implement large-scale industrial initiatives. MOST assumed responsibility for coordinating national R&D efforts, integrating scientific research with industrial objectives. Institutionally, the HCI drive accelerated the expansion of GRIs, many of which were spun off from KIST to focus on industry-specific applied research (e.g. in machinery, chemicals, energy).

At the same time, policy coordination mechanisms expanded: MOST collaborated with the Ministry of Commerce and Industry (MCI) to align industrial targets with technology programmes, while the EPB continued to oversee financing and planning. This inter-ministerial coordination reflected the cross-agency collaboration emphasized in Bonvillian's model of IIP implementation.

The HCI drive relied on several key policy instruments:

- a) Directed credit: State-owned banks provided subsidized loans to chaebols investing in priority industries;
- b) Public R&D projects: Government-funded initiatives in materials, machinery and process engineering, often embedded within GRIs;
- c) Procurement and localization: Domestic production mandates for defence and infrastructure equipment;
- d) Technology cooperation: Bilateral agreements with Japan, Germany and the United States for industrial technology transfer.

Policy capability advanced through centralized planning and continuous monitoring. Implementation relied on reciprocal control mechanisms: firms received protection and subsidized credit in exchange for investment, export performance and technological upgrading. This reciprocal control mechanism ensured that state support translated into capability accumulation rather than pure rent-seeking. While this phase entailed increased financial risks and technological dependence, it significantly deepened the Republic of Korea's industrial base and engineering capabilities.

The outcome was rapid structural transformation. The manufacturing sector's share of gross domestic product (GDP) rose from 20 per cent in 1970 to over 30 per cent by 1980, while exports diversified from textiles to heavy industrial goods such as ships and steel products (Song 2011). However, this phase also revealed emerging tensions—rising corporate debt, technological dependence on foreign licensors, and environmental challenges—that would drive the policy shift in the Republic of Korea in the following decade.

The 1980s: Technological self-reliance and systemic innovation

Following the macroeconomic instability and the second oil shock (1979), the new administration reoriented policy from industrial expansion towards technological self-reliance, endogenous R&D and efficiency. The 1980s marked the Republic of Korea's transition from imitation to innovation, and from state-led industrialization to a more

balanced public-private partnership model (Jang 2011; Hong 2011). The government strengthened the STI governance framework through the Second Science and Technology Promotion Plan (1982–1986). MOST assumed a central role in setting R&D priorities, coordinating ministries, and fostering industry-university-research collaboration. New programmes were launched to integrate science education, basic research, and industrial application. The National R&D Program (1982) funded strategic technologies in electronics, materials and energy. The Korea Science and Engineering Foundation (KOSEF), the precursor of the National Research Foundation (NRF), was established to manage competitive research funding.

This decade also saw the creation of Daedeok Science Town (later Daedeok Innopolis), the Republic of Korea's first national innovation cluster, bringing together public laboratories, universities and private R&D centres. It embodied the regional ecosystem concept that is central to Bonvillian's framework several decades earlier. A significant structural shift occurred as the private sector emerged as the dominant R&D performer. Incentives such as the Tax Credit for R&D Investment (1982) and the Accreditation System for Corporate R&D Centres (1984) encouraged chaebols such as Samsung, Hyundai and LG to establish in-house research facilities. By 1990, the private sector accounted for over 70 per cent of R&D expenditure, among the highest share globally.

This reflected a successful transition from state-led to co-governed innovation – a hallmark of mature IIP. The government's role shifted from direct control to strategic coordination and evaluation, consistent with Santiago & Zagato (2024) concept of adaptive policy capability. The policy process also became more explicitly evaluation based. MOST institutionalized performance evaluation of R&D programmes, using measurable indicators such as patents, technology licences and productivity gains. Periodic science and technology foresight exercises aimed to anticipate emerging industries and align public R&D with long-term industrial missions. These monitoring and evaluation practices prefigure the emphasis on feedback and learning central to contemporary IIP and mission-oriented innovation frameworks.

The 1990s: Globalization, ICT and the knowledge-based economy

The 1990s ushered in a new policy paradigm characterized by globalization, democratization, and the rise of the knowledge-based economy. As the Republic of Korea integrated into global markets and joined the Organisation for Economic Co-operation and Development (OECD) in 1996, industrial policy shifted towards innovation-driven globalization. The Seventh Five-Year Economic and Social Development Plan (1992–1996) emphasized knowledge-intensive industries, such as semiconductors, ICT, biotechnology and advanced materials.

The government introduced regulatory and financial reforms to support venture businesses and technology start-ups. The Small and Medium Industry Promotion Act (1991) and the Technology Development Promotion Act (1994) established new funding mechanisms for SMEs and technology commercialization.

MOST restructured its policy architecture to promote decentralization and the diffusion of innovation. The National Science and Technology Council (NSTC) was established to coordinate across ministries, while regional innovation centres connected universities with local industries. Large investments in information infrastructure (e.g. the Korea Information Infrastructure Project) laid the foundations for the Republic of Korea's later leadership in broadband and digital services.

This period also saw the rise of public-private co-financing schemes, blending public grants with venture capital, and the emergence of the venture boom in the late 1990s. The Republic of Korea's innovation policy became increasingly systemic, emphasizing networked governance rather than purely hierarchical control. The Asian Financial Crisis of 1997 tested the country's innovation system. The crisis revealed weaknesses in financial governance and over-leveraged conglomerates but also accelerated structural reforms. In response, the government launched the Technology Competitiveness Reinforcement Program (1998), expanded SME financing, and promoted information technology (IT) and venture industries as new growth engines. These post-crisis reforms marked the Republic of Korea's entry into the knowledge-based economy, consolidating its transition from technology follower to innovation leader. Importantly, the state retained its IIP functions—strategic coordination, capability building, and policy learning—while granting greater market autonomy. M&E systems were further strengthened, and lessons from earlier phases were institutionalized in new agencies and councils.

Implications for IIP theory

The experience of the Republic of Korea exemplifies how a developing country can anticipate and operationalize IIP principles long before they were codified in contemporary theory. Several parallels are evident between the Republic of Korea's developmental trajectory and Bonvillian's (2024) IIP framework:

- a) Top-down missions: The Republic of Korea's HCI drive and later ICT programmes represented clear national missions, analogous to initiatives in the United States, such as CHIPS or ARPA-E, albeit focused on capability accumulation rather than re-shoring.

- b) Bottom-up ecosystems: The establishment of industrial complexes, Daedeok Science Town and regional innovation centres reflected the regional approach of modern IIP by clustering firms, universities and institutes.
- c) Demonstration and scale-up: Public-private R&D programmes and pilot plants served as large-scale demonstrations bridging research and commercialization.
- d) Coupling research and production: Institutions such as KIST and sectoral GRIs linked laboratory research with industrial application and process engineering.
- e) Evaluation and feedback: The institutionalization of foresight and programme evaluation in the 1980s and 1990s created policy learning mechanisms similar to those promoted in current mission-oriented innovation frameworks.
- f) Conditionality and reciprocity: Reciprocal control mechanisms—state support in exchange for performance—created strong incentives for firms to invest in learning and upgrading.

The Republic of Korea's success derived not only from policy design but also from the development of policy capabilities, i.e. the ability to plan strategically, coordinate effectively, and learn adaptively. These capabilities align directly with Santiago & Zagato's (2024) framework for sustainable industrial policymaking and highlight why industrial innovation policies cannot be transplanted without attention to the underlying institutional context. Between the 1960s and 1990s, the Republic of Korea transformed its innovation landscape through a sequence of state-led, learning-oriented industrial innovation policies. Each decade built on the previous one: institution building in the 1960s, industrial deepening in the 1970s, technological self-reliance in the 1980s, and knowledge-based innovation in the 1990s. This cumulative process exemplifies the evolutionary nature of IIP: rather than a static blueprint, IIP in the Republic of Korea functioned as a dynamic governance mechanism, continuously adapting to internal challenges and external shocks.

The next chapter distils these historical insights into transferable lessons for developing countries aiming to design and implement industrial innovation policies that address contemporary development challenges.

4. Lessons for developing countries

The experience of the Republic of Korea with industrial innovation policy shows that technological and institutional transformation is possible even in resource-scarce environments, provided that governments act strategically, learn continuously, and coordinate effectively. While no single model can be universally applied, the Republic of Korea's trajectory offers principles that can inform the design of IIPs in developing countries.

Developing countries face a more complex global environment than the Republic of Korea encountered during its early industrialization. GVCs are more fragmented, technologies evolve rapidly, and climate and digital transitions impose new constraints. At the same time, international regimes governing trade, investment and intellectual property rights are more stringent and comprehensive than in the 1960s–1970s. These frameworks, ranging from WTO rules to TRIPS and bilateral agreements, limit some of the policy instruments (e.g. local content requirements or selective export subsidies) that the Republic of Korea employed in earlier decades (UNIDO 2019). Nevertheless, the central message of the Republic of Korea's experience remains clear: industrial transformation requires deliberate, innovation-oriented policy intervention. As Bonvillian (2024) argues, innovation extends beyond the research laboratory into production, scale-up and deployment. Developing countries, often rich in ideas but constrained in implementation capability, need policy frameworks that systematically link these stages.

At the same time, the Latin American experience illustrates that the absence of strong domestic demand for local innovation and reliance on imported technologies, often without substantial local capability accumulation, contribute to persistent productivity gaps (Crespi & Dutrénit 2014). The contrast with the Republic of Korea and other East Asian economies underlines the importance of demand-driven innovation policies and the strategic use of domestic and export markets as learning arenas. For developing countries, the core principle is to align policy ambitions with existing capability levels, avoiding premature shifts to high-technology industries before mastering foundational manufacturing processes. The notion of “digital leapfrogging” without a solid production base often results in shallow adoption of imported digital solutions, generating limited local value added.

Implementing IIP in developing countries requires contextual adaptation and sequencing. While advanced economies such as the United States can leverage sophisticated R&D systems and financing instruments, most developing countries must first build foundational capabilities, namely policy intelligence, institutional frameworks,

implementation capacity and political continuity. As emphasized by Santiago & Zagato (2024), the sequencing of capability development is critical: countries must establish these “policy foundations” before undertaking complex innovation missions.

The experience of the Republic of Korea exemplifies this principle. The government did not begin with frontier R&D, but with targeted learning-by-doing strategies and institution-building, using trade and industrial policies to develop basic manufacturing capabilities. Only after establishing planning, research and evaluation systems did it progress towards mission-oriented innovation. This aligns with the concept of a capability stairway, in which countries move from technology acquisition to adaptation, diffusion and ultimately creation (UNIDO 2021; UNIDO 2019; Andreoni, Chang & Labrunie 2021). Drawing on this and other experiences, the following five interdependent lessons emerge for developing countries seeking to design and implement IIP.

Demand-driven, mission-oriented innovation

A central lesson from the experience of the Republic of Korea is that innovation policy must be firmly anchored in (industrial) demand. The Republic of Korea did not pursue science and technology development as an autonomous or exclusively supply-driven endeavour. Instead, STI policies were consistently aligned with industrial needs, most notably export competitiveness, industrial deepening, and later national missions such as ICT development.

Export markets served as critical learning arenas. Firms faced international competition, quality standards, and cost pressures, driving continuous technological upgrading and process innovation. Public procurement and infrastructure projects further reinforced domestic demand for industrial capabilities, particularly during the HCI drive and later in ICT diffusion. Equally important was strategic focus. Faced with limited financial, human and institutional resources, the Republic of Korea concentrated policy efforts on a narrow set of priority industries and technologies at each stage of development. This strategic orientation enabled scale, coordination, and learning-by-doing, avoiding the dilution of resources across too many objectives.

Conditionality is central to mission success. In the Republic of Korea, access to subsidized credit, protection or public contracts was conditional on performance indicators such as export volumes, investment levels or technological upgrading. Contemporary mission-oriented innovation policy debates, particularly those advocated by Mazzucato (2018), emphasize that conditionality should also address broader public value dimensions, including environmental sustainability and social inclusion. For developing countries, this implies designing contracts, procurement schemes and partnerships where public support is explicitly tied to learning, capability building and

societal outcomes, with risks and rewards more equitably shared between the public and private sectors.

Developing countries can adopt similar approaches by:

- a) Identifying societal missions (e.g. renewable energy, food security, digital inclusion);
- b) Aligning industrial incentives (subsidies, procurement, credit) with those missions; and
- c) Coordinating across ministries, regions and research institutions.

However, missions must remain adaptive. As Bonvillian (2024) notes, the success of mission-oriented programmes depends on continuous learning and adjustment, rather than rigid adherence to pre-set plans.

Institutional foundation

The Republic of Korea's success relied on strong institutional foundations, particularly centralized policy intelligence and coordination capacity. Institutions such as the EPB and later MOST played a critical role in aligning industrial, technological, and financial policies within coherent national strategies.

Three lessons are particularly relevant:

- a) Establish a strong coordination centre: A dedicated inter-ministerial agency should integrate industrial, technological, and financial policies under a unified strategic framework. This could take the form of a planning commission, a high-level STI council, or a presidential delivery unit.
- b) Embed analytical capability: Data-driven policy design, evidence-based evaluation, and scenario planning are essential for guiding industrial targeting, including periodic foresight exercises and sectoral diagnostics.
- c) Institutionalize feedback loops: Mechanisms for continuous policy learning, through monitoring, evaluation and stakeholder consultation, ensure adaptability and help prevent lock-in to ineffective strategies (Santiago & Zagato 2024).

Equally important was the creation of intermediary institutions linking science and industry. Applied research institutes such as KIST, KAIST and other government research institutes adapted foreign technologies to domestic conditions and diffused them across firms. For developing countries, similar roles can be filled by sectoral technology centres

or applied research organizations focused on addressing concrete production challenges rather than purely academic research. As emphasized by UNIDO (2021), these institutions function as “technology translators,” enabling firms to adopt cleaner, more productive, and more resilient production methods. They need not be large or costly but must be demand-driven, oriented towards solving real industrial problems.

The establishment of Daedeok Science Town and subsequent regional innovation centres illustrates how localized clusters can facilitate knowledge diffusion. Developing countries can replicate this approach by leveraging existing industrial zones or university hubs to establish regional innovation ecosystems, particularly around priority industries or missions (e.g. agro-processing, renewable energy, digital services).

Policy capability

Institutions alone are not sufficient, however. The Republic of Korea’s success depended considerably on the policy capability of the state itself. Key ministries, such as EPB and MOST, recruited staff from the top tier of the civil service through highly competitive national examinations, ensuring both analytical competence and professional commitment. The career civil service system provided:

- a) merit-based recruitment of elite technocrats,
- b) long-term career stability as professional public servants, and
- c) incentives for policy learning and institutional memory.

In parallel, the Republic of Korea’s policy intelligence capacity was significantly strengthened by the emergence and consolidation of professional, domain-specific policy think tanks, such as the Korea Development Institute (KDI) for economic and industrial policy, the Science and Technology Policy Institute (STEPI) for STI policy, and a range of others focused on social, environmental, labour and welfare issues. These institutions provided systematic policy research, evidence-based analyses, and long-term strategic perspectives that individual ministries could not easily generate on their own, especially during periods of rapid industrial transformation. Their analytical capabilities, data infrastructure, and policy evaluation methodologies helped policymakers anticipate emerging challenges, benchmark international practices, and design more coherent cross-sectoral strategies. As the Republic of Korea’s policy agenda grew in complexity from macroeconomic stabilization and export-led industrialization to innovation, sustainability, and social inclusion, these policy think became indispensable in enhancing policy design, coordination and continuity, thereby supporting the

country's pursuit of long-term, adaptive, and strategically informed development trajectories.

For developing countries, investing in policy capability entails professionalizing the civil service, strengthening analytical institutions, and institutionalizing strategic planning and evaluation. Without such capabilities, industrial innovation policy risks becoming fragmented, reactive, or captured by short-term interests.

Implementation capability

Many developing countries fail not at the design stage, but in implementation. The Republic of Korea's experience highlights the critical role of implementation capability, i.e. the translation of strategic intent into tangible outcomes. As Santiago & Zagato (2024) note, implementation—not design—is the most common point of failure in developing countries. The Republic of Korea's strength lay in its ability to execute large-scale programmes effectively, monitor progress, and adapt to setbacks. This capability emerged from several institutional features:

- a) Professionalization of the bureaucracy and merit-based recruitment of technocrats,
- b) Clear mandates and coordination rules among ministries,
- c) Centralized coordination mechanisms to avoid fragmentation,
- d) Action plans backed by committed budgets,
- e) Rigorous monitoring and evaluation systems, and
- f) Political continuity supporting long-term programs across administrations.

Korea's policy process was characterized by learning-by-doing, both within firms and government. Programs that failed were modified or replaced; institutions were restructured to address emerging challenges. For example, evaluation of early R&D programs in the 1980s led to the introduction of more systematic performance metrics and foresight systems in the 1990s. The experience of the Asian Financial Crisis triggered reforms in corporate governance and financial supervision, while simultaneously reinforcing the commitment to innovation and upgrading.

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For developing countries, adopting iterative policy cycles - where monitoring and evaluation feed directly into design revisions - is essential. This requires a shift from static planning towards adaptive governance, in line with Bonvillian's emphasis on institutional learning in IIP and with contemporary public policy literature on experimentation and feedback.

Conditionality played a central role. Public support—credit, R&D funding, protection, or procurement—was linked to measurable performance indicators such as exports, investment, or technological upgrading.

Policy and political continuity further reinforced implementation effectiveness. Long-term industrial and innovation programs were maintained across political cycles, enabling cumulative learning and sustained capability building.

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Policy and Political Continuity

A precondition for improving implementation capability is to secure policy continuity backed by strong political support. In contemporary democratic societies, nonetheless, sustaining strong political leadership and long-term policy continuity is increasingly difficult. One of the biggest challenges in most developing countries is to secure political continuity for long-term support on IIP. Most effective and feasible policy instruments to secure political continuity for long-term IIP is to improve public understanding on science, technology and innovation. Korea's experience suggests that one effective way to address this challenge is to raise public understanding of science, technology, and innovation.

A precondition for improving implementation capability is securing policy continuity supported by strong political backing. In contemporary democratic societies, however, maintaining sustained political leadership and long-term policy continuity is increasingly challenging. One of the greatest obstacles for developing countries is ensuring enduring support for Industrial Innovation Policy (IIP). Korea's experience suggests that an effective way to address this challenge is to strengthen public understanding of science, technology, and innovation, thereby building broader societal support for long-term industrial and innovation agendas.

One of the earliest and most emblematic initiatives was the "One Skill per Person" campaign, launched as part of a broader movement for national scientific modernization. The campaign encouraged every citizen - farmers, workers, youth, homemakers - to acquire at least one practical technical skill, thereby linking everyday livelihoods to national development goals. Through school programs, mass media messaging, community-based training, and collaboration with professional associations, the movement embedded scientific literacy and technical competence into the fabric of daily life (KEDI 1973; MOST 1987). By positioning skill acquisition and scientific thinking as patriotic responsibilities, the campaign created a social foundation that legitimized large-scale public investments in industrial upgrading, vocational training, and research capability.

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As this cultural orientation toward science deepened, it helped sustain political continuity around long-term national strategies despite changes of administration and shifting economic conditions. Public support for STI became a durable source of legitimacy for policies that required long planning horizons - industrial deepening in the 1970s, R&D expansion in the 1980s, and the ICT and knowledge-economy drive in the 1990s.

As this cultural orientation toward science strengthened, it helped sustain political continuity for long-term national strategies despite changes in administration and shifting economic conditions. Broad public support for STI became a durable source of legitimacy for policies requiring extended planning horizons—industrial deepening in the 1970s, R&D expansion in the 1980s, and the ICT and knowledge-economy drive in the 1990s.

Subsequent public-engagement instruments, such as the Science Culture Promotion Act (1994), nationwide science festivals, media-based popularization campaigns, and outreach activities led by MOST and the Korea Science and Engineering Foundation (KOSEF), reinforced this societal consensus (Kim 2005; Choi 2012). These initiatives cultivated a population receptive to technological change, supportive of public R&D spending, and willing to endorse ambitious national missions. In this sense, Korea's early efforts in STI popularization were not peripheral cultural programs but integral components of the institutional infrastructure that enabled sustained, cross-administration commitment to industrial innovation policy. They nurtured a shared societal expectation that science and technology were central to national progress, thereby reducing political resistance and creating a stable constituency for long-horizon developmental investments.

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High public understanding of science increased societal support for industrial and innovation policies. Over time, this translated into electoral support for political leaders who prioritized STI and industrial development, thereby reinforcing the political sustainability of IIP. Sustainable industrial innovation policy requires political leadership supported by broad public understanding of science and technology, which helps secure long-term policy continuity in democratic systems.

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5. Conclusion

This paper has reinterpreted Korea's post-1960 industrial transformation through the analytical lens of Industrial Innovation Policy (IIP). By doing so, it demonstrates that Korea's success was not the product of isolated industrial or S&T policies, but rather of a coherent, adaptive system that integrated both.

It argued that;

- a) IIP represents a conceptual synthesis that bridges traditional industrial policy and S&T policy by focusing on the post-research stages of innovation, where technologies are demonstrated, scaled, and diffused.
- b) Korea's historical experience from the 1960s to the 1990s illustrates that many principles now emphasized in contemporary IIP debates - mission orientation, institutional coordination, demonstration and scale-up, and policy learning - were already operationalized under conditions of institutional prematurity.
- c) Korea's experience reveals a set of enabling conditions that are particularly relevant for developing countries, where institutional foundation, policy capability, implementation capability, and political continuity remain binding constraints.

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- a) IIP represents a conceptual synthesis bridging traditional industrial policy and S&T policy by focusing on the post-research stages of innovation, where technologies are demonstrated, scaled, and diffused.
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- c) Korea's experience reveals a set of enabling conditions particularly relevant for developing countries, where institutional foundations, policy capability, implementation capability, and political continuity remain binding constraints.

From the 1960s to the 1990s, Korea sequentially advanced from industrial learning to innovation creation through deliberate policy orchestration. It built institutions such as EPB, MOST, KIST, KAIST, and many other institutions, launched mission-oriented initiatives like the HCI drive and ICT strategies, and gradually shifted from state-led industrialization to co-governed innovation. These decades of experimentation yielded a model that anticipated many principles later codified by Bonvillian (2024) - top-down missions, regional ecosystems, demonstration projects, and adaptive policy feedback - while also illustrating the importance of conditionality, demand-driven innovation, and crisis-induced reform.

The Korean experience highlights that innovation-led industrialization requires a systemic approach—one that connects research, production, financing, and capability-building, and that embeds missions within strong institutions and iterative learning processes. As UNIDO (2021, 2019) and related literature (Soete 2007; Andreoni, Chang & Labrunie 2021; Santiago & Zagato 2024) emphasize, policy coherence and institutional learning are defining features of successful innovation-driven industrialization.

From the 1960s to the 1990s, Korea advanced sequentially from industrial learning to innovation creation through deliberate policy orchestration. It built institutions such as EPB, MOST, KIST, KAIST, and numerous sectoral organizations; launched mission-oriented initiatives such as the HCI drive and ICT strategies; and gradually shifted from state-led industrialization to co-governed innovation. These decades of experimentation produced a model that anticipated many principles later codified by Bonvillian (2024)—top-down missions, regional ecosystems, demonstration projects, and adaptive policy feedback—while also illustrating the importance of conditionality, demand-driven innovation, and crisis-induced reform.

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Implementation, not design, remains the greatest challenge. Policies succeed when backed by strong institutions, analytical capability, and leadership continuity. UNIDO's framework for policy capability, combining analytical, operational, and adaptive competencies, provides a practical roadmap for partner countries. Moreover, Korea's case affirms that crisis moments can catalyze reform. Economic shocks in the 1970s and

1990s forced institutional adaptation, demonstrating that resilience and innovation often emerge under pressure. Policymakers in developing contexts can leverage such windows of opportunity to introduce structural reforms that strengthen long-term competitiveness.

Based on these analyses, it distilled Korea's experience into five additional interrelated lessons for developing countries:

Implementation, rather than design, remains the primary challenge. Policies succeed when supported by strong institutions, robust analytical capability, and continuity of leadership. UNIDO's framework for policy capability—combining analytical, operational, and adaptive competencies—offers a practical roadmap for partner countries. Moreover, Korea's experience affirms that crisis moments can catalyze reform. Economic shocks in the 1970s and 1990s compelled institutional adaptation, demonstrating that resilience and innovation often emerge under pressure. Policymakers in developing contexts can leverage such windows of opportunity to introduce structural reforms that strengthen long-term competitiveness.

Based on these analyses, Korea's experience can be distilled into five additional interrelated lessons for developing countries:

- a) demand-driven mission-oriented innovation aligned with industrial and societal needs;
- b) strong institutional foundations linking planning, science, and industry;
- c) policy capabilities grounded in professional civil service and policy intelligence;
- d) implementation capabilities supported by disciplined bureaucracy, budgeting, and evaluation; and
- e) sustainable policy and political leadership, which can be effectively reinforced by public understanding of science and technology.

Taken together, these lessons emphasize that Industrial Innovation Policy is not primarily a question of choosing the "right" instruments, but of building systems capable of learning, coordination, and long-term commitment.

As a conclusion, it is worth discussing the relevance of the policy implications to UNIDO's ISID and Korea as a knowledge partner.

Taken together, these lessons underscore that Industrial Innovation Policy is less about selecting the “right” instruments than about building systems capable of learning, coordination, and sustained commitment.

In this context, the policy implications bear direct relevance to UNIDO's Inclusive and Sustainable Industrial Development (ISID) agenda and to Korea's role as a knowledge partner. Korea's historical experience provides an empirically grounded reference for operationalizing innovation-led industrialization under conditions of late development, while UNIDO's mandate and technical cooperation platforms offer mechanisms to translate such experience into context-sensitive policy support for partner countries. Together, they illustrate how historically informed policy learning and international cooperation can support developing economies in designing Industrial Innovation Policies aligned with contemporary development challenges.

Relevance to UNIDO's ISID

The findings of this paper are closely aligned with UNIDO's framework for Inclusive and Sustainable Industrial Development (ISID). Korea's experience illustrates how industrial innovation policies can simultaneously advance productivity growth, structural transformation, and long-term resilience when they are embedded in strong institutions and guided by clear societal objectives.

From an inclusiveness perspective, Korea's emphasis on skills development, diffusion of technology through GRIs, and later support for SMEs and regional innovation centres demonstrates how innovation can be broadened beyond frontier firms. Demand-oriented innovation and capability building helped integrate firms and workers into expanding industrial value chains.

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From a sustainability perspective, the Korean case highlights the importance of sequencing and capability accumulation. Rather than attempting premature technological leapfrogging, Korea built a broad production base before moving toward more knowledge-intensive and, later, environmentally and digitally advanced sectors. This insight is particularly relevant for contemporary green and digital transitions, where sustainability objectives must be grounded in productive and institutional capability.

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From a resilience perspective, Korea's adaptive use of crises—such as the oil shocks of the 1970s and the Asian Financial Crisis of 1997—demonstrates how industrial innovation systems can be restructured rather than dismantled under stress. This adaptive governance capability is central to UNIDO's current emphasis on resilience amid global uncertainty, supply-chain fragmentation, and climate-related shocks.

In this sense, Industrial Innovation Policy, as reframed in this paper, offers a practical pathway for operationalizing ISID by linking innovation, production, and institutional learning within a mission-oriented framework. This perspective is consistent with recent OECD analyses emphasizing mission-oriented and transformative STI policies (OECD 2023).

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Korea as a Knowledge Partner

Korea occupies a unique position in the global development landscape. It is the only country to have transitioned from an Official Development Assistance (ODA) recipient to an ODA donor, and this transformation was achieved within a relatively short historical period. This experience gives Korea distinctive credibility as a knowledge partner for developing countries.

Korea's value lies not in exporting policy templates, but in sharing process-based knowledge: how institutions were built, how policy capability was strengthened, how implementation discipline was enforced, and how political support for long-term industrial innovation was sustained. These aspects are often missing from conventional policy advice, which tends to focus on instruments rather than on the conditions that allow those instruments to function.

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Korea's experience also demonstrates the importance of learning-oriented cooperation. Initiatives such as the Knowledge Sharing Program (KSP) and sector-specific policy dialogues illustrate how development cooperation can move beyond best-practice diffusion toward co-diagnosis and co-design of policy solutions tailored to local contexts. The Brazil–Korea cooperation case (MOEF 2021), for example, shows how Korean experience can be translated through joint analysis rather than direct replication.

For knowledge sharing in industrial innovation policy to be effective, it must be systemic rather than ad hoc. Multilateral organizations such as UNIDO play a critical role in this process by providing neutral platforms, analytical frameworks, and capability-development instruments that mediate between national experiences and local realities.

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UNIDO's comparative advantage lies in:

- a) diagnosing industrial and innovation system bottlenecks,
- b) supporting institutional and policy capability development,
- c) facilitating South–South and triangular cooperation, and
- d) aligning national industrial strategies with global sustainability objectives.

In this context, Korea's experience with Industrial Innovation Policy can be most effectively leveraged when embedded in UNIDO-led frameworks that emphasize adaptation, learning, and inclusiveness. Cooperation between UNIDO and the Korean government can help ensure that Korea's rich developmental experience contributes to building local policy capability, rather than encouraging superficial policy borrowing.

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This paper has argued that Industrial Innovation Policy is best understood as a dynamic governance system - one that connects innovation with production, aligns public support with societal goals, and evolves through continuous learning. Korea's historical trajectory demonstrates that such systems can be built even under conditions of resource scarcity and institutional immaturity, provided that governments invest in demand orientation, institutional foundations, policy and implementation capabilities, and political sustainability.

For developing countries confronting today's complex challenges - digital transformation, decarbonization, demographic pressures, and geopolitical uncertainty - the central message is clear: industrial innovation is not a luxury of advanced economies, but a foundation of development itself. Korea's experience shows that the most powerful innovation may ultimately lie not in technology alone, but in the innovation of policymaking.

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For developing countries facing today's complex challenges—digital transformation, decarbonization, demographic pressures, and geopolitical uncertainty—the central message is clear: industrial innovation is not a luxury of advanced economies, but a core foundation of development. Korea's experience illustrates that the most powerful innovation often lies not in technology alone, but in the innovation of policymaking itself.

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