Digital Policy Hub — Working Paper

Artificial Intelligence and Innovation Policy: A Comparative Perspective

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Summer 2024 cohort

About the Hub

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The Digital Policy Hub working papers are the product of research related to the Hub's identified themes prepared by participants during their fellowship.

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Thank you to Mitacs for its partnership and support of Digital Policy Hub fellows through the Accelerate program. We would also like to acknowledge the many universities, governments and private sector partners for their involvement allowing CIGI to offer this holistic research environment.

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Key Points

- In the intensifying global race for advantage in artificial intelligence (AI), three considerations around innovation policy are critical:

  - There needs to be consistent and clear priority setting, set out over time.

  - AI policy needs to be embedded in a larger ensemble of industrial priorities that include a focus on digitalization and information and communication technology.

  - AI priorities need to also exist within a larger governmental focus on innovation that is targeted and focused on demonstrable results.

- The Republic of Korea has forged successful policies in these domains. Sweden, while having a somewhat later start in AI, has also moved forward quickly.

- Canada, with a long and illustrious history in AI, is beginning to lose its competitive edge. Innovation indicators show worrying trends of deceleration.

- AI policy priorities, while important, have tended to evolve in a more fragmented manner. Canada is at an important juncture. AI policy priorities need to be tightened and focused, if Canada is to have more enduring comparative advantage.

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Introduction

Innovation policy — and industrial policy more broadly — is fraught with challenge in the current global environment. Protectionist impulses by nations and superpowers sit astride highly integrated international production networks and value chains. Competition has ratcheted up in intensity, particularly in high-tech areas, and the dawn of an age of digitalization makes innovation imperative for economic growth and prosperity. For smaller, export-oriented economies such as the Republic of Korea (hereafter Korea), Sweden and Canada, the calculations and strategies needed to compete in these circumstances are especially critical and daunting.

This working paper is part of a larger comparative project examining dimensions of innovation policy and how smaller nations confront such challenges. Its focus is on two countries who are recognized leaders in innovation — Korea (Organisation for Economic Co-operation and Development [OECD] 2023) and Sweden (OECD 2016) — and a third country with a much more fractured history on this front, Canada (Scharf 2022).[1] AI represents an especially valuable lens for this inquiry, given its centrality and that of the big data that fuels it to the growth equation, as well as the associated risks it generates.[2] The most recent OECD definition of an AI system is as follows: "a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that influence physical or virtual environments" (Grobelnik, Perset and Russell 2024).

The purpose of this working paper's inquiry is twofold. First, it focuses on government priorities in Korea, Sweden and Canada and the degree to which they have been

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1 See also Scharf (2022), chapter 3 on the strength of Korea's and Sweden's performances in a range of innovation indicators.

2 On risks, see Scharf (forthcoming 2025).

consistent in addressing AI as a policy goal; in other words, whether there has been policy durability. Second, select measures dealing with AI venture capital and patents are examined to get a read on innovation indicators. As such, the questions central to this research are: To what extent are AI public policies in Korea, Sweden and Canada characterized by durability over the 2000 to 2024 period, and is there evidence that these policies are enabling the conditions for innovation?

Theoretical Framework

The analysis of this working paper draws on two currents of literature centred on public policy choices in the context of innovation. The first is the developmental network state (DNS) framework associated with the work of Fred Block, Matthew R. Keller and Marian Negoita.[3] Critical to this framework is that government initiatives to enable successful innovation must have policy durability and focused priority setting and be sustained over time. While distinct from the DNS approach itself, Mariana Mazzucato's contributions on innovation equally highlight the need for "clear direction" (Mazzucato 2018b, 4) and "deliberate" public policy choices" (Mazzucato and Semieniuk 2017, 30).[4]

Selection of the Case Studies

The selection of these case studies is not solely based on Korea's and Sweden's successes with innovation. Korea and Sweden represent models with wide comparative and geographic relevance. In the case of Korea, there has been the history of the "developmental state" — specifically public policy's vigorous role in enabling rapid technological catch-up and economic development (Amsden 1989, Chibber 1999, Evans 1995, Ó Riain 2004, Yeung 2016). In Sweden, the history speaks to the social-democratic foundations of public policy and state efforts imbued with a focus on collaborative undertakings with business and labour (Edquist and Lundvall 1993, Esping-Andersen 1990, Hall and Soskice 2001, Mjøset 1987, 2016).[5] Despite the differences between these countries, this working paper offers an opportunity to examine their similarities regarding the policy priority setting that underpins innovation progress and success. For Canada, this inquiry reveals the conditions that enable AI innovation and offer an associated comparative advantage, beyond that of the usual default comparison with the United States.

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3   See Block (2008); Block and Keller (2011); Keller, Block and Negoita (2022); Block, Keller and Negoita (2024).

4   See also Mazzucato (2015, 2018a, 2021); Dosi et al. (2023). For an extensive discussion of DNS, see Scharf (2022, chapter 1).

5   On the respective literatures for Korea and Sweden, see Scharf (2024b unpublished); on Sweden, see also Baccaro and Pontusson (2016) and Ornston (2018); on Korea, see also Breznitz (2007).

Korea

Policy Priorities: Foundations

The "Miracle on the Han River" is a phrase referencing the immense strides the Republic of Korea has made over the last several decades in terms of the innovation and growth ushered into its economy and society. As the OECD (2023, 12) has recently indicated, Korea has "sustain[ed] rapid progress towards the global innovation frontier." An embedded legal framework centring on science, technology and innovation (STI), as well as five-year economic development plans that began as early as 1962, have been integral parts of that unfolding history (Scharf 2024a). Yet, interestingly, Korea did not unfurl a national strategy on AI until 2019 (Government of the Republic of Korea 2019b).

Nevertheless, robotics, the information and communication technology (ICT) industry, particularly semiconductors, and the move to digital "informatization" more generally have established critical foundation for developing prowess on the AI front. Thus, policy durability, and priority setting, needs to be set in a larger context. To that end, three dimensions are of particular importance: the Group of Seven (G7) initiative, the basic Science and Technology (S&T) plans, and the launch of the country's AI strategy in 2016.

A critical component of the Korean government's priority setting in the 1990s was the effort to move the country into the G7 circle. Heavy investments were made in future-oriented technology development, specifically the research and development (R&D) spending program between 1992 and 2001 called the G7 Leading Technology Development Program (Oh, Lim and Kim 2016; Yoon 2014). Centred on critical areas such as next-generation semiconductors and superconducting, as well as advanced manufacturing systems, this program was an important building block for later developments.

Equally important from 2003 onward were the five-year basic plans on S&T, which consistently focused on critical technology "growth engines" (OECD 2009, 201) that could propel innovation.[6] Central to the first three plans (2003–2007, 2008–2012, 2013–2017) was the importance of ICT, robotics, and frontier technologies such as next-generation semiconductors, networks and system software, as well as intelligent manufacturing processes (ibid., table 3.9). In the Fourth Plan, which centred on digitalization and its associated technologies, AI was prioritized as being fundamental for achieving comparative advantage. Credited with "strengthening… the foundation of Industry 4.0" (Government of the Republic of Korea 2018, S.III, strategy 2), this focus on AI paved the way for a national strategy. By the Fifth Plan, AI had become one of 12 national "strategic" technologies (Government of the Republic of Korea 2022, S. IV 2.12, task 11) that were to carve out technological sovereignty for the country in the face of growing global autarkic tendencies.

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6   With respect to "economic growth engines," see OECD (2009, 184) on the First Basic Plan; see ibid. (186, especially 201–5) and Yim and Lee (2015) on the Second Basic Plan; and see OECD (2014, 35–36), Cha (2016) and Yim and Lee (2015) on the Third Basic Plan.

A National Strategy for AI

Among the overarching features of the Korean policy landscape, since 2016, AI has moved to the top of the priority-setting agenda and the focus on it has been consistent. Following the defeat of the reigning Go champion in March 2016 by the AI-designed AlphaGO,[7] President Park Geun-hye took immediate action. Highlighting "the importance of AI before it is too late," the government rolled out a plan to invest one trillion won in AI by 2020 (McFaul et al. 2023; Zastrow 2016). By June 2019, AI had become a presidential initiative under President Moon Jae-in. In December that year, the government had announced its National Strategy for Artificial Intelligence under the banner of "Toward AI World Leader beyond IT" (Government of the Republic of Korea 2019b).

The strategy itself is extensive, resting on a sober analysis of the country's strengths and weaknesses, the positioning of its competitors and the quantitative objectives needed to address existing gaps. Moreover, it is ambitious, indicating that by 2030, Korea is to become the "world's 3rd largest" country in terms of "digital competitiveness" (ibid., 16).

The strategy is centred on three pillars that not only reach into economic and societal spheres but also have legal ramifications. The first of these pillars aims to establish a "global-leading AI ecosystem" (ibid., 16–29) that will build out high-capacity computational infrastructure; wed private and public data that can feed AI; leverage existing industrial strengths to enhance competitiveness (as with semiconductors); and enable AI start-ups to globally scale. In regard to the last of these, the strategy both proposes "preferential" (ibid., 28–29) access to incubator programming and sets criteria for the selection process for such firms.

The strategy of the second of these pillars focuses on the "Best Use of AI," which means attracting and curating the talent that will drive AI innovation forward while also ensuring that Korean citizens learn the necessary AI skills. Public services are also to be revamped with AI design. The third pillar's priority is on "People-Centred AI" (ibid., 44–49) with attention to systems that provide for job security in the face of industrial transformation, as well as an AI code of ethics to mitigate risks. Finally, this strategy is not only a visionary document , but one that concretely lays out the tasks to be assigned to individual government ministries as this project is steered forward.

The OECD has maintained of late that Korean public policy needs a "paradigm shift" (OECD 2023, 16), with a more integrated approach that incorporates a broader perspective of the economy. Yet, what is immediately striking about the Korean AI strategy is the extensive reach of its implementation; it is already embedded in broader initiatives that prioritize digitalization, AI, "smart" manufacturing and development focused on futurist technologies.

Since the 2000s, there has been a focus on digitalization in Korea, with the country having made great strides in this area (Scharf 2024a), and both digital technologies and AI are manifest in the Fourth and Fifth S&T Plans (Government of the Republic of Korea 2018, 2022). The Mid-to-Long Term Master Plan for the Intelligent Information Society reinforces these priorities, setting out the actions needed to meet the dawn of the Fourth Industrial Revolution and a new digital age, including the application of

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7   Go is an extremely complex strategic board game.

"intelligent IT to all industries" (Government of the Republic of Korea 2017, S.VI.2). In the face of the COVID-19 pandemic, Korea also launched a Digital New Deal, focusing on ICT "competitiveness," innovation and associated infrastructure (Government of the Republic of Korea 2020). In June 2019, the Manufacturing Renaissance Strategy was announced, which is dedicated to developing "smart factories," 2,000 of which were to be based in AI (Lee 2019). That same year also witnessed the rollout of a 5G+ Strategy aimed at ensuring seamless communication networks and "hyper connectivity" (Government of the Republic of Korea 2019a, 6). Equally of note, in 2022, Samsung indicated that it would be investing US$356 billion in next-generation technologies, including semiconductors (OECD 2023, 33).

To the contrary then, AI in Korea has not been an isolated priority cut adrift. It has formed part of a coterie of ancillary and reinforcing public policies focused on advanced infrastructure, R&D and the leveraging of existing industrial strengths. In Korea, there has been policy endurance around futurist, domestically driven technologies and R&D — including the building blocks for AI — that can be seen from the 1990s onward. If policy durability does constitute a critical enabler for innovation, priority setting in the case of Korea definitively meets that bar.

Sweden

Policy Priorities: A Later Start?

Sweden can be seen as having come relatively late to the table regarding policy engagement on AI in terms of deeming it a policy priority. In reviewing a number of key policy documents — namely, the annual reports of Vinnova, Sweden's primary innovation agency, from 2007 onward and the research and innovation bills from 2000 through to 2020[8] — there is no reference to AI until 2017, save for a single passing reference to AI and robotics in 2000 and to AI in 2016.[9] Even then, when it first appears in the 2020 research and innovation bill in a more detailed discussion, it is embedded within the larger rubric of digitalization.[10] However, by 2017, with the government concerned about the country's progress on the AI front and about eroding research quality more generally, Vinnova was commissioned to study the matter.

While AI had not been the subject of Vinnova's earlier analysis, it is worth noting that the agency's policy recommendations were framed within the larger context of innovation writ large and its requisites for success. In 2014, Vinnova had reflected broadly

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8   See *Regeringens proposition 2000/01:3, Forskning och förnyelse*, 7 September 2000, online: <www.regeringen.se/contentassets/02af30e0df8b42cdb278c8524eb476ea/forskning-och-fornyelse/>; *Regeringens proposition 2004/05:80. Forskning för ett bättre liv*, 17 March 2005, online: <www.regeringen.se/contentassets/b807df77fcb646feb634ca0823dd2a3c/forskning-for-ett-battre-liv/>; *Regeringens proposition 2008/09:50. Ett lyft för forskning och innovation*, 20 October 2008, online: <www.regeringen.se/contentassets/05cb6c62a34e4b37a114611a3ebcbd5b/ett-lyft-for-forskning-och-innovation-prop.-20080950>; *Regeringens proposition 2012/13:30. Forskning och innovation*, 11 October 2012, online: <www.regeringen.se/contentassets/4ef9d72bd1b84b3fad482671b5509fa7/forskning-och-innovation-prop.-20121330>; *Regeringens proposition 2016/17:50 Kunskap i samverkan — för samhällets utmaningar och stärkt konkurrenskraft*, 24 November 2016, online: <https://data.riksdagen.se/fil/276B2209-A8A3-411E-AF7F-1706658FB9EB>; *Regeringens proposition 2020/21:60, Forskning, frihet, framtid – kunskap och innovation för Sverige*, 17 December 2020, online: <www.regeringen.se/contentassets/da8732af87a14b689658dadcfb2d3777/forskning-frihet-framtid--kunskap-och-innovation-for-sverige.pdf>.

9   *Regeringens proposition 2000/01:3., supra* note 8, s.6.3.2 and *Regeringens proposition 2016/17:50, supra* note 8, with reference only in s.8.2.3. The first appearance of AI in Vinnova annual reports comes in Vinnova (2017, 98).

10 *Regeringens proposition 2020/21:60, supra* note 8, s.4.4 and s.10.1.2.

on this issue (Elg 2014) and what is immediately striking about the document is the holistic approach in which it frames innovation, as well as the philosophical, economic and social tenets it espouses. *Innovations and new technology* eschews the notion of innovation as a "sudden flash of genius" (ibid., 28), defining it instead as an "iterative, experimental search process" (ibid., 6) that engages all actors in the ecosystem and rests on their collaboration. In addition, Vinnova shifts the significance of the state from being the dominant entity among stakeholders to establishing an enabling "milieu" that will provide the institutional stability and framework for an evolution of innovation.

By 2017, Vinnova had pivoted to its AI mandate and mission to assess the state of AI in Sweden and the path needed for a way forward. Following extensive consultations, by May 2018, Vinnova (2018) had tabled its report, setting out both the strengths and vulnerabilities that the country was facing. Sweden has benefitted from being a highly digitalized society and economy, as well as having robust information technology (IT) infrastructure and an innovation system resting on a resilient "culture of cooperation" (ibid., 11). However, there was a growing demand for AI talent and Sweden was falling behind internationally in research with respect to AI and machine learning in particular. On the patent front, while Swedish industry held strong in computer networks and mobile telecommunications, other sectors were falling behind internationally. All of this required a "national concerted effort" to be made (ibid., 17) in order for Sweden to gain from the developments in AI.

A National Approach to AI

This thinking on the part of Sweden's premier innovation agency set the stage for the government to act on the AI issue with clear vision and purpose. Further, it created the context for an inclusive and tightly woven agenda, one that did not just pivot on supply chains but linked the transformational capacity AI carried for "strengthened Swedish competitiveness" as much as for "enhanced [societal] welfare" (Government Offices of Sweden 2018, 4). Shortly on the heels of the Vinnova analysis, a National Approach to Artificial Intelligence was unfurled in 2018.

The strategy set out by the government was to align with the larger aim of Sweden becoming "the world leader" (ibid., 4) in digital transformation. Four areas of focus were deemed significant. First, academic institutions would need to adopt a more comprehensive and less siloed approach, crossing disciplinary boundaries and providing upskilling for experts as much as for the general population. Second, "applied research" (ibid., 7) and its practical applications would need to be strengthened as much as fundamental science, with both resting on "collaboration" (ibid., 7) networks among industry, the public sector and academia. Third, there was to be a focus on innovation and commercialization, particularly with respect to the creation of AI "testbeds" (ibid., 8) and incubators that could accelerate AI deployment. Fourth, all of these areas of focus rested not only on the upkeep of IT infrastructure, but on a "framework" (ibid., 10–11) of governance attuned to the responsible and ethical use of AI — and essential to democracy. The Swedish government is still reckoning with this national approach, with an updated version of the AI strategy being planned.[11] In December 2023, the prime minister announced an AI commission to "strengthen Swedish competitiveness" (Regeringskansliet 2023). The mandate of this commission will focus on the safety and

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11   Private correspondence with a Swedish official (December 2023).

security of AI in an information age, with a clear recognition that Sweden needs to up its game on the business side, creating the conditions to attract international investment.

In reviewing Sweden's policy initiatives, it is important to establish a larger context, as in the previous discussion of the Korean case. Innovation itself had been a centrepiece of the government's Research and Innovation bills from 2000 onwards, including the priorities and funding associated with that. Undergirding these initiatives were two areas of policy focus by the government that go back to the early 2000s. First, there was a very concerted effort to bring Sweden into the digital age, ensuring the economic and societal benefits and technological innovation that would result from it (Scharf 2024a). Second, as early as 2000, the government made information technology a "priority" area through its Research and Innovation bills.[12] Later legislation in 2004[13] would broaden that priority area to technology more generally and by 2008, the government had established strategic research areas, including technology and specifically IT,[14] that were deemed critical and were to directly contribute to "international competitiveness" (Åström, Arnold and Olsson 2020, 10–12).

Clearly, digitalization and IT provide the ecosystem in which AI development can thrive, and while Sweden's focus on AI specifically may have started later than in other countries, its foundation in ICT was set much earlier. As in the Korean example, policy durability around ICT has provided an important foundation for AI progress in Sweden.

Canada

Within the larger Canadian innovation policy landscape, where priorities and associated financing have frequently shifted over the years (Scharf 2022), federal policy around AI is unique. It may well be one of the lone outliers in having been marked by consistency. Indeed, the government has financially supported AI development for the better part of 40 years.[15] However, unlike the Korean and Swedish cases, AI priority setting, in the Canadian context, has not been accompanied by a similar focus on ICT. Nevertheless, the contours of policy durability are visible and it makes for an interesting comparison with countries replete with a generally successful innovation history.

Policy Priorities: Early Engagement

The history of AI in this context begins with the creation of the Canadian Institute for Advanced Research (CIFAR) in 1982 (Scharf 2022; Brown 2007). Established by a small circle of eminent scientists and researchers and with the backing of a small group of industrialists as well as the Government of Ontario, this institute was dedicated to responding to twentieth-century challenges for "humanity" (Industry Canada 2013, 13). Central to this mission was its flagship program, then called Artificial Intelligence, Robotics and Society – a program that by 2007 would be led by the distinguished scholar Geoffrey Hinton. Hinton, Yoshua Bengio and Yann LeCun are considered the "godfathers of AI."[16]

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12 *Regeringens proposition 2000/01:3, Forskning och förnyelse, supra* note 8.

13 *Regeringens proposition 2004/05:80, Forskning för ett bättre liv, supra* note 8.

14 *Regeringens proposition 2008/09:50, Ett lyft för forskning och innovation, supra* note 8, S.7.2.

15 See Scharf (2022, chapter 8) on the timelines.

16 Hinton, Bengio and LeCun were awarded the ACM A.M. Turing Award in 2018 in recognition for their achievements: see https://awards.acm.org/about/2018-turing.

Beginning in the fiscal year of 1987, the federal government began providing financial support to CIFAR in the form of small grants. As the institute was faced with the potential for bankruptcy, the government stepped up and provided longer-term financing. This support has continued without interruption over the years up until today,[17] lasting over the administrations of different political parties. By 2013, an extensive evaluation of the agency undertaken by Industry Canada concluded that the agency was meeting the government's objectives around "relevance" (Industry Canada 2013, 30), priorities and cost effectiveness. The success of AI and its rich history, as well as the breakthroughs that have been made at CIFAR, have been most recently credited in the 2017 budget (Department of Finance Canada 2017, 90).

A Continuing Presence

In reviewing the history of policy on the AI front, there are three key inflection points: early engagement in the late eighties, the push for commercialization in 2017 and current efforts to build the computational capacity needed for AI. With respect to the second of these inflection points, the commitments on AI were featured within the larger Innovation and Skills Plan rolled out in the 2017 budget. Developed to address growing concerns around innovation and productivity, the plan was intended to catalyze investment and ensure the transfer of knowledge from academia into markets.

The government launched a Pan-Canadian Artificial Intelligence Strategy to be delivered through CIFAR (CIFAR 2017; Department of Finance Canada 2017). Funded with $125 million, the strategy was meant to deepen the talent pool in AI in the country, strengthen the linkages and collaboration among the pre-eminent AI research institutes — the Alberta Machine Intelligence Institute, Mila — Quebec Artificial Intelligence Institute and the Vector Institute — and "cement Canada's position as a world leader" (CIFAR 2017, 13). CIFAR was further tasked with examining the ethical and legal considerations burgeoning around AI.

As well, a centrepiece of the government's Innovation and Skills Plan were superclusters. Intended to function as a magnet for investment and a crucible for innovation synergies, these "dense" clusters were to draw in large corporations, small and medium-sized enterprises, venture capital (VC), academia and government expertise (Department of Finance Canada 2017, 79–80). These hubs were to crack the commercialization and innovation challenges that Canada faced. In the year following the 2017 budget, Scale AI was named as one of the five superclusters that would enable Canada's leadership on the global AI stage (Innovation, Science and Economic Development Canada 2018). But these efforts proved daunting, with an Advisory Council on AI soon recommending that the initiatives had to be substantially deepened, both around commercialization and "skilled talent." In fact, "urgent action" was needed (Innovation, Science and Economic Development Canada 2020), precipitating another round of substantial funding by the government in the 2021 budget (Department of Finance Canada 2021; Innovation, Science and Economic Development Canada 2022).

The third wave of AI priority setting, titled Securing Canada's AI Advantage (Prime Minister of Canada 2024; Department of Finance Canada 2024), and its $CDN2.4 billion price tag has centred largely around the effort to strengthen computational infrastructure, lessening reliance on private foreign sources, as well as continuing the effort to infuse

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17   Funding was also provided to Hinton through the Natural Sciences and Engineering Research Council of Canada (Wells 2017).

Canadian industries with AI technology. Additionally, there will be the creation of an AI Safety Institute dedicated to mitigating the risks of AI. Yet, if compute power is meant to break down the obstacles to growth and innovation, issues of "scale-up" (Prime Minister of Canada 2024) and AI adoption (Department of Finance Canada 2024) still remain.

What is remarkable about the Canadian experience is the policy durability in AI over this extended period and the priority space it occupied within the agendas of respective governments. Yet, the fragmentary nature of these endeavours is also noteworthy, with no one fulsome strategy document incorporating its various pieces. The AI supercluster is not an integrated piece of the Pan-Canadian AI Strategy, although it is intended to operate in parallel. Moreover, a second "phase" introduced in 2021 has been layered on to the original strategy (Innovation, Science and Economic Development Canada 2022), now with a focus on computational infrastructure.

While it is true that Canada was among the first nations to introduce an AI strategy (OECD 2023), its subsequent AI policy endeavours, unlike that of Korea and Sweden, are not embedded in larger visionary thinking, be it heralding technological leadership that benefits society writ large or embracing a governance of AI that engages "all sectors of society" (Government Offices of Sweden 2018, 5). This speaks to a background in which AI has stood somewhat apart from the more shifting nature of innovation priorities in Canadian federal public policy over the years. Space and robotics have been important and ancillary components of the AI efforts, particularly in the early years of development in the eighties.[18] But AI, in the Canadian context, is not linked to policy priorities or support for ICT, as with the cases of Korea and Sweden,[19] nor is it part of a consistent undertaking to analyze the specific vulnerabilities in the Canadian innovation ecosystem.

Policy initiatives in AI developed in the Canadian environs in unique circumstances, with ground-breaking science as a critical part of its foundation. But AI has also been framed within a public policy landscape that is more fractured with respect to innovation. For comparative inquiry, questions surrounding policy implications are raised when critical initiatives are of a stand-alone, isolationist nature.

Innovation Indicators

To assess the impact of federal policy initiatives on AI, two key dimensions need to be evaluated: filings to the World Intellectual Property Organization for AI and VC investments in AI for OECD countries.

With respect to patent data, what can immediately be seen in Figure 1 is the acceleration in patent applications, particularly from 2012 onward. Despite this overarching trend, however, Korea has shown especially strong acceleration, experiencing an increase of 8,966 percent over the base year between 2000 and 2020. While Canada has experienced a pattern of growth, it has not nearly approached the acceleration of Korea. Indeed, by 2020, Canada's standing on this measure was only 19 percent of that of Korea, in a field that is supposed to be the country's strong suit. Sweden, too, has experienced substantive growth, and despite its late start in AI remains strongly competitive with Canada.

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18   On space, see Scharf (2022, chapter 8).

19   In terms of Canadian throne speeches, ICT was referenced only four times over the 2000–2020 period (ibid., Table 1).

With respect to OECD data regarding VC investments in AI (see Figure 2), what this shows is a clear change in rankings. In 2023, Korea had overtaken Canada with US$2.2 billion in AI VC. Canada stood at US$1.85 billion, which is also below Sweden at US$2.0 billion, with the Scandinavian country having caught up quickly. Even at times of more general slowdown, Korea's descent has been more modest since 2022.

Whatever competitive edge Canada may have initially had is in fact decreasing. For Korea, the later start in terms of a formal launch of the National Strategy for AI does not seem to be impacting the indicators, with the data indicating a substantive strengthening of the country's position on both patents and VC. Sweden, too, has strengthened its position significantly on VC since 2019, albeit at a somewhat more modest rate than Korea.

Policy Implications

In examining the questions raised at the outset of this comparative inquiry, there are clear policy lessons to be drawn. As the case of Korea particularly highlights, policy consistency and "deliberate" priority setting are critical in enabling the conditions for AI development and its resulting gains over time. Moreover, this progress does not rely on an isolated set of priorities functioning apart from the broader scope of related technologies (such as digitalization, 5G+, ICT and networks, next-generation manufacturing) or indeed industrial strategy. Rather, the wider technological ecosystem provides an important crucible in which AI innovation may develop. Korea's progress in AI has been decades in the making and has been embedded within a broader STI agenda.

While Sweden has had a later start at the AI policy table, here too AI progress has emerged from an array of policy initiatives, leveraged particularly through attention to digitalization and ICT priorities. In Sweden, a holistic focus on innovation for the economy and society and on collaboration has informed policy developments since the beginning of the 2000s. By contrast, Canada provides a much more ambiguous case for analysis. While Canadian policy has been aimed in this direction since 1987, AI has operated in a more isolated environs. The larger context for AI development, with a focus on digitalization and ICT prioritization as seen in the case studies of Korea and Sweden, is missing from Canada's history on this front.

In the comparative race around AI, there are three important policy lessons for Canada. First, the country's attention needs to be centred on policy consistency and clear priority setting, wedded to effective implementation and with a focus on ensuring that ecosystems absorb AI learning and techniques. Second, attention needs to be focused on integrated initiatives such as digitalization, ICT, advanced manufacturing and digital infrastructure that leverage AI success. In short, Canada needs an effective industrial strategy and one with a realistic assessment of sectoral advantage, such as in manufacturing or energy. Finally, the Korean and Swedish cases illustrate the significance of a broader vision, with AI forming part of a holistic innovation agenda and not operating in an isolated and fragmented manner: Canada must work to achieve something similar.

Conclusion

Given the decelerating trends in innovation indicators, Canada is at an important juncture in AI. The country now requires a laser focus on policy consistency with broader attention to leading-edge technologies and industrial sectors.

Recommendations

- **Canada is at a critical crossroads in AI: it needs a hard reboot to retain its competitive edge.**

- **AI policy in Canada requires a focused effort, swifter implementation and a laser focus on diffusing AI through not only large firms but also small and medium-sized enterprises.** Policy needs to achieve this through meaningful incentives and targeted criteria.

- AI policy also requires targeted efforts — namely, on digitalization and digital infrastructure, attention to ICT and the evaluation of opportunities in areas such as manufacturing and energy — in order to create the conditions in which AI may thrive. **AI priorities need to be linked with a broader industrial strategy that assesses and leverages Canada's sectoral strengths.**

- **AI in Canada must be embedded within a larger innovation strategy that has endurance and shows demonstrable results.** As the case studies of Korea and Sweden both show, AI best thrives in the crucible of robust ecosystems and enabling public policy, not in isolation.

Acknowledgements

Figure 1: Patent Applications to the World Intellectual Property Organization – Artificial Intelligence
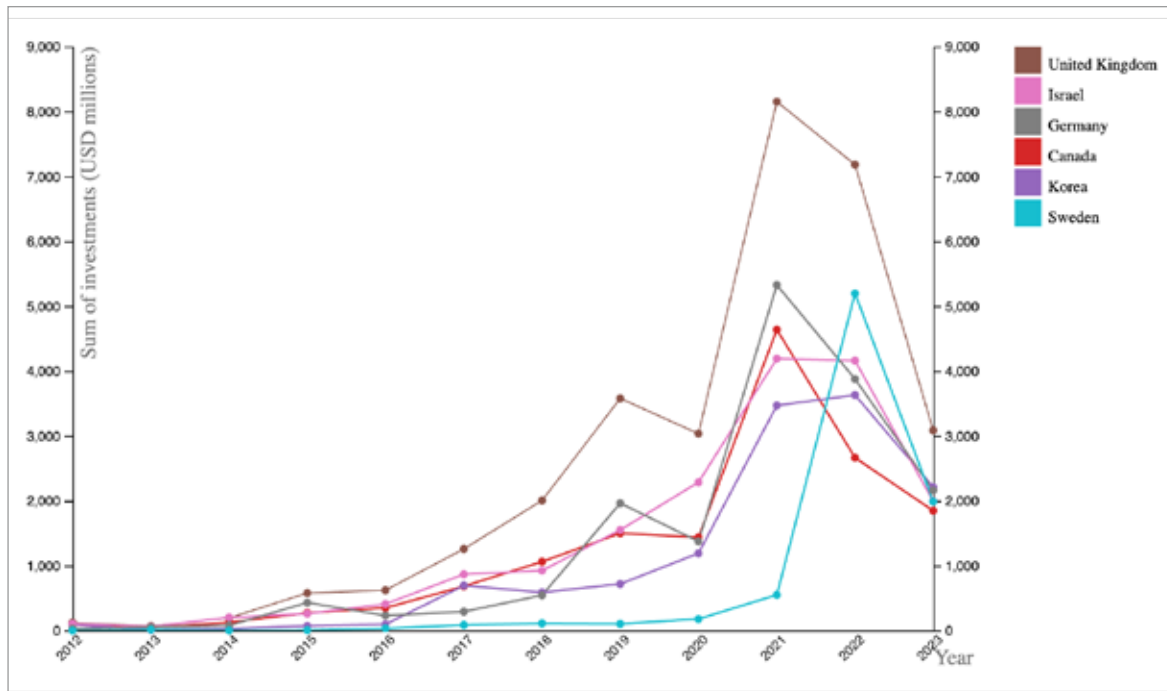
Dataset: Patents by Technology	
Patent authority	World Intellectual Property Organization
Selected OECD technology domain	Artificial intelligence
Reference date type	Priority date
Agent role	Inventor
Measure	Patent applications

World Intellectual Property Organization – Artificial Intelligence
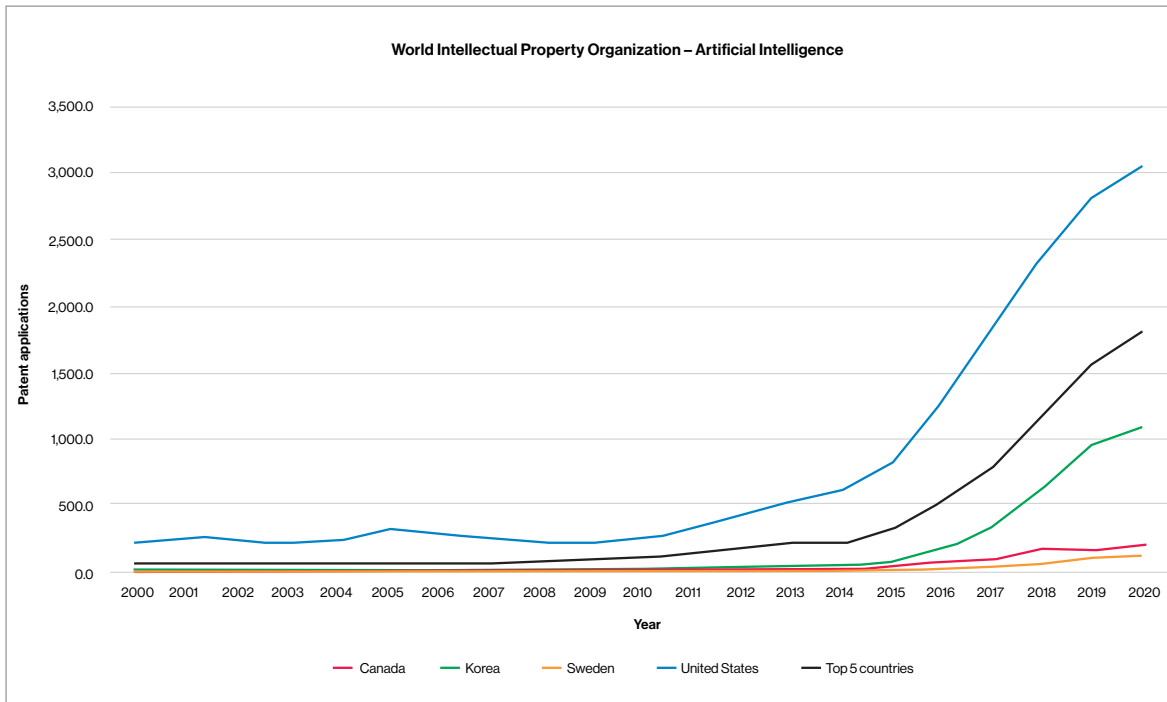
Source: OECD, https://data-explorer.oecd.org/vis?df[ds]=DisseminateFinalDMZ&df[id]=DSD_PATENTS%40DF_PATENTS&df[ag]=OECD.STI.PIE&dq=.A...PRIORITY...INVENTOR..._T&pd=2020%2C2021&to[TIME_PERIOD]=false. Data accessed November 11, 2024 at 4:16 pm EST.

Note: Top 5 countries are the United States, the People's Republic of China, Japan, the Republic of Korea and Germany

Figure 2: VC Investments in AI by Country (by Year)

Source: OECD, https://oecd.ai/en/data?selectedArea=investments-in-ai-and-data&selectedVisualization=vc-investments-in-ai-by-country. Data accessed July 21, 2024 at 2 :30 pm EST.

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Acronyms and Abbreviations

AI   artificial intelligence

CIFAR   Canadian Institute for Advanced Research

DNS   developmental network state

G7   Group of Seven

ICT   information and communication technology

IT   internet technology

OECD   Organisation for Economic Co-operation and Development

R&D   research and development

S&T   science and technology

STI   science, technology and innovation

VC   venture capital

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