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Understanding and Enhancing National Innovation Systems: Dynamics, Challenges and Strategies

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Abstract: *National Innovation Systems (NIS) represent a complex interplay of individuals, organizations, policies, and processes that shape a country's ability to innovate and drive GDP growth, technological advancement as well as employment rates. Understanding these interactions and collaboration dynamics can significantly influence a country's innovation performance and thereby create a coherent national or even transnational innovation mindset This paper provides a review of the concept of national innovation systems, tracing its evolution, key components, theoretical underpinnings, and empirical evidence. Furthermore, it proposes a strategic approach, the Co-Innovation Cosmos, for enhancing NIS effectiveness, considering the role of government, industry, academia, and other stakeholders in fostering innovation-led development.*

Key Words: ***National Innovation System, Innovation Ecosystems, Economic Development, Technology Transfer, Knowledge Creation, Innovation Policy, Co-Innovation Cosmos***

1. INTRODUCTION

In today's increasingly interconnected and knowledge-driven global economy, innovation plays a central role in driving productivity, competitiveness, and sustainable development. *National Innovation Systems* (NIS) offer a comprehensive framework for analyzing the intricate networks of institutions, organizations, and actors that shape a country's innovation ecosystem. This paper provides a systematic overview of NIS, examining their theoretical underpinnings, structural components, and dynamic interactions, with a focus on their implications for policy formulation and strategic decision-making. In addition, it introduces a novel concept to strategically establish new NIS and restructure existing NIS, the *Co-Innovation Cosmos*.

2. CONCEPTUAL FOUNDATIONS OF NATIONAL INNOVATION SYSTEMS

In the late 1980s, the development of a conceptual model began that examined innovation systems within the framework of nation-states, emphasizing the importance of systemic interactions and co-evolutionary processes in shaping innovation dynamics at the national level [1]. These foundational ideas have since evolved to incorporate a broader understanding of the multifaceted interactions within *National Innovation Systems*. These foundational ideas have since evolved to incorporate a broader understanding of the multifaceted interactions within innovation systems [2]. Key theoretical pillars of NIS include:

- *Innovation ecosystems*: Recognizing the interconnectedness of diverse stakeholders, including government agencies, research institutions, universities, industry players, and civil society, in driving innovation outcomes. This concept underscores that innovation does not occur in isolation but is the result of complex, adaptive networks where knowledge, resources, and technologies flow and evolve. The success of innovation ecosystems is often contingent on the strength of linkages between these actors, the quality of their interactions, and the enabling environment provided by policy and infrastructure.

- *Triple helix model*: Highlighting the collaborative relationships and knowledge flows among academia, industry, and government as essential drivers of innovation-led growth. This model has been further expanded to consider the dynamics of the "quadruple" and "quintuple" helix frameworks, which incorporate civil society and environmental sustainability as additional dimensions. These expansions reflect the growing recognition that sustainable and inclusive innovation requires the involvement of a broader set of actors and considerations, including societal needs and ecological impacts.

- *Innovation capabilities*: Emphasizing the role of human capital, technological infrastructure, institutional frameworks, and innovation policies in enhancing a nation's capacity to innovate and adapt to changing market conditions. Building innovation capabilities is not just about developing individual components but about fostering an integrated system where skills, technologies, and institutions work synergistically. This involves

nurturing a culture of continuous learning, investing in cutting-edge technologies, and creating flexible institutions that can respond rapidly to global changes and challenges.

Moreover, recent advancements in NIS theory have integrated insights from complexity theory, which views innovation systems as complex adaptive systems that evolve over time through interactions among heterogeneous agents [3]. This perspective highlights the non-linear, often unpredictable nature of innovation processes, where small changes can lead to significant outcomes due to the system's inherent feedback loops and emergent properties.

3. COMPONENTS AND DYNAMICS OF NATIONAL INNOVATION SYSTEMS

National Innovation Systems encompass crucial, interconnected capabilities, mainly [4]:

- *Research and development (R&D) infrastructure*: comprising universities, research institutes, and technology transfer offices that generate new knowledge and technologies.

These institutions not only drive basic and applied research but also serve as hubs for collaboration with industry and government, ensuring that innovations are both scientifically sound and commercially viable.

- *Industry innovation networks*: encompassing firms, clusters, and value chains that collaborate on research, development, and commercialization activities.

These networks facilitate the flow of information, resources, and technology across companies and sectors, fostering innovation through collaboration and competition. The strength of these networks is often reflected in the density of connections between organizations and their ability to quickly adapt to market demands.

- *Government policies and institutions*: shaping the regulatory environment, providing funding support, and implementing incentives to promote innovation across sectors.

Effective government policies are critical in setting the stage for innovation by creating a stable, predictable environment that encourages investment in R&D and entrepreneurship. Moreover, government institutions can play a key role in bridging gaps between different sectors, ensuring that innovation efforts are aligned with national development goals.

- *Knowledge diffusion mechanisms*: facilitating the dissemination and absorption of innovation through networks, partnerships, and technology transfer channels. The effectiveness of knowledge diffusion is often a determinant of how quickly and widely innovations can be adopted across different industries and regions. Mechanisms such as intellectual property rights, open innovation platforms, and collaborative research initiatives are essential for ensuring that knowledge flows freely within and beyond national borders.

- *A lively entrepreneurship culture*: supporting startups and creating an open mindedness for entrepreneurial business approaches.

Startups are often regarded as a driving force behind an ongoing economic transformation. They encourage and reward new ideas and out-of-the-box thinking and thrive on innovation product development, business models and customer engagement. Due to their constant search for their own product-market-fit they adapt quickly to changes in the market, to customer needs or unforeseen challenges. Their *agility* and *flexibility* allows them to pivot when necessary and embrace change as a constant. Furthermore is their willingness to take calculated risks a defining characteristic. This systematic *risk-taking* involves being comfortable with uncertainty and fostering an environment where failure is seen as a learning opportunity rather than a setback.

Startups face numerous challenges and setbacks; they also cultivate an outstanding *resilience* and *persistence* mindset. Such a culture that emphasizes resilience, perseverance, and the determination to overcome obstacles is regarded as vital for long-term success in the startup world.

Open communication and *transparency* build trust within the team. In a startup, where resources are often limited, trust in leadership and among team members is crucial for maintaining morale and commitment. And a shared sense of *purpose* and *passion* for the mission can unite a startup team and drive them to work towards the common vision with energy and enthusiasm. Finally, *continuous learning*, encouraging employees to develop new skills, staying curious, and improving their expertise helps the young companies to stay competitive and innovative.

All these startup culture components could be also regarded as fundamental guidelines for lively Nation Innovation Systems and are complemented with a strong understanding of *collaboration* and *teamwork* needs. In startups, collaboration is key. And also on an overall economic level and understanding for the incredible importance of collaboration and cooperation and cross-functional teamwork paves the way for a dynamic environment that supports growth, innovation, and success [5,6].

Nevertheless, the dynamics of NIS are characterized by feedback loops, path dependencies, and emergent properties that influence the pace and trajectory of technological change and economic growth. So is it possible to systematically develop the Innovation DNA of a country?

4. POLICY IMPLICATIONS AND CHALLENGES

Policy interventions aim to create an optimal breeding ground for a widespread innovation mindset and for nurturing and sustaining vibrant NIS. To achieve this, policymakers must address several critical areas [7]:

- *International collaboration*: Leveraging global networks and partnerships to access knowledge, markets, and resources is essential for fostering cross-border innovation ecosystems. However, this also necessitates overcoming geopolitical tensions, differing regulatory standards, and intellectual property concerns, which can hinder effective collaboration. Challenges in designing and implementing innovation policies include ensuring policy coherence, addressing market failures, fostering inclusive innovation, and balancing short-term objectives with long-term goals.

- *Regulatory frameworks*: Creating an enabling environment that promotes competition, protects intellectual property rights, and facilitates technology transfer and commercialization requires continuous adaptation to technological advances and the evolving global economic landscape. This includes updating regulations to accommodate emerging technologies, while also ensuring that these frameworks do not hinder innovation through excessive regulation.

- *Education and skills development*: Enhancing human capital through STEM education, vocational training, and lifelong learning programs is vital to cultivate a skilled workforce capable of driving innovation. This also involves integrating creativity, critical thinking, and interdisciplinary learning into education systems to prepare individuals for the demands of a rapidly changing innovation landscape.

- *Funding and investment*: Allocating resources to support basic and applied research, technology development, and innovation-driven entrepreneurship is crucial. However, public funding often faces constraints, and there is a growing need to mobilize private investment and explore alternative financing mechanisms, such as venture capital, public-private partnerships, and crowdfunding, to sustain long-term innovation efforts.

Collaborations are pivotal for the transfer and valorization of knowhow, which refers to the practical knowledge and expertise essential for innovation. The successful exchange of knowhow between stakeholders often requires more than just a partnership; it demands an efficient and dynamic framework that facilitates interaction across disciplines. Moreover, these collaborations must be supported by clear communication channels, trust-building mechanisms, and shared goals to ensure alignment between different stakeholders.

Research institutions, with their focus on cutting-edge science and technology, generate vast amounts of knowledge that can significantly impact industrial applications. However, without the proper channels for transferring this knowledge, its potential remains largely untapped. Industry partners, on the other hand, provide the practical insights and market-driven perspectives that can refine research outputs into commercially viable innovations. To bridge the gap between research and commercialization, there needs to be a stronger focus on innovation intermediaries, such as incubators, accelerators or similar systems, which can guide the process from concept to market.

The interaction between these entities needs to be both inter- and transdisciplinary, ensuring that insights from diverse fields contribute to holistic and innovative solutions. Supporting agencies play a crucial role in this ecosystem by providing the necessary resources, funding, and policy frameworks that enable these collaborations to thrive. These agencies often act as intermediaries, ensuring that the connections between research institutions and industry partners are not only established but also nurtured to foster sustainable innovation.

However, even with all the necessary components in place, many innovation ecosystems fail to achieve their full potential. Although the ingredients for creating innovation ecosystems seem to be known, many approaches fail. One key reason is the lack of attention to the physical and spatial dimensions of innovation ecosystems. The physical component of these ecosystems comes more and more into focus and researchers already speak of a remarkable shift in the spatial geography of innovation [8]. This shift underscores the importance of coherent systems of innovation districts, co-innovation spaces, and proximity to knowledge hubs in fostering vibrant innovation environments. Policymakers and urban planners must consider these spatial factors when designing innovation strategies to ensure that physical spaces support and enhance collaborative efforts.

5. FROM LOCAL INNOVATION SYSTEMS (LIS) TO REGIONAL INNOVATION SYSTEMS (RIS) TO NATIONAL INNOVATION SYSTEMS (NIS)

A *Local Innovation System* (LIS) refers to a geographically concentrated network of firms, including specialized suppliers, service providers, and customers, along with associated non-market institutions such as universities, research institutes, training centers, standard-setting organizations, local trade associations, regulatory bodies, technology transfer agencies, business associations, and relevant governmental entities. This system collectively facilitates the development and creation of new products and/or services within specific business sectors.

Local Innovation Systems often emerge organically in areas where there is a high concentration of resources, talent, and entrepreneurial activity, creating a fertile ground for innovation. They are also often manifested in the idea of innovation districts, urban “clusters of change”. All innovation districts contain economic, physical and networking assets and form “a synergetic relationship between people, firms, and place (the physical geography of the district) that facilitates idea generation and accelerates commercialization”. Innovation Districts adhere to one of three general models [8]:

- *“anchor plus” model*: Centers around major institutions like universities or hospitals, which act as anchors for the surrounding innovation ecosystem.

- *"re-imagined urban areas" model*: Involves the transformation of older industrial areas into vibrant hubs of innovation and creativity.

- *"urbanized science park" model*: Represents a shift from traditional, isolated science parks to more integrated urban environments where research, business, and living spaces co-exist.

These LIS are urban drivers of change with powerful potential to activate and influence the development of entire regions, resulting in the rise of *Regional Innovation Systems* (RIS). RIS expand the concept of LIS by encompassing broader geographic areas, integrating multiple LIS, and fostering collaboration across cities and regions. This regional approach amplifies the impact of innovation activities, creating a more diversified and resilient economic base that can support sustained growth.

6. THE SPATIAL EVOLUTION OF INNOVATION CLUSTERS

Probably the most renowned and influential regional transformation cluster is the *Silicon Valley*.

Catalyzing innovation and entrepreneurship through a vibrant ecosystem of venture capital, technology startups, and research-intensive universities, the Silicon Valley became the lighthouse example of collaboration between a large number of different stakeholders, glued together by the will to leave a large-scale impact on the world and change existing socio-economic patterns. This region exemplifies how a well-developed RIS can drive national and even global economic change, serving as a model for other regions seeking to replicate its success [9].

Historically, *Hong Kong* presents a compelling example of a region that has undergone several change loops and showcasing an early understanding of radical transformation. From its origins as an industrial hub to becoming an entrepot of trade and finally evolving into an innovation hub, Hong Kong underwent massive structural changes of its economy to adapt to the geopolitical changes and the rise of surrounding economies and paved the way of researching the role of smart cities as influential driving forces in a global context [3].

A number of countries in Africa are actively fostering startup cultures to establish innovation hubs, with the expectation that these efforts will have a transformative impact on their broader economies. Some of these initiatives have achieved notable success, positioning certain regions as emerging centers of technological and entrepreneurial activity. For instance, *Kenya's "Silicon Savannah"* has gained international recognition as a vibrant tech hub, with Nairobi becoming a focal point for startups in fintech, agritech, and mobile technology. The success of companies like M-Pesa, a mobile money transfer service, has not only revolutionized financial inclusion within Kenya but has also inspired similar innovations across other African nations. Similarly, in Nigeria, the growth of Lagos as a startup ecosystem, often referred to as *"Yabacon Valley",* has seen significant advancements in sectors such as e-commerce, fintech, and digital services. Scaleup companies there have attracted substantial foreign investment, demonstrating the potential of startups to drive economic growth and create jobs in the region. Additionally, Rwanda's focus on becoming a technology and innovation hub, particularly through the *Kigali Innovation City* project, illustrates how strategic governmental support can create conducive environments for startups. The country has invested heavily in infrastructure, regulatory reforms, and education to cultivate an ecosystem that supports entrepreneurship and technological advancement. These examples underscore the potential of innovation hubs to stimulate economic development in Africa by creating new industries, improving access to services, and fostering an entrepreneurial culture that can drive long-term growth.

As fast followers, several emerging countries are now systematically embracing and fostering innovation cultures to transform their economies.

Saudi Arabia, for instance, has embarked on an ambitious journey to diversify its economy through initiatives like Vision 2030, which places significant emphasis on innovation, technology, and entrepreneurship. The creation of the King Abdullah Economic City and the NEOM project are prime examples of how the country is investing heavily in creating environments that nurture startups and attract global talent. These initiatives aim to reduce the country's dependence on oil by cultivating new sectors such as renewable energy, biotechnology, and digital services.

Similarly, other countries in the MENA region are making substantial strides in promoting innovation-led growth. The *United Arab Emirates*, particularly Dubai and Abu Dhabi, have established themselves as regional leaders in fostering innovation hubs. Dubai's success with initiatives like the Dubai Internet City and the Dubai Future Accelerators has attracted numerous startups and tech companies, positioning the city as a leading tech hub in the region.

In addition, countries like *Egypt* and *Jordan* have seen growing tech ecosystems, with Cairo and Amman becoming increasingly recognized for their vibrant startup scenes. Egypt's Information Technology Industry Development Agency (ITIDA) has been instrumental in supporting startups through funding, mentorship, and infrastructure, while Jordan's entrepreneurial ecosystem has been bolstered by initiatives such as the Oasis500 accelerator. These examples highlight the growing momentum in the MENA region towards leveraging innovation as a key driver of economic transformation, with the potential to create new industries, generate employment, and enhance global competitiveness.

The evolution from LIS to RIS, and eventually to NIS, is marked by increasing complexity, scale, and integration. While local systems may initiate innovation, regional systems enhance it by leveraging broader

networks, and national systems institutionalize it by embedding innovation within the national policy framework. Just like above, this progression once again raises the question: is it possible to systematically develop the Innovation DNA of a country?

The concept of *"Innovation DNA"* refers to the unique set of capabilities, cultural attributes, and institutional arrangements that define a country's innovation potential. While every country has its distinct Innovation DNA, there is a possibility to systematically develop and enhance it through targeted policies, strategic investments, and cultural shifts. By understanding and nurturing the specific components that make up a country's Innovation DNA, policymakers can create conditions that are favorable to sustained innovation and long-term economic growth.

7. THE CO-INNOVATION COSMOS

In the rapidly evolving landscape of technological advancement and market competition, the search for an overall helpful concept is ongoing.

With the *Co-Innovation Cosmos* (CoIC) model we propose a new geography of innovation challenging the focus on isolated innovation hubs or the idea that innovation districts alone can elevate their cities up the value chain of global competitiveness and create spillover effects for the broader region.

Our approach underscores the importance of fostering deep systemic collaborations between industry partners of all company sizes, research institutions, and supporting agencies. But to lead to a systematic level of collaborative innovation, there is a pressing need for a hierarchical system of interconnected physical spaces:

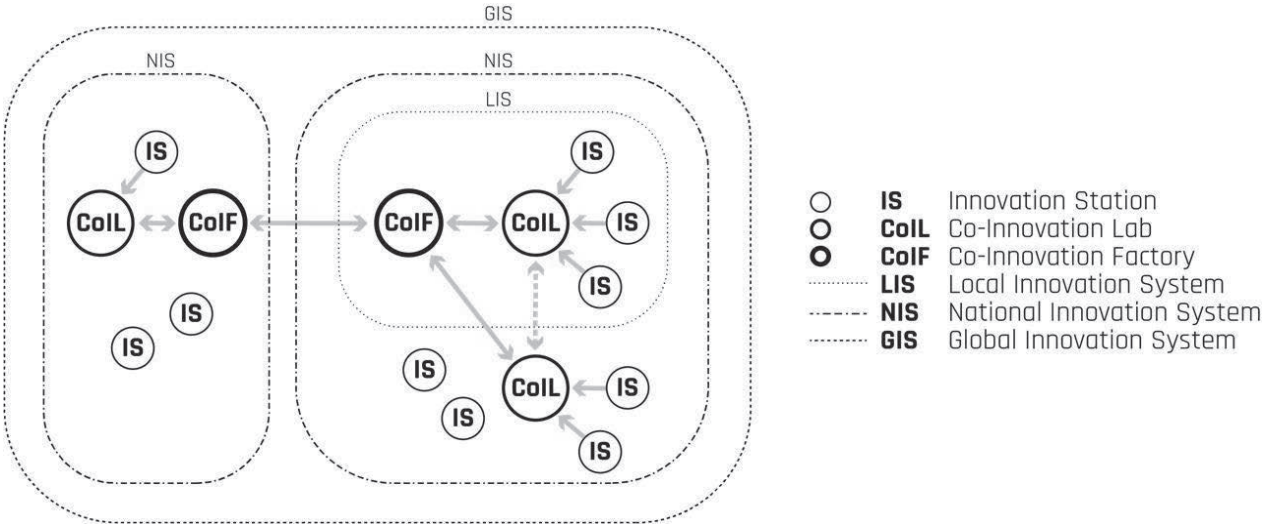
At the core of the Co-Innovation Cosmos is a central innovation hub, the *Co-Innovation Factory* (CoIF), a larger physical unit, located in a nation's metropolis and is a dedicated platform that facilitates the fast and efficient exchange of ideas, resources, and expertise among all stakeholders [10]. This hub would serve as the nucleus for inter- and transdisciplinary collaboration, streamlining the process of knowhow transfer and valorization. It would enable the seamless integration of diverse knowledge streams, thereby accelerating the development and deployment of innovative solutions across industries.

In summary, the establishment of a central hub for collaborative innovation is essential for bridging the gap between research and industry. The CoIF would not only host a range of innovation activities, embedded in customized Innovation Parcours, but also serve as a living laboratory for experimentation in general. This approach ensures that innovations are not just theoretical, but are grounded in practical application, making them more likely to succeed in the market.

Connected to the CoIF is a system of *Co-Innovation Labs* (CoIL), which are specialized units run by corporations. These labs are distributed across the country, each focusing on respectively relevant specific sectors. CoILs are designed to foster close collaboration within organizations as well as between companies, startups, and research entities, enabling them to work together on targeted innovation projects. By being closely linked to the CoIF, these labs benefit from direct access to the CoIF's resources and expertise, ensuring that innovations developed within the labs can be rapidly scaled and commercialized.

The smallest physical unit in our Co-Innovation Cosmos is the *Innovation Station* (IS). These stations are small, agile units not bound to a specific location, designed to serve as entry points into the innovation ecosystem. IS units provide local entrepreneurs, students, and small businesses with the resources, mentorship, and networking opportunities they need to develop their ideas into viable products or services. By being connected to the larger CoIL and CoIF structures, Innovation Stations ensure that even grassroots innovations can find their way into the broader innovation ecosystem, benefiting from the resources and expertise available at higher levels.

The Co-Innovation Cosmos thus creates a multi-layered innovation network, where each level - Innovation Station, Co-Innovation Lab, and Co-Innovation Factory - plays a critical role in fostering innovation. This *hierarchical system of interconnected spaces* ensures that innovation is not just the domain of



isolated hubs but is distributed across a nation's entire economy, enabling broader participation and more equitable access to innovation resources.

In summary, the Co-Innovation Cosmos offers a novel framework for organizing and accelerating innovation at multiple levels of society. By establishing a central hub for collaborative innovation, supported by a network of specialized labs and grassroots stations, this model aims to enhance the transfer and valorization of knowledge, drive the next generation of technological advancements, and ensure that the benefits of innovation are widely distributed across the economy.

8. CYCLICAL INNOVATION PROCESS ENCOMPASSING THE CO-INNOVATION COSMOS

The diagram illustrates a *structured and cyclical process designed to foster an innovation mindset* and guide individuals or organizations through a comprehensive innovation journey. This *Co-Innovation Process* (CoIP) model revolves around and aligns with the principles of the Co-Innovation Cosmos, which emphasizes collaborative and iterative innovation practices within a supportive ecosystem. The process is broken down into seven distinct stages, each building upon the previous to create a cohesive pathway from the initial desire to innovate through to the realization and refinement of innovative solutions [11].

1. *Innovation Desire*: The process begins with the emergence of a desire to innovate, either from individuals or organizations. This desire is the spark that ignites the entire journey. In the context of the Co-Innovation Cosmos, this desire is often fueled by recognizing opportunities or the need to address specific challenges. The initial drive to innovate is critical, as it sets the stage for all subsequent activities.

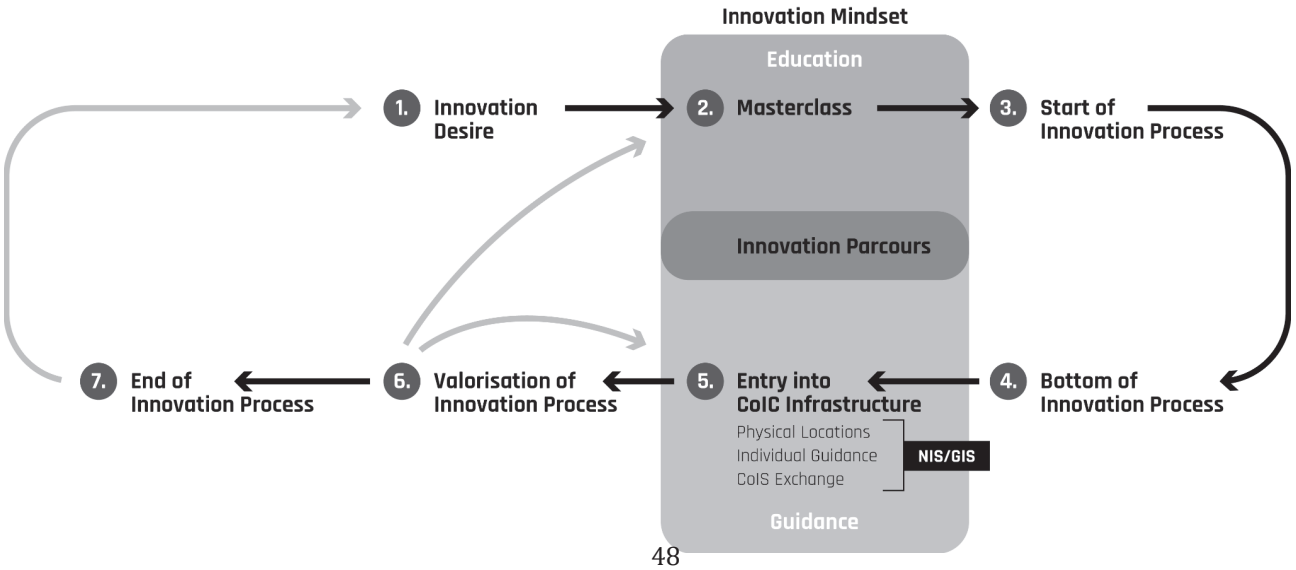
2. *Masterclass*: Participants engage in a masterclass (i.e. guided Innovation Parcours) as part of the foundational education phase. This step is crucial as it offers insights into the Co-Innovation Cosmos' fundamental innovation methodologies, tools and best practices, which form the core of the innovation mindset. Foremost, it emphasizes the importance of collaborative learning and shared experiences within the innovation ecosystem.

3. *Start of Innovation Process*: Equipped with new knowledge from the masterclass, participants then begin their own innovation process. This phase marks the transition from theory to practice, where ideas begin to take shape. Within this framework, this stage involves applying learned concepts in a real-world context, often through collaboration with other stakeholders in the ecosystem. The innovation process is not linear but iterative, allowing for continuous feedback and refinement.

4. *Bottom of Innovation Process*: As participants progress, they reach a critical juncture in the innovation process - referred to as the "Bottom of Innovation Process." This stage represents a deep-dive analysis where initial ideas are challenged, validated, or redefined. It's a moment of reflection and recalibration, ensuring that the innovation direction aligns with both the goals of the individual or organization and the broader ecosystem. This step may involve prototyping, testing, or even pivoting ideas based on the feedback received.

5. *Entry into CoIC Infrastructure*: Upon reaching this stage, participants gain entry into the CoIC infrastructure, in order to receive necessary support in overcoming the previous phase. Therefore, the CoIC provides a robust support system, including access to physical locations, individual guidance, and a platform for exchanging ideas within the CoIC network. This stage is essential for grounding innovation in a supportive environment where participants can access resources and expertise to further develop their ideas. The guidance offered by the CoIC ensures that participants remain aligned with their objectives and are able to successfully continue their innovation process.

6. *Valorisation of Innovation Process*: With the resources and support of the CoIC infrastructure, participants actively continue and valorize their innovation processes. This stage involves detailed planning, resource allocation, and the execution of innovation strategies. Participants might engage in



collaborative projects and leverage networked resources to bring their innovations to life. The Co-Innovation Cosmos fosters an environment of shared learning and co-creation, making this stage particularly dynamic and rich with collaborative potential.

7. *End of Innovation Process*: The final stage marks the culmination of the innovation journey. Here, participants have fully developed their innovations, which are now ready to be launched, scaled, or integrated into broader systems. However, the end of the innovation process does not signify the end of innovation itself. Within this framework, this stage often leads back to new cycles of innovation desire, driven by the outcomes of the previous process. This cyclical nature ensures that innovation remains continuous and responsive to emerging challenges and opportunities within the ecosystem.

9. FUTURE DIRECTIONS AND CONCLUSION

As countries navigate the challenges of the 21st century, the role of NIS in fostering innovation-led growth and societal progress will become increasingly prominent. To remain competitive and resilient, future research and policy agendas should focus on:

- Harnessing emerging technologies and digital transformation to unlock new sources of innovation and economic value. This includes leveraging advancements in artificial intelligence, biotechnology, and renewable energy to create breakthrough innovations that can address both current and future needs.

- Addressing societal grand challenges, such as climate change, healthcare, and inequality, through innovation-driven solutions and inclusive NIS. Future efforts must focus on creating innovations that not only generate economic benefits but also contribute to social equity and environmental sustainability.

- Promoting responsible innovation governance frameworks that balance economic competitiveness with social and environmental sustainability. Establishing robust regulatory and ethical standards is essential to ensure that innovation contributes positively to society and the environment, rather than worsening existing problems.

In conclusion, the NIS concept generally represents a first step for understanding and fostering innovation ecosystems at the national level, with profound implications for economic prosperity, social well-being, and global competitiveness. However, as the innovation landscape evolves, there is a growing need for more sophisticated and interconnected models that can better integrate the diverse range of stakeholders involved in innovation processes. With our proposed Co-Innovation Cosmos a structural and interconnected approach could be adapted to systematically integrate all relevant stakeholders. By fostering deep, collaborative innovation across industries, research institutions, and government agencies, the Co-Innovation Cosmos model can achieve a larger impact on both national and international scales.

Looking ahead, we can envision this collaborative innovation method as a catalyst for broader cooperation on a transnational level and potentially paving the way to a *Global Innovation System* (GIS). Such a system would allow for the pooling of resources, knowledge, and expertise across borders, addressing global challenges with a coordinated and unified approach.

The Co-Innovation Cosmos model could serve as a do-tank for the future of nations, transforming innovative ideas into actionable solutions and driving sustainable growth on a global scale. By embracing this model, nations can not only enhance their own innovation ecosystems but also contribute to a more collaborative and innovative global community.

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