New Horizons for Innovation Policy and Evaluation

Chapter 10

New horizons for innovation policy and evaluation

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Summary

The chapter draws together implications of the work and looks ahead to the future of innovation policy and evaluation. We recognise the profound changes in the realm of innovation, and the shift from traditional, narrow approaches to a more inclusive and dynamically complex perspective. This transformation is influenced by a broader understanding of innovation, the impacts of crisis, climate change, and the evolution of societal structures. It highlights how outdated assumptions about innovation are being challenged by realities that include diverse contributors beyond just firms and traditional markets. Innovation is increasingly understood as embedded in the complexity of modern societal structures, characterized by deep interconnectivities. This creates a need for new policy evaluation frameworks and concepts. The ones that are flexible, dynamic, capable of addressing the multifaceted impacts of innovation across economic, environmental, and social domains. These frameworks must also account for the intersectionality present in modern societal issues, which are interwoven rather than discrete as well as the exponential, rather than linear, effects of innovation. Such approach reflects a shift from promoting technological advancement in isolation to fostering a broader range of innovations that include services, environmental sustainability, and social inclusivity. Finally, evaluations should not only seek to measure economic impacts but also how well policies promote inclusivity, environmental sustainability, and social equity.

10.1. Introduction

We are now living in an era of 'interesting times' and the scent of change is in the air. Many things have led to where we now find ourselves (e.g., our deeper understanding of how industry works and how innovation actually takes place, war, climate change) and there is the sense that we have come to the end of a cycle. Exactly how this cycle will be characterised is something that will be decided by historians in the future, but for now, it is enough for us to recognise that many of our hazy ideas and assumptions about the way things work are past their sell-by date and are no longer valid. It will come as a shock to many of us that the world we thought we lived in – or rather, had been told we lived in – doesn't actually exist and probably never did. Focussing on innovation, the gap between the 'official' and the 'wider' views of that activity are now too wide to be denied, and each of the contributions in this book have explored some of the issues that need to be more fully considered in the future. The chapters have also thrown into sharp relief the fact that the innovation space is changing fundamentally and that many of the old, often implicit, assumptions no longer hold true. For example, the mass production paradigm (with its implication that one size will fit all) and the relentless supply-side focus that implies that innovation only takes place within a firm, and only for the market, was probably never valid or reasonable. Indeed, as we have seen, many of these assumptions about innovation are simply articles of faith backed by strong beliefs in the way the world should be ordered – but the gap between the world of 1960s policy (when many of these ideas were established) and what actually happens is now too great. It is now possible to observe many forms of innovation taking place all around the world, with users

(not just commercial manufacturers) playing the leading role in the creation of new products and processes. Users possessed of the relevant skills and knowledge are now an important part of an innovation ecosystem that is much broader, and should be sensitive to many more issues, than was conceived when the promotion of innovation became a serious consideration for advanced nations.

10.1.1. The innovation space is continuing to change

Innovation is embedded in the complexity of modern societal structures, and modern societies are characterized by multifaceted structures with deep interconnectivities between various sectors. The sheer breadth of innovation policy, which now encompasses a broad swath of activities in modern society, necessitates a policy evaluation framework that can account for the ripple effects of innovation across diverse spheres, including economic, environmental and social domains. Moreover, it recognises the intersectionality present in modern societal issues, which often cannot be siloed into discrete categories but rather exist in a web of interrelated phenomena. The dynamic nature of innovation calls for development of evaluation tools and practices. Innovation is inherently dynamic, constantly evolving and adapting to shifting societal paradigms and technological advancements. Consequently, policy evaluations must mirror this dynamism, exhibiting the flexibility to adapt to changing circumstances and nuances. It requires evaluative frameworks that are capable of capturing the fast-paced, transformative impacts that innovations can have on societies, recognising that innovations can sometimes have exponential, rather than linear, effects.

With innovation policies increasingly being viewed as tools for directional change steering societal developments along desired paths, evaluation methods must be capable of assessing not just the economic impacts but also the directional effectiveness of these policies. Evaluations should, therefore, be designed to scrutinise whether policies are indeed steering innovations towards areas that are aligned with broader societal goals and values, offering a more holistic view of the repercussions. Modern innovation policies are often characterised by an increased focus on inclusivity and equity, aiming to ensure that the benefits of innovation are distributed more evenly across society. Evaluations should thus integrate metrics that accurately reflect the extent to which policies foster inclusivity and address social inequalities, going beyond traditional economic indicators to encompass measures of social equity and justice. Given the pressing global challenges such as climate change and resource scarcity, innovation policies are progressively aligned with sustainable development goals. Policy evaluations should, therefore, incorporate criteria that assess the environmental and sustainable impacts of innovation, embracing a triple bottom line approach that considers economic, social and environmental dimensions.

In summary, the evolving landscape of innovation, characterised by increased complexity and a broader societal focus, calls for a congruent evolution in policy evaluation. An evolved policy evaluation mechanism, which is dynamic, multidimensional and forward-looking, becomes pivotal in aptly gauging the societal impacts of innovation policy. Such a mechanism would not only measure the repercussions accurately but also foster policies that are more aligned with the nuanced and integrated reality of modern societies, thereby ensuring a future that is sustainable, inclusive and equitable. It is an essential step in transitioning from policies focused merely on growth to those emphasising holistic development, ultimately cultivating societies that flourish in harmony with the environment and foster the wellbeing of all their members.

10.2. Implications for innovation policy and evaluation

There have been many changes in the aims, processes and outcomes of innovation since the 1960s and, as a result, many changes have been made to its management and measurement. In the context of these changes, the evolution of innovation policy has also been phenomenally fast, with early policies often being limited to a primary focus of fostering technological advancement through the promotion of research and development (R&D). Over a relatively short period of time, this limited focus has evolved to include a much broader range of issues, including innovation in services and collaborative innovation in which firms share or trade the intellectual property, as well as social, environmental and inclusive innovation. These can be summarised as follows:

- **Service innovation**: alongside manufacturing innovation, the policy focus has broadened to recognise, quantify and encourage innovation in the service sector;
- **Open innovation**: encouraging collaborative innovation, fostering partnerships between commercial stakeholders, as well as governments, academia, industries and civil society;
- **Societal innovation**: recognising that innovation can lead to societal advancements, policy has come to encourage initiatives that foster societal wellbeing, including education, healthcare and social inclusion;
- **Environmental innovation**: given the mounting concerns over environmental issues, policies are increasingly geared towards encouraging green and sustainable innovation;
- **Inclusive innovation**: policies now often aim to foster inclusivity, promoting innovations that cater to a wider demographic, including marginalized groups.

This widening of scope is a recognition of the breadth and complexity of the involved actors, processes and issues that have a bearing on innovation in the 21st century and opens up a great many opportunities for the development of effective, broad-based innovation policy. Arguably, the framing of innovation policy has its roots in the consumer society of the 1960s that was characterised by mass production and mass consumption, with unthinking consumers acting as a passive market for goods and services. It is now clear that consumers are highly sensitised to a wide range of equality and other issues, do not necessarily want mass-produced goods and services and can be innovators in their own right. Regulation that seeks to remove full ownership of digitally enhanced goods, such as Digital Millennium Copyright Act (DMCA) has been challenged. There is also a growing demand for goods that can be easily repaired, upgraded or recycled. The supply chains of the goods and services we buy are now rigorously examined for ethical breaches and there is continuous pressure on commercial entities to act in a socially conscious manner. The implications of these shifts were explored in more depth in Part 2 of the book, with Part 1 focusing on an exploration of the origins and development of innovation policy.

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The main contributions of the chapters that form the first part of the book are explored in more detail in the following section.

10.3. The evolution of innovation policy: Key issues identified in Part 1

The first part of this book illuminates the evolving landscape of innovation policy. It highlights the shift from simple to complex understandings of innovation, the generational changes in policy and the corresponding evolution in evaluation methodologies. Through

detailed discussions and a case study, it provides insights into the multifaceted nature of innovation policy and its evaluation in the contemporary context. The aim of Chapter 2 is partly to set the scene for later contributions discussing specific topics related to the innovation concept, innovation policy and its evaluation. However, the chapter also argues that innovation and policy debates have witnessed a generational shift from a 'too simple' to a 'too complex' conceptualisation of the innovation process. It has also been argued that such a development has created increasingly complex innovation policies and a need for ever more complex policy evaluation practices. The chapter goes on to outline three main generations of innovation policy: science and technology; national innovation systems; and transformative innovation policy. These three distinct generations, and their associated policy instruments, share similarities while also having different emphases and being different in many important ways. The chapter also outlines the governance, coordination and change management challenges inherent in the design and implementation of transformative innovation policy and their implications for policy evaluation and impact assessment. It also discusses approaches characterising policy impact evaluation for each of the three generations of innovation policy, given the co-existence of the three generations in contemporary evaluation practice. In contrast, Chapter 3 examines the evolution of the international data collection efforts that seek to quantify key aspects of the innovation process. Reliable innovation statistics have proved to be an essential way to describe the evolving innovation space with research, development and innovation outcomes and activities tending to attract policy attention only when they can be statistically presented. The definitions concerning differing aspects of the innovation process are developed and refined by the OECD and laid down in the Frascati Manual, with the manual providing a detailed summary of the core definitions of all aspects of the commercial R&D process. The chapter explores how the approach to data collection has been revised over seven editions since the introduction of the manual in 1963. It presents how the revisions were made in response to changes in business practice and the wider world economy as ways of undertaking R&D continue to evolve. The chapter also explores the challenges of evolving measurement and data collection and raises a series of issues that provide directions for further research and development in this area.

Chapter 4 is a case study of an organisation that monitors the impact of innovation activities – potentially over long periods of time – and presents the societal impact evaluation process developed by the Novo Nordisk Foundation, one of the increasingly important private foundations that fund research activities. The foundation is amongst the top individual funders in the world when it comes to philanthropic activities, and it is also a significant funder in Denmark, accounting for 14 per cent of all public research. Against this background, it is understandable that the foundation has a well-developed impact evaluation process that plays a significant role in their research and innovation system. In order to monitor and assess its investments in research, the Novo Nordisk Foundation has developed an impact management concept that covers all the processes and deliverables needed throughout all stages and beyond the research grant life cycle. These include data collection, progress monitoring, evidence-informed management and evaluation of the achievement of milestones and success. Significantly, the impact management process is an ongoing process, and the impact management framework is tailored so that each project can be monitored on an individual basis. Shifting the focus on innovation from an individual organisation to the scale and complexity of an entire country, Chapter 5 describes the evaluation of the national innovation policy (NIP) in Brazil. This chapter presents a comprehensive framework for monitoring and evaluating the NIP based on models for continuous policy, programme and institution evaluation. In contrast to the Novo Nordisk Foundation, innovation policy evaluation in the Brazilian context faces several challenges, including the difficulty of

defining and measuring policy outcomes, the scarcity of reliable data and the intricacies of interactions among various stakeholders involved in the development and implementation of the policy. Additionally, political and economic factors, such as shifts in government leadership and economic fluctuations, can impact the evaluation process in practical terms. The comprehensive evaluation framework that is presented in this chapter extends beyond real-time knowledge acquisition of the efficacy and effectiveness of the policy outcomes. The chapter also highlights the volatility that is likely to impact all innovation policies and programmes – something that has particularly affected Brazil over the past two decades.

10.4. The evolution of innovation policy: Key issues identified in Part 2

Part 2 of this book critically examines the evolving sphere of innovation policy. It explores how traditional innovation concepts have expanded to incorporate societal and inclusive aspects. Through detailed analyses and case studies, the chapters underscore the need for innovation policies that are not only technologically sound but also socially inclusive and globally aware. This part of the book offers valuable insights into creating effective and inclusive innovation policies that are responsive to the complexities and demands of the 21st century. One contribution in this part of the book explores the topic of an evolving innovation space with an analysis of the Oslo Manual. Just like the Frascati Manual explored in Chapter 3, the Oslo Manual represents the internationally recognised methodology for collecting and using innovation statistics and has assumed a preeminent role in shaping how we understand innovation. An analysis of innovation concepts presented in the four editions of the Oslo Manual (1992, 1997, 2005 and 2018) is presented in Chapter 6. The analysis highlights how the policy understanding of the concept of innovation, the innovation actors involved in the process and their activities, and the understanding of innovation diffusion and spillovers, have had to evolve over time. In essence, the analysis seeks to explore how innovation and its related concepts have evolved from their origins as a narrow technical concept to being forced to embrace a far broader societal agenda.

Chapter 7 elaborates on the concept of inclusion and its role and significance as a policy objective – an issue that has been increasing in science, technology and innovation (STI) policy agendas in recent years. This coincides with the broadening of the innovation policy agenda from its overly narrow technology focus to positioning it as an agent of societal change, with inclusion and a more democratic design and delivery of innovation policy being seen as one of the key factors that could drive global sustainable innovation. However, the concept of inclusion has a variety of meanings and interpretations that are used by practitioners and researchers and in policy discussions. This chapter seeks to unravel the different dimensions of inclusion in the context of STI policy-related evaluation and make clear that inclusion is a multidimensional policy objective in this context. The necessary conceptual clarity laid out in this chapter is designed to assist in the valid and robust policy evaluation of inclusion initiatives. This issue is further explored in Chapter 8, which presents a case study of a framework that is designed to assess inclusion – the Inclusion-Immediacy Criteria (IIC) framework – applying it to assess the outcomes of the US National Science Foundation-funded research projects. The framework examines how research impacts can be assessed in the case of marginalised groups, focusing on two dimensions: inclusion and immediacy. In the context of this framework, inclusion characterises research based on the intended beneficiaries of the R&D, while immediacy refers to the incorporation of the impact in relation to the research project. Research evaluation of social impact has a long tradition, and it is crucial to understand the impacts of research, development and innovation on inequality. Still, this issue not receiving as much attention as economic growth and increasing

innovation. However, the COVID-19 pandemic demonstrated that it is impossible to solve these problems only by developing solutions in wealthy countries, by wealthy scientists, and for wealthy people. Instead, this chapter argues that policies and the innovations aimed to solve global challenges need to be inclusive in order to succeed. The final contribution in Part 2, Chapter 9, presents a fundamentally new innovation policy approach that has been specifically tailored for the rapidly evolving innovation space – a space where innovation is becoming more decentralized, distributed and global as more of the tools and capabilities of innovation, in particular digital tools, move into households and are directly accessed by users.

10.5. Consequences for innovation policy and evaluation

The contributions in this book have clearly outlined the evolution of the innovation concept and the approach often taken in innovation policy charting a clear shift from a technology-centric approach to a broader, more inclusive approach to innovation. In terms of innovation policy, there needs to be a pivotal shift towards a directional policy aiming to achieve a more sustainable and inclusive innovation ecosystem. While such a shift will bring a host of benefits, including fostering resilience and promoting holistic development, it also presents certain challenges, including the potential dilution of focus and increased regulatory complexities. In the future it will be imperative to strike the right balance of policy focus. That is, fostering a broad-based approach to innovation while continuing to maintain a sharp focus on critical technological advancements. This is necessary for successful navigation in this complex landscape. However, it is clear that such fundamental changes also create a different agenda concerning innovation research, innovation management and innovation policy. The agenda to be tackled now and in the near future can perhaps be most conveniently organised in the form of a SWOT analysis:

Strengths

- Resilience: A broader approach to innovation can make economies more resilient, as it fosters diversity in innovation sources and types.
- Holistic development: The broadening focus can promote overall societal development, addressing various facets of societal needs and challenges. Here, innovation policy covers ground that has previously belonged to social and health policies. How should this be managed?
- Sustainable growth: Encouraging environmental innovations can lead to sustainable growth by fostering green technologies and sustainable practices. However, policy directionality has challenges of its own. For instance, have we chosen to promote the right technologies for a green transition? What are the long-term consequences of promoting wind power and electric cars?

Weaknesses

- Resource allocation: A broader focus can sometimes dilute the allocation of resources, potentially slowing progress in key technological areas.
- Measurement challenges: With the broadening scope, measuring and evaluating the impact of innovations can become increasingly complex and challenging. Here, new data sources and are likely to offer new tools for impact evaluation. The challenge seems to be willingness to renew evaluation practices.

Opportunities

- Cross-sectoral synergies: A broader innovation policy fosters cross-sectoral synergies, promoting interdisciplinary innovations that can offer novel solutions to complex challenges. Although there is a clear need for systemic changes, this is nothing new for the innovation policy. However, creating a shared understanding in highly complex and dynamic situations can be a challenge for policy design and delivery.
- Social equity: By focusing on inclusive innovations, policies can foster social equity, helping to bridge societal gaps and reduce inequalities. This is an increasing area of interest but it will remain to be seen how it is possible to balance the need for inclusion and the pressure to create economic growth.

Threats

- Over-regulation: A broader policy framework can sometimes lead to over-regulation, potentially stifling innovation. Regulation seems to be a particular challenge for the European Union. The big question is, how can Europe compete with the US and China in terms of offering fertile ground for innovations under its current type of regulatory regime?
- Global competition: As innovation policies broaden, staying competitive in the global landscape, where some regions might focus intensively on specific technological advancements, becomes challenging. It will be a major question whether it will be autocratic regimes or liberal democracies that succeed in developing and delivering optimal innovation policy.

The evolution of innovation policy towards a broader, more inclusive approach presents a complex landscape. It requires careful management to leverage its strengths, mitigate weaknesses, capitalise on opportunities and navigate threats. This shift has far-reaching implications for how innovation is conceptualised, managed and evaluated, calling for strategic balance and foresight in policy-making and evaluation practices.

10.6. Policy evaluation in this new context

In the emerging innovation landscape, holistic approaches to societal impact evaluation are gaining prominence. These approaches consider a wide range of innovation actors and their societal, environmental and economic impacts. Tailored metrics are essential for evaluating policy impacts across diverse dimensions, including technological advancements, societal wellbeing, inclusivity and environmental sustainability. It is likely that holistic approaches to societal impact evaluation will become increasingly relevant as such approaches are able to take account of a wide array of innovation actors, ranging from individual innovators to large organisations, and consider societal, environmental and economic impacts. It is important to create tailored metrics to gauge the policy impact in a variety of dimensions including, but not limited to, technological advancements, societal wellbeing, inclusivity and environmental sustainability. In this way, only tailored metrics are able to cover the essential features of complex policy actions. Dynamic evaluation models are becoming an increasingly realistic option for evaluators and are an ideal solution. It is now possible to develop dynamic evaluation models that can adapt to a fast-evolving innovation landscape, incorporating real-time data and analytics that offer timely insights and feedback. At the same time, changes in society have led to participatory impact evaluation becoming an option, creating a need to develop a form of participatory evaluation that involves a range of stakeholders, including the community, industry partners and academia, in order to foster a more grounded and inclusive evaluation process. For example, inclusion and equity enable demographic representation,

thereby ensuring that policies are reaching and benefiting all demographic groups equitably. Geographical equity is similarly important in ensuring that innovation policies foster geographical equity, benefiting regions equitably. Geopolitical considerations are another increasingly important dimension of innovation policy impact evaluation, and national security concerns are on the rise, with innovation policy effectively becoming part of national security. Evaluating the impact of innovation policies needs to include national security perspectives, considering aspects like cybersecurity and technological sovereignty. The field of international collaborations is being shaped by various security concerns, and it is important to assess how and with whom innovation policy fosters international collaborations and partnerships.

Environmental sustainability is a global challenge that drives innovation policy on national and multinational levels. Green innovations represent solutions to global problems and evaluations should assess which policies best promote green innovations and contribute to environmental sustainability. Resilience to ongoing climate change is something that government policies need to promote, and policy evaluations should assess the role of innovation policies in fostering resilience to climate change. Technological advancements can contribute to the technological sovereignty of a nation or trade block like the EU; this means evaluating policies in the context of promoting technological sovereignty, fostering home-grown technologies and reducing dependencies on external entities. At the same time, ethical considerations need to be part of a new form of technological evaluation, as highlighted by the debates on artificial intelligence (AI). The COVID-19 crisis and evolving geopolitics have created real and potential disruptions in logistics and supply chains, and supply chain resilience has become a focal of concern for innovation policy. Policy evaluation should thus gauge how policies foster resilience in supply chains and promote diversified and secure supply chains. Innovation in logistics is closely related to supply chains and it is important to assess the role of policies in fostering innovations in the logistics sector, promoting security, efficiency and sustainability. Finally, innovation policy is likely to influence societal wellbeing in novel ways and it is important to assess the role of policies in fostering education and skills development, promoting a skilled workforce capable of driving innovation.

10.7. Key evaluation dimensions

- Inclusion and equity: Evaluating demographic representation ensures that policies benefit all groups equitably.
- Geographical equity: Policies should be assessed for their ability to foster balanced regional development.
- Geopolitical considerations: National security concerns, including cybersecurity and technological sovereignty, are becoming integral to innovation policy evaluation.
- Environmental sustainability: Evaluating policies for their effectiveness in promoting green innovations and addressing climate change is critical.
- Technological sovereignty: Assessing policies in the context of promoting home-grown technologies and reducing external dependencies.
- Ethical considerations: Ethical aspects, especially in emerging fields like AI, are crucial in policy evaluation.
- Supply chain resilience: Evaluating how policies contribute to resilient and diversified supply chains, particularly in light of global disruptions such as COVID-19.

- Logistics innovation: Assessing the role of policies in promoting secure, efficient and sustainable innovations in logistics.
- Societal wellbeing: Evaluating the impact of policies on education, skills development and overall societal wellbeing.

In conclusion, developing a comprehensive innovation policy impact evaluation mechanism involves incorporating a holistic approach that considers a wide array of dimensions including societal, environmental, geopolitical and economic aspects. Such an evaluation mechanism should also foster inclusivity and consider the diverse array of innovation actors involved in the ecosystem. Incorporating these new dimensions in policy evaluation would ensure a more rounded assessment, facilitating policies that are grounded in the contemporary realities of the evolving innovation landscape.

10.8. Setting the stage for the ex-ante evaluation of innovation policy

Previous sections have described various dimensions of the dynamic innovation environment, but in order to navigate successfully in this complex environment, policy makers need to utilise all available tools, like ex-ante evaluation. This approach starts by defining clear objectives and specific goals before initiating any policy, thus delineating what the policy seeks to achieve in concrete terms. As laid out in the previous sections, objectives should encompass a holistic view, taking into account various dimensions such as societal wellbeing, economic progress and environmental sustainability. Similarly important is stakeholder engagement, including the insights from a broad spectrum of stakeholders, industry experts, academics and community representatives. Feedback is highly necessary in the dynamic environment, and this can be achieved through a feedback loop that continually incorporates stakeholders' inputs during the policy development process.

Leveraging ex-ante evaluation in policy design could include the following steps:

Scenario analysis

- Future mapping: Using scenario analysis to map out various possible futures and understanding how different policy interventions could perform in different scenarios.
- Risk assessment: Identifying potential risks and challenges that might emerge in different scenarios, facilitating a more resilient policy design.

Predictive analytics

- Data-driven insights: Leveraging predictive analytics to garner data-driven insights, facilitating a more informed policy design.
- Trend analysis: Analysing emerging trends and trajectories to understand potential future developments and shape policies accordingly.

Benchmarking

- Comparative analysis: Conducting a comparative analysis with other regions/countries to understand best practices and lessons learned.
- Performance metrics: Setting performance metrics based on benchmarks, facilitating a more targeted and results-oriented policy design.

Pilot programmes

- Test beds: Before full-scale implementation, testing policies through pilot programmes to gather real-world insights and make necessary adjustments.

- Feedback and adjustments: Using pilot programmes to garner feedback and make necessary adjustments to the policy design.

Integration of ex-ante and ex-post evaluation feedbacks to the policy design will facilitate constant policy refinements. Full documentation and transparency of the evaluation process and results are needed for future development needs and stakeholder buy-in. These steps make learning and adaptability possible through a continuous learning approach, where policies are seen as living documents that can be changed based on the learning from the ex-ante evaluations and subsequent evaluations post implementation. By effectively leveraging ex-ante evaluations in innovation policy design, we can foster policies that are more resilient, informed and grounded in a deep understanding of the potential future scenarios and trends. This proactive approach facilitates a policy design process that is collaborative, data-driven and focused on achieving clearly defined objectives, thereby driving successful outcomes in the dynamic and evolving innovation landscape.

10.9. Technological competition and geopolitics

The landscape of innovation policies in Western countries is increasingly influenced by technological competition and geopolitics. This trend, expected to continue, is reshaping the approach to innovation and policy-making. In response to global events such as the aggressive Russian war in Ukraine, governments are boosting their investments in R&D, particularly in areas like military technologies. This intensification reflects a drive to maintain competitiveness. Additionally, Western countries are addressing supply chain resilience by diversifying their sources – a strategy that has become more pressing due to the COVID-19 pandemic and rising geopolitical tensions. Another strategic focus is the strengthening of intellectual property rights (IPR) frameworks. Despite the recognised benefits of open knowledge sharing, protecting technologies against potential theft and misuse is becoming increasingly important, especially with China's growing prominence in the IPR sector. Furthermore, there is an ongoing competition, particularly between Western nations and China, to set global standards for emerging technologies, underscoring the strategic significance of technology standards and regulations.

10.9.1. Geopolitical influences on innovation

The development of secure communication networks, especially with the advent of technologies like 5G and 6G, is being driven by national security concerns. In addition, international collaborations are evolving to become more selective, often aligning with geopolitical alliances. Skilled immigration policies are also undergoing revisions to attract talent and boost domestic innovation. Moreover, broader economic policies, including sanctions and export controls, are being incorporated into innovation policies to safeguard national interests. The overarching goal is to protect national interests while promoting a collaborative and sustainable global technological ecosystem. As a result, technological competition can be increasingly seen as key frontier where leading nations compete, bringing into focus several areas of technological competition including:

Increasing policy focus on research and development

- Increased investment: Governments are tempted to increase investments in R&D to foster innovation and stay competitive in the global technology race. This can be seen also in the case of various military technologies which have been brought to focus by the illegal Russian war against Ukraine.

Supply chain resilience emphasises diversification

- Western countries might work on diversifying their supply chains to reduce dependence on a single country or region. COVID-19 highlighted the risks of long supply chains that were realised in several disruptions across the industries. Geopolitics and competition with China have further emphasised such risks.
- The complexity of the situation was highlighted in a speech by the president of the European Commission, Ursula von der Leyen, in March 2023: *"I believe it is neither viable – nor in Europe's interest – to decouple from China. Our relations are not black or white – and our response cannot be either. This is why we need to focus on de-risk – not de-couple."*[1] What all this means in practice will remain to be seen.

IPR and the strengthening of IPR

- Western countries may be tempted to strengthen IPR frameworks to protect their technologies from potential theft and misuse, this despite the demonstrated benefits of the free sharing of knowledge and innovations in some parts of innovation space. At the same time, China has become a major force also in the field of IPR.
- According to World Intellectual Property Organization (WIPO), the highest numbers of patents in force were recorded in China (3.6 million), the United States of America (3.3 million) and Japan (2 million).[2]

Technology standards and regulations

- Competition on who is setting global standards: Western nations and China will seek to lead in establishing international standards for emerging technologies to secure their competitive edge.

Geopolitics will also push forward developments that may have significant influence on global innovation spaces and related policies. We can see a number of such developments, including:

National security concerns emphasise secure communications

- With the advent of technologies like 5G and 6G, there's an emphasis on developing secure communication networks to prevent espionage and cyberattacks.

International collaborations are likely to be more selective

- While international collaborations will continue, they might become more selective, focusing on allies sharing similar geopolitical perspectives.

Talent acquisition is a new frontier

- Emphasizing the role of skilled immigration policies as part of the innovation space, Western countries might revise their immigration policies to attract skilled workers and foster innovation domestically.

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[1] Speech by President von der Leyen on EU-China relations to the Mercator Institute for China Studies and the European Policy Centre, available at: ec.europa.eu/commission/presscorner/detail/en/speech_23_2063

[2] World Intellectual Property Organization (WIPO), Facts and Figures, Statistics Database, September 2022. https://www.wipo.int Accessed; April 12th, 2024.

Economic policies are increasingly being characterized by sanctions and export controls

- Innovation policies might be influenced by broader economic policies, including sanctions and export controls, aimed at protecting national interests.

There is also a growing emphasis on ethical development and respecting privacy, influenced by varying global perspectives on these issues. Alongside this, climate change concerns are catalysing a shift towards sustainable and green technologies, reflecting an increasing focus on environmental responsibility. AI remains a key strategic competitive area, with policies oriented towards responsible development and deployment. Space technologies are also receiving heightened attention for both exploration and defence purposes, reflecting new arenas for geopolitical competition. The focus on biotechnology and biosecurity has been amplified by pandemic experiences, with an emphasis on responsible development in these areas. Additionally, education reforms are being recognised as essential for nurturing domestic talent and ensuring a continuous supply of skilled professionals to fuel innovation. In order to navigate the complex interplay of technological competition and geopolitics, Western nations are tasked with strategically designing their innovation policies. This involves developing novel impact evaluation methods to ensure the effectiveness and success of future innovation policies.

10.10. Is innovation policy going back to basics?

The origins of technology and innovation policy is often rooted in technological sovereignty and military needs. At present we can see this original objective emerging again as a result of Covid-19 experiences and geopolitical developments (Edler et al., 2023).
Innovation policy has undergone a significant evolution over the past decades, transitioning from a narrow focus on technology development to a broader, more systemic approach. This evolution reflects the changing landscape of global technological advancement, economic competition and societal needs. While initially centred on supporting the development of specific technologies, innovation policy has expanded to encompass entire innovation systems and, more recently, has adopted transformative and mission-driven approaches. However, recent geopolitical shifts have catalysed a return to prioritising key technology development and industrial policies for instance, AI and telecommunications (Rossi, 2023). This chapter will now explore this trajectory, examining the implications of each stage and the dynamic interplay between technological innovation and geopolitical considerations.

In the early stages, innovation policy was primarily concerned with the development of specific technologies. This approach was driven by a belief in the linear model of innovation, where scientific research leads directly to technological breakthroughs. Policies were designed to support R&D activities, primarily through public funding and subsidies. Examples include the United States' investment in space technologies during the Cold War era and Japan's focus on electronics and automotive technologies in the post-WWII period. As the understanding of the innovation process deepened, it became clear that innovation is not a linear, but a complex, interactive process, involving various actors and institutions. This realisation led to the development of innovation system policies, which consider the broader ecosystem, including universities, research institutes, companies and government agencies. This systemic approach aimed to foster interactions and knowledge flows between these actors, emphasising the importance of networks, clusters and the business environment. The European Union's Framework Programmes for Research and Technological Development exemplify this approach, seeking to create a cohesive innovation ecosystem across member states. The next evolutionary phase saw innovation policy adopting a more ambitious,

transformative approach, characterised by mission-driven policies. These policies target broader societal challenges such as climate change, public health and sustainable development. They are inherently multidisciplinary, requiring coordinated efforts across different sectors and stakeholders. The European Green Deal and the United Nations Sustainable Development Goals (SDGs) are prominent examples of this approach. These policies are not just about fostering technology, but about using innovation as a tool for societal transformation.

However, in recent years, a significant shift has occurred, driven by intensifying geopolitical competition. Nations have become increasingly focused on key technologies and industrial policies, recognising that technological leadership is integral to economic and national security. This shift marks a partial return to earlier stages of innovation policy, with renewed emphasis on developing strategic technologies like AI, quantum computing and biotechnology. The United States' focus on maintaining its technological edge over China and the EU's efforts to achieve digital sovereignty illustrate this trend. This shift towards technology and industrial-centric policies in the geopolitical arena has brought several implications, including a narrowing of the focus of innovation policy. While broad, systemic innovation policies are still relevant, there has been a renewed emphasis on specific technologies deemed crucial for national security and economic competitiveness. Collaboration and simultaneous competition between nations is also creating a complex policy environment and the geopolitical context is redefining international collaborations, with a greater focus on strategic alliances and technology sharing among allies, contrasting with the open, collaborative model of previous eras (Edler et al., 2023). The balance between economic and security interests is also being reconsidered, and nations must now balance the drive for economic growth through innovation with the need to protect their technological assets and maintain security. As a result, ethical and regulatory challenges are emerging, and this renewed focus raises concerns about ethical considerations and the need for regulatory frameworks to govern the development and use of advanced technologies. A stylised table that aims to capture differences in innovation policy approaches between the three major policy actors the US, EU and China is presented next, see Table 1. Each one of these has their own strategic approaches to AI and innovation policy, reflecting their relative strengths such as state control in China, citizen voice in Europe, and business practices in America (Bal and Gill, 2020). Different approaches to innovation policy can be seen in presented eleven key areas ranging from RDI funding to environmental and sustainability policies The table has three columns hightlighting innovation policy related weaknesses and strengths in the case of the EU, the US and China, topic by topic. The presentation has been compiled with the help of AI assisted tools providing an example of its capability to distill together key information from a large data set

Dimension	EU	USA	China
R&D Funding	High investment in Horizon Europe program (Strength). May lack private sector investment intensity (Weakness)	Significant private and public R&D investment (Strength). Funding priorities can be politically influenced (Weakness)	Massive state-driven investment in tech R&D (Strength). Lack of academic freedom can hinder innovation (Weakness)
Education & Workforce	Strong emphasis on digital literacy and STEM education (Strength). Skill gaps still exist (Weakness)	Global leader in higher education and tech innovation (Strength). Faces challenges in K-12 STEM education (Weakness)	Rapidly improving in STEM education (Strength). Still catching up with global leaders (Weakness)
Public-Private Partnerships	Active in encouraging collaborations (Strength). May face bureaucratic hurdles (Weakness)	Strong culture of innovation and venture capital (Strength). Can face regulatory and political obstacles (Weakness)	Government actively supports tech firms (Strength). Can lead to market distortions (Weakness)
Regulatory Environment	Strong regulatory frameworks like GDPR (Strength). Regulations can be seen as overly strict (Weakness)	Flexible regulatory environment (Strength). Sometimes lacks in privacy and consumer protection (Weakness)	Regulatory environment favors domestic companies (Strength). Overregulation can stifle innovation (Weakness)
IP Protection	Strong IP regime (Strength). Enforcement can be challenging across member states (Weakness)	World leader in IP creation and protection (Strength). Concerns over IP theft, especially from foreign entities (Weakness)	Focused on increasing IP creation (Strength). Issues with IP enforcement and protection (Weakness)
Tax Incentives & Financial Support	Various incentives by member states (Strength). Variability across states (Weakness)	Significant tax incentives for tech companies (Strength). Criticized for favoring large corporations (Weakness)	Strong government support for tech sector (Strength). May lead to inefficiencies and overreliance on state support (Weakness)
Infrastructure Development	Invests in digital and green infrastructure (Strength). Requires ongoing investment to keep pace (Weakness)	Advanced in tech infrastructure (Strength). Inequalities in access across regions (Weakness)	Rapidly developing infrastructure (Strength). Quality and sustainability concerns (Weakness)
International Collaboration & Standards	Leaders in setting global standards (Strength). May face challenges in global alignment (Weakness)	Influential in global tech standards (Strength). Tensions with other tech superpowers can affect collaboration (Weakness)	Expanding international presence (Strength). Geopolitical tensions can hinder collaboration (Weakness)
Ethical & Social Considerations	High focus on ethical AI and digital privacy (Strength). Could slow down rapid tech deployment (Weakness)	Focus on innovation, less on regulation (Strength). Lag in addressing ethical and social impacts (Weakness)	Ethical considerations often secondary to rapid development (Weakness). Focus on technological sovereignty (Strength)
Market Access & Trade Policies	Fair trade policies (Strength). Balancing internal and external market interests can be challenging (Weakness)	Open market policies (Strength). Trade tensions can impact tech sector (Weakness)	Aggressive in pursuing market access (Strength). Faces pushback and trust issues internationally (Weakness)
Environmental & Sustainability Policies	Green Deal and focus on sustainability (Strength). Integrating these goals with fast tech growth can be complex (Weakness)	Growing focus on sustainability (Strength). Balancing economic growth with environmental policies (Weakness)	Increasing focus on sustainability (Strength). Challenges in balancing growth with environmental concerns (Weakness)

Table 10.1 Major innovation issues affecting the US, EU and China

10.10.1. Conclusion

Dynamic international environment, evolving innovation policies and evaluation practices ought to go hand in hand. Changing geopolitics, systemic rivalry and limits of globalisation form a new context for innovation policy. The evolution of innovation policy has gone from technology development to transformative missions. More recently, there is a pivot back and focus on key technologies and industrial policies which reflects the dynamic nature of global technological and geopolitical landscapes. While this shift brings new challenges, it also offers opportunities for nations to reassess and recalibrate their innovation strategies in a rapidly changing world. The balance between broad, systemic approaches and targeted technological advancement will likely define the next phase of innovation policy. These

changes set new requirements for innovation policy evaluation concepts and practices aided by vastly improved access to data and AI tools.

References

Bal, R., & Gill, I., 2020. Policy Approaches to Artificial Intelligence Based Technologies in China, European Union and the United States. . https://doi.org/10.2139/ssrn.3699640.

Edler, J., Blind, K., Kroll, H., and Schubert, T., 2023. Technology sovereignty as an emerging frame for innovation policy. Defining rationales, ends and means. Research Policy, Volume 52, Issue 6, July 2023, 104765, https://doi.org/10.1016/j.respol.2023.104765.

Rossi, M. 2023. EU technology-specific industrial policy. The case of 5G and 6G. Telecommunications Policy 48 (2024) 102639. https://doi.org/10.1016/j.telpol.2023.102639