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A Comparison of AI Policies and Programmes in Finland, the Netherlands and Sweden – Case Sweden

Håkan Burden and Susanne Stenberg, RISE; Gabriela Bodea, Frans van Ette and Claudio Lazo, TNO; and Heikki Ailisto, VTT

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Abstract

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In 2018 the Swedish Government released its strategy on AI, the national approach for artificial intelligence. The strategy focuses on three main areas – education, research and innovation – with the ambition that Sweden would be the best country in the world regarding applying AI. Two key areas were mentioned – the competitiveness of Swedish enterprises on a global market and the strengthening of the public sector.

Since then, the domestic discourse has changed, as Social-democratic lead governments have been replaced by a Conservative-Liberal government, the launch of ChatGPT, as well as the introduction of EUs Digital Decade with new targets for digitalisation and a proposed regulation of AI. We have therefore conducted a first evaluation of the strategy and the state of AI in Sweden. Based on official reports and interviews we recommend that the Swedish strategy on AI should …

… acknowledge the EU and accommodate for the upcoming regulations and resources within the Digital Decade,

… embrace the pluralism of Swedish governance and facilitate collaboration among authorities and different levels of administration,

… ensure the competence and the mandate of the public sector accordingly,

… be adaptable to changes in both the domestic and international discourse,

… investigate long-term funding solutions of strategic AI initiatives, and finally,

… define sustainable and ethical AI in order to facilitate responsible usage and development of AI as well as facilitate procurement.

This will require prioritisation of targets and initiatives as well as a way of assessing progress which is suitable for the Swedish context.

Key words: Policy development, Artificial Intelligence, Strategy, Digitalisation, Cross-country comparison, European Union, Digital Decade

Front-page illustration: “An evaluation of the Swedish AI strategy”, by deepai.org.

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Content

The Authors

Håkan Burden is a Senior Researcher at RISE Research Institutes of Sweden with a PhD in Computer science with a focus on EU's regulation of digitalization. He co-leads the RISE Policy Lab Digital Systems, the RISE initiative on certification of AI-systems as well as the AI Policy Impact at the Center for applied AI at RISE.

Susanne Stenberg is a Senior Researcher at RISE Research Institutes of Sweden. She has previously been a judge and also worked for the government's office. Today her research focuses on how digitalization evolves due to legal and technical developments and the subsequent implications for sustainable development. Susanne co-leads the RISE Policy Lab Digital Systems, the RISE initiative on certification of AI-systems as well as the AI Policy Impact at the Center for applied AI at RISE.

Claudio Lazo is Digital Strategy & Policy Researcher at TNO in The Netherlands, specializing in AI policy and systems innovation. He has published about AI ethics, governance and policy and works in the European VISION project to support four large AI research networks with roadmapping.

Frans van Ette is Program Director AI at TNO in The Netherlands. He has initiated and led the working group Data Sharing of the Dutch AI Coalition. His main interest is in federated data sharing and the EU-led data spaces.

Gabriela Bodea is senior researcher at TNO in the Netherlands. Her area of expertise is the social impact of ICT, privacy and security. She led or contributed to several projects monitoring and assessing the impact of AI, especially in the public sector.

Heikki Ailisto is a research professor at VTT Technical Research Centre of Finland focusing on industrial applications and impact of AI. He is a member of the steering group for AI flagship Finnish Center for AI, where his responsibility is the impact of research.

The report is the outcome of a collaboration and would not had happened if it was not for the generous and insightful contributions of all authors. Still, the responsibility in relation to the text is distributed so that Heikki Ailisto is responsible for section 7.1 regarding the description of the Finnish AI strategy; Claudio Lazo, Gabriela Bodea and Frans van Ette are responsible for section 7.2 and the details on the Dutch AI strategy; while Håkan Burden and Susanne Stenberg are responsible for the remaining sections in the report.

Svensk sammanfattning

År 2018 lanserade Sverige en nationell inriktning för AI. Målsättningen då var att Sverige ska var bäst i världen på att dra nytta av fördelarna med AI som teknologi genom satsningar inom forskning, undervisning och innovation. Dokumentet har kallats för den svenska AI-strategin och ibland fått kritik för att den är för vag eller inte resurssatte målsättningarna. Det är dock inget som är unikt för området AI – samma tillvägagångssätt har använts för bl.a. cancer och life science. Det har nu gått fem år och det är dags att utvärdera vad som åstadkommits med hänvisning till strategin.

Utifrån de intervjuer vi genomfört och de offentliga rapporter vi analyserat är våra slutsatser att Sverige gjort framsteg inom AI-användning sedan lanserandet av strategin, även om det inte alltid avspeglas i internationella mätningar av AI-mognaden. De största offentliga satsningarna utifrån vår analys är universitetens bidrag till WASP (Wallenberg AI, Autonomous Systems and Software Program), riktade myndighetsuppdrag samt Vinnovas satsningar på AI Sweden och, från i år 2023, innovationsprogrammet Avancerad digitalisering.

Även om mycket har åstadkommits återstår det utmaningar i form av kompetensbehov (alltifrån utvecklandet av AI-system och cybersäkerhet kopplat till AI, till hur man kan värdera nyttan av AI och säkerställa dess effekt i relation till etik och hållbar utveckling), dataförvaltning (såsom garantera kvalitet, integritet och säkerhet), digital infrastruktur (energisnål beräkningskapacitet, resurser för data-lagring och -delning samt hur dessa ska underhållas och utvecklas) samt vision och nytta (som svar på frågor om vad AI kan bidra med och när är det lämpligt att (inte) använda AI?).

Våra rekommendationer är att …

… relatera den svenska strategin för AI till de initiativ som pågår på EU-nivå,

… utnyttja pluralismen i den svenska förvaltningsmodellen och samtidigt möjliggöra samarbete mellan och på nationell, regional och kommunal nivå,

… utveckla kompetensen hos offentlig sektor samt dess mandat som svar på kommande EU-regler och -resurser,

… planera för att vara anpassningsbar i en föränderlig värld,

… skapa en långsiktig struktur för nationella satsningar inom AI, samt

… definiera vad hållbar och etisk AI är i relation till en svensk kontext.

Avslutningsvis vill vi poängtera vikten av att våga prioritera. Sverige kan inte vara bäst på tillämpningen av AI inom hälsa och sjukvård, energisektorn, tillverkningsindustrin, offentlig handläggning, skogsanalyser, bilindustrin, utbildning och arbetsmarknad, smarta fartyg, brottsbekämpning, digital infrastruktur och så vidare. Ibland räcker det att tillämpningen kommer samhället till gagn. Och för att veta det rekommenderar vi att det tas fram en utvärdering anpassad efter de svenska förutsättningarna så att framgångarna på både lokal och nationell nivå samt inom så olika verksamheter som skattedeklarering, kontantlösa betalningar och kontakt med vårdgivarna fångas upp.

1 Introduction

In 2018 the Swedish government adopted its national strategy for AI. The year before a digital strategy had been formulated with the ambition that Sweden should be the number one country in the world in terms of making use of the promises of digitalisation to strengthen the welfare system and ensure Swedish businesses' competitiveness on a global market (N2018/03008). The formal name of the document uses the term approach while it was submitted to EU's AI Watch as the national strategy (AI Watch Sweden, 2021).

Since then, the EU has launched the Digital Decade with subsequent proposed regulations on data, the digital aspects of products and not least AI (DD, 2023). Simultaneously there has been new funding opportunities to facilitate research related to building an European digital infrastructure, competence and data-sharing, among others.

The newly launched Digital Decade Policy Program will also raise new targets for the digitalisation of Sweden (DDPP, 2022). Among the new indexes for assessing digital maturity will be the percentage of industry that use cloud or big data solutions as well as apply AI; the number of key public services that are online; and the ratio of citizens with basic digital skills. And most probably a few of EU's 12 million new ICT specialists will live in Sweden.

The policy programs at EU level will not only affect citizens, but also public and private entities and their ability to deliver in a digitalised society. The CE-marking of digital services in relation to fundamental rights and finding new business models as the existing become obsolete will require new competences and mindsets in relation to emerging roles and new responsibilities (Burden and Stenberg, 2022; Burden and Stenberg, 2023).

Returning to the members state perspective, Sweden held general elections in September 2022 which resulted in a new parliament and a change of government. As the Social-democrats leave the scene and a Liberal-Conservative government takes place the national priorities might shift (Apanasevic et al., 2022). The new government is probably considering their take on AI and digitalisation and new strategies will likely be published in a near future. At the same time the war in Ukraine and the tensions in the Chinese Sea together with the application for membership in NATO are also factors that could have an impact on the digital strategy in general and the application of AI specifically.

All in all, we think the time is right to assess the national AI policy and raise what we see as possible trajectories for the future.

2 Research Questions and Methods

This section describes the scope of the comparison and the overall method in coming up with the conclusions. The last heading details our responsibilities as authors.

2.1 Research Questions

The project had three over-arching research questions:

1. What kind of national AI policies and programmes have been initiated and how have been implemented?
2. What is the impact of the AI policies and programmes?
3. What kind of conclusions and recommendations can be made for future policies and programmes based on the analysis?

The first question will be answered in section 4 where we describe the national strategy document and subsequent initiatives. Section 5 will then give an overview of how the AI landscape has changed since the launch of the AI strategy. Finally, our conclusions and recommendations will be found in section 9. In support of these sections, section 3 will describe the major national actors within the Swedish AI ecosystem; section 6 highlights insights from interviews we have conducted in order to better understand the initiatives and current situation; section 7 gives overviews of the AI strategy, state of the AI landscape and suggestions from the parallel analysis conducted for Finland and the Netherlands; finally, section 8 discusses the Swedish findings.

2.2 Project Meetings

A rewarding part of the project has been the recurring meetings with the authors from the two other research institutes, TNO of the Netherlands and VTT in Finland. During these meetings we have had the opportunity to reflect over national peculiarities and common themes as well as sharing different perspectives due to the various competences and research areas of all involved. It was during these meetings that the overall scope of the project and the disposition of the reports was handled.

We have also had regular meetings within the Swedish project team to discuss the findings from the interviews in relation to the reports. This has facilitated an incremental and iterative analysis of the material during the project's duration.

2.3 Interviews

Interviews have been conducted with representatives of key actors in relation to forming the Swedish AI landscape in terms of its initiation and implementation. Each interview lasted for 60 to 90 minutes, and some interviews were done with multiple interviewees in the same meeting.

We have interviewed three managers from RISE – Charlotte Karlsson who is the president of the digital division, Hanifeh Khayyeri who is the vice president of computer science and Sverker Jansson who is director of RISE center for applied AI. All three in the same interview lasting one and a half hour.

Vinnova, the Swedish innovation agency, was represented by Daniel Rencrantz, director of administration. He was head of the department of innovation management in the period 2017 to 2021.

AI Sweden was represented by Peder Blomgren, who chairs AI Sweden's board and is Head of Data Office R&D at AstraZeneca; Michael Tranemo, member of AI Sweden's board and Head of Data Science R&D at Volvo Cars; and Mikael Ljungblom, Head of communication at AI Sweden.

WASP (Wallenberg AI, Autonomous Systems and Software Program) was represented by Sara Mazur, Chair of the WASP board since 2020.

Patrick Eckemo and Johan Harvard where public administrators and drivers of the national policy in the period 2017 to 2019. Patrick held a senior position at DIGG, the Agency for Digital Government, 2018 to 2021 and is now Chief Digital and Innovation Officer at the Swedish Companies Registration Office. Johan was Deputy Director at the Government's office of Sweden, ministry of enterprise and innovation, 2014 to 2019 and is now employed by Combient as Director for relationship management.

Each interview started with formalia (the international nature of the endeavor, no recordings but notes taken, no explicit citations, each interviewee given the opportunity to comment on the final draft), the objective of the study, a presentation of the two researchers and then the interviewee(s) presented themselves.

Depending on the interaction within each interview the exact phrasing and order of questions varied but overall the questionnaire focused on the role of the organization, the perceived situation in 2017/18, outcomes and reflections on what had been more and less successful. The interviews concluded with a question on wishes for the future.

The interview notes were analysed separately by the researchers and then the findings were compared and grouped into themes. The outcome is presented in sections 6 and 8.

2.4 Supplementary Data Collection and Analysis

While the interviews were a large part of the project in terms of trying to find the explanations for the current situation, reports from different national authorities and indexes from international bodies form the background in terms of rankings and statistics. The reports have been summarised and analysed in relation to the national policy on AI. The analysis is then summarised before being compared with the analysis of the interviews.

The reports were selected through recommendation as we have asked different stakeholders what they think represent relevant contributions. We have focused on the reports that represent the outcome of work done either within the description of the authorities' obligations or specific assignments. This means we have used a light-weight snowballing methodology with the inclusion criteria that the report represented the insights of a national authority with the mandate to evaluate Sweden's AI progress.

There are multiple reports with a qualitative frame of analysis that can be accessed from DIGG's website. Comparing these qualitative analyses with the national statistics

and the international indexes is out of scope for this contribution but is recommended as future work.

2.5 Disclaimer and Responsibility

Since April 2021 we have been following the proposed AI Act and subsequent negotiations in an on-going analysis of European AI Policy from the perspective of how coming regulations changes the common market. In this work we have been discussing the details of the act with actors from both the private and public sector in relation to their own AI usage and development. This has given us insights into several organisations' AI journey and what they perceive as challenging and/or rewarding.

We are also active in the policy work done within RISE Center for Applied AI, responsible for RISE's remittals on the AI Act and the AI liability directive. We have also presented our analyses and participated in activities organised by the AI Agenda for Sweden and AI Sweden, by the government's office and politicians at both national and EU level. As a consequence of that work, we have in parallel to the study on AI strategies also run a policy lab in relation to public administrations' ability to apply AI with an appendix in the official report (I2021/01825).

Complementing our research on the effects of EU's regulation of digitalisation in general and AI specifically in relation to specific actors with an analysis at member state level has been a rewarding effort. It also means that we have insights beyond the official assignments and reports on AI, and that we are actively participating in the efforts put in place in relation to the AI strategy and subsequently do not claim to be neutral onlookers. We therefore make it explicit when we formulate our own analysis or views and when we refer to the conclusions, agenda and insights from others. We are very thankful for having the opportunity to interview representatives from the major actors within the AI ecosystem. We still take responsibility for the themes and representation of the topics raised during the interviews.

Even if RISE is an active part in the AI ecosystem our views do not necessarily represent those of our employer. In short, we are responsible for the report and the recommendations, and any errors or misinterpretations fall on us.

3 Major Actors

This section describes major actors in the Swedish AI ecosystem that have a national representation. The important work done by individual universities and businesses as well as local and regional municipalities is therefore out of scope as it represents specific parts of Sweden and not the whole country. Furthermore, the section is a pragmatic crashcourse with the ambition to supply background knowledge for the following sections.

3.1 Governance at the National Level

The Government of the Kingdom of Sweden is the national cabinet of Sweden and the country's executive authority. The Government operates with collective responsibility and is responsible for its actions to the Parliament (the Constitution; the Instrument of Government (1974:152)). The Parliament consists of 349 members and elections are held every fourth year, unless an election is called for earlier. The Parliament appoints the Prime Minister who then appoints the ministers of the Government.

Individual cabinet ministers do not bear any individual ministerial responsibility for the authorities reporting to their ministry; instead, the director general (or equivalent) reports directly to the Government as a whole. That also means that ministers cannot (should not) intervene in individual cases as these shall be handled by the individual authorities (Riksdagen, 2023).

The Government Offices is a government agency with 4500 employees that acts as the Government's staff and supports the Government in governing Sweden and realising its policies. The Government Offices include the ministries and the Office for Administrative Affairs. Each ministry is headed by a minister who has a staff of politically appointed officials, for example state secretaries, political advisers and press secretaries.

Every year the Government issues directions for the national authorities. The directions set out the objectives of the authorities' activities and how much money they have available to fulfil their obligations, as scoped by the state budget decided upon by Parliament every year. However, a national authority's mandate is given by law, often called the instruction of the national authority, that is policymaking by the Parliament. The Government therefore has quite substantial scope for directing the activities of the national authorities, but it has no powers to interfere with how an authority applies its authority or decides in a specific case. The national authorities take these decisions independently and report to the ministries. The directions are complemented by governmental assignments that are targeted initiatives for one or more authority. The assignments are either carried out within the set budget or come with a specific budget.

There are a number of national authorities with a responsibility for facilitating research. In this report Sweden's Innovation Agency, Vinnova, is a recurring actor since they specifically fund one of the national initiatives, AI Sweden, and applied research in general. The latter being relevant as it aligns with the national AI strategy's focus on the application of AI and not the development as such (a focus covered by i.e. the Swedish Research Council). Vinnova is a governmental agency under the Ministry of Climate

and Enterprise, and the national contact authority for the EU framework programme for research and innovation. The relationship with the national AI strategy is also detailed in section 4.2.

3.2 The Swedish Municipalities

The Swedish governance model also gives the local and regional municipalities of Sweden a high level of autonomy with the right of taxation and specific responsibilities – childcare, secondary schools, social services and support for those with special needs, care of the elderly, health services and hospitals, public transport, waste management and urban planning, among many. Many municipalities also provide services for leisure activities or housing but can also run businesses like amusement parks and laundry services (Burden and Stenberg, 2022; SKR, 2022).

An example of the division of mandate and responsibility can be given through the regional municipality of Västra Götaland. As a region it is responsible for the health care and public transport, but also for regional development. One of the local municipalities of the region is the city of Gothenburg. As a local municipality it is responsible for education targeting pre-University studies and care of the elderly. A local municipality can also have a body responsible for the development of the city in terms of private investments and job opportunities. At the same time there is a national authority, The Swedish Agency for Economic and Regional Growth. The same responsibility can thereby be found at all three levels but the mandate and scope will be different depending on what level of administration is under question.

3.3 WASP

Wallenberg AI, Autonomous Systems and Software Program (WASP, 2021) is a national initiative within fundamental research, education and faculty recruitment. WASP has five partner universities: Chalmers University of Technology, Linköping University, Lund University, KTH Royal Institute of Technology, and Umeå University. In addition, there are affiliated research groups at Örebro University, Uppsala University and Luleå University of Technology that are also included in WASP. The distribution of universities means that WASP covers the south (Lund), north (Luleå), west (Chalmers in Gothenburg) and east (KTH in Stockholm) of Sweden.

The underlying vision is excellent research and competence in artificial intelligence, autonomous systems and software for the benefit of Swedish industry. WASP runs its own research program combining strategic areas (AI, autonomous systems and software) with thematic areas (perception, decision making, interaction, etc.) as well as a national graduate school with 400+ PhD students while also facilitating opportunities for recruiting staff to Swedish universities.

The WASP initiative is by far the biggest research programme in Sweden, with a 6.2 billion SEK budget and a timeframe spanning from 2015 until at least 2031. 4.9 billion SEK of the budget comes from the Knut and Alice Wallenberg foundation and 1.3 billion from partner universities and the Swedish industry. The ambition has grown with the success of the programme. When WASP was initially launched in 2015 the budget was 1.8BSEK, including co-funding. An additional 1BSEK was added in 2017 to

cover AI and its mathematical foundations (we abbreviate billion to B, million to M and 10 SEK ≈ €1).

3.4 AI Sweden

AI Sweden describes itself as the national centre for applied AI with the mission to accelerate the use of AI for the benefit of society and the competitiveness of Sweden (AI Sweden, 2023). The funding comes both from the Swedish Innovation Agency, Vinnova, as well as by various partners. The list of partners represents over 100 different organisations, across the triple-helix. Currently AI Sweden have offices in Stockholm, Gothenburg, Lund, Örebro, Eskilstuna, Luleå and Linköping.

The funding from Vinnova is approximately 150 million SEK for the period 2018 to end of 2024. The amount covers both the base funding (such as establishing nodes across Sweden) and resources for specific purposes (such as collaborations within natural language processing and edge-learning). For more details, see Vinnova's official database of projects which lists both finished and on-going initiatives within AI (Vinnova, 2023). AI Sweden is also successful in obtaining funding as coordinator of research projects with 30 projects listed on their webpage.

One of the contributions of AI Sweden is the webpage my.ai.se where actors can share their experiences of using AI. The webpage lists 170+ examples of AI usage, ranging from chatbots deployed by municipalities, generating master thesis templates with ChatGPT to recommendation systems for eco-friendly building materials as well as waste recognition systems. AI Sweden is also the coordinator of the Vinnova-funded initative on municipal AI adoption Begin your AI journey (in Swedish, Starta er AI-resa). AI Sweden has an impact report listing the full contributions for 2022 (AI Impact, 2023).

Formally AI Sweden is a research project coordinated by Lindholmen Science Park. The science park is in turn a company owned by the city of Gothenburg, Chalmers University of Technology and private actors with financial support from the region of Västra Götaland. The region also directly funds the Gothenburg node of AI Sweden with 7MSEK/year through its regional development funds.

3.5 RISE Research Institutes of Sweden

RISE Research Institutes of Sweden AB (RISE) is a Swedish state-owned research institute with offices at 30+ different sites across Sweden. RISE was formally organised into its current form in 2018 after a period of consolidation of several research institutes owned to various degrees by the state. Due to the background of the former institutes RISE has offers within applied research and development; test, inspection and certification; lifelong learning; and transition management (RISE, 2023; Wikipedia, 2023).

RISE has an assignment to contribute to sustainable development through the renewal and competitiveness of Swedish industry, the renewal of public administration as well as contributing to solutions to societal challenges together with the private sector.

In support of the assignment RISE obtains strategic competence funds from the government. In 2022 the amount was 847MSEK (Prop. 2020/21:60). Of these 63MSEK were to be used for the renewal of society and 88MSEK towards digital transformation. The latter includes pooling competences and resources towards the digital renewal of the private sector through advanced digital solutions and supporting the AI-transition. Corresponding numbers for 2023 were 55MSEK and 75MSEK. There are no specific sums for AI meaning RISE can decide how to distribute the funds across initiatives as long as the distribution aligns with the assignment. One of the initiatives is the Center for Applied AI at RISE which receives approximately 12MSEK 2023.

Another initiative funded by RISE is the AI Agenda for Sweden (500.000 SEK annually; AI Agenda, 2023). The agenda is a network of actors across society invested in AI development and/or usage. The aim is to clarify the potential of AI for different stakeholders while creating an inclusive, equal and sustainable society. An outcome of the work is 25 recommended actions, of which several have resulted in government assignments to national authorities.

4 The Swedish AI Policy

This section will dewscribe the Swedish AI policy and the subsequent government assignments aimed at fulfilling the intentions. It's worth noting that we use the phrases "policy document" and "strategy" as synonyms when describing the national declaration of intent regarding AI.

4.1 The AI Strategy

In 2017 the Swedish Government adopted a digital strategy with the explicit ambition that Sweden should be best in the world in utilizing the possibilities of digitalization (N2017/03643/D). The ambition was in turn based on targets set by the Swedish Parliament in 2011 and subsequently analysed in a number of investigations.

The digital strategy defines the overall ambition in terms of five goals – everyone in Sweden should have the possibility to use and develop their digital competence; Sweden shall have the best opportunities for everyone to take part in a digital society in a responsible and secure way; Sweden will have the best opportunities for developing, distributing and using digital innovation; in Sweden improved efficiency and quality is enabled through relevant, targeted and legally secure digitalisation; and all of Sweden shall have access to infrastructure facilitating quick broadband and stable mobile services that support digitalisation.

The strategy mentions AI five times across 40+ pages – as an important technology together with blockchains and high-performance computing, in relation to professional competences enabling more efficient operations within both the public and the private sectors, and as a tool for managing large datasets. In 2018 the Government's office released a specific strategy for AI (The national approach for artificial intelligence; N2018/03008, 2018). A recurring question in the Sweden is if the text is to be seen as a strategy or not (see e.g. Larsson and Ledendal, 2022). We use theterm strategy as it is the strategy document submitted to the EU AI Watch (and it does not really matter what it is called in our view).

In comparison to the digital strategy (which has numbers for broadband coverage, a responsible authority and a budget) the AI strategy has no explicit targets (beyond being best) and no dedicated resources. However, AI is not the only area with a strategy without explicit resources – in 2018 the Government decided on a position regarding cancer (S2018/03084FS) which pointed to different ongoing initiatives without promising more money, in 2022 the position was complemented with an agreement between the Government and the regional municipalities resulting in more funds to shorten the queues for cancer treatment (S2022/04845). Another area of strategic importance for Sweden, life-science, has a strategy with bold ambitions but no dedicated resources achieving them (N2019/06). In short, strategies without explicit resources are not uncommon, the funding is then given later for more specific targets with the strategy as motivation. The strategy for AI seems to follow this pattern which does not necessarily say anything regarding its importance.

The AI strategy takes off in the claim that Sweden should be best in the world regarding the utilization of digitalization by reaping the benefits of AI to strengthen the welfare

system and Swedish enterprises' competitiveness on a global market. The strategy then describes three areas– Education, Research and Innovation – that rest firmly on the fundamental building block of Frameworks and infrastructure.

Education has three main objectives in the form of life-long learning initiatives targeting professionals, non-technical educations should have an element of AI and strong links between research, higher education and innovation. The first objective mentions universities as an important actor while the latter two refrain from mentioning specific responsible actors. The second and third objective share the need that managers, leaders and non-technical professionals have an understanding of AI.

Research encompasses both fundamental and applied research and there should be close collaborations with international research environments. The WASP initiative is seen as a beneficial initiative and in terms of international collaborations the US and China are mentioned as strong research nations and the EU as an important actor in terms of research funding and programs. Just as for education there is a coupling with the other two aspects so that there are synergies between research, education and innovation. The final objective mentions that AI research has dual purposes, and these should be explored so that insights from civil and military research can strengthen Sweden's total defense.

Innovation and the capability to apply AI can be facilitated by pilots and testbeds. Here public-private collaborations play an important role to ensure ethical and sustainable development and use. Topics include transparency and explainability. A special mentioning goes to managing the risks of AI and developing mitigation strategies to manage disinformation, impacts of low data quality as well as ethical and legal challenges. The third and final objective is the need to build partnerships with other countries and specifically the EU. At the same time such collaborations should respect national security concerns and the subsidiarity between the union and the member states.

Frameworks and infrastructure include the need to develop standards and principles to guide responsible use and development of AI, both on a national and an international level. The balance between personal integrity and citizen trust in relation to the need for data is a vital challenge to address. To facilitate AI development, infrastructure in terms of High-Performance Computing is needed as well as the connections for sharing the high-quality data originating from public administration. Interoperability between national and international initiatives is identified as an important factor for data and services to be accessible but also to ensure transparency. Finally, Sweden needs to participate in the European debate and take an active role to ensure that the benefits of AI are at hand.

The AI strategy emphasizes the importance of collaborations across academia, industry and both national and municipal governance. The challenges and opportunities are substantial and if Sweden is to take a leading position in utilizing the benefits of AI different sectors of society have to collaborate.

4.2 Implementing the AI Strategy

One of the instruments for realizing the national policy on AI is through governmental assignments. Table 1 shows the assignments in relation to other initiatives in order to

give an overall timeline. The top rows therefore position WASP, RISE and AI Sweden in relation to the years they were launched. In the case of RISE it is worth mentioning that the individual research institutes that were amalgamated into RISE were active before 2016 in AI-related activities. The Agency for Digital Government (abbreviated DIGG in Swedish) was created in 2018 as a national authority for facilitating digitalization within public administration.

The timeline spans over three governments (abbreviated Gov. in table 1), corresponding to the general elections that were held in 2014, 2018 and 2022. Between 2014 and 2018 the Social-democrats governed together with the Greens; 2018 to 2022 saw three different governments headed by the Social-democrats, twice with support from the Greens; in 2022 a Conservative-Liberal government was elected consisting of three parties. Each government then set up the government's office according to the specific configuration of ministers of the government. The government 2014 – 2018 chose to manage AI topics in the ministry for business (Bus. in table 1). After the election in 2018 AI was managed by the minister for infrastructure (Infra.). The national policy document on AI was launched in 2018 and subsequently followed by two assignments from the ministry of education (Educ.) towards life-long learning initiatives within higher education and mitigating the fragmented educational initiatives among universities. The figures within the coloured fields represent the budget of each assignment in millions of SEK and a dash, '-', represents the assignment being carried out within the budget of the authorities' directions.

The search was conducted in February 2023 on the government's webservice using the key words "AI" and "artificiell intelligens" (Swedish for Artificial intelligence). There might be other relevant assignments that are not covered by the search if they for instance focus on digitalisation without explicitly mentioning AI.

Since the search was conducted one note-worthy assignment from the new government is for Vinnova to use at least 300MSEK in 2023 and at least an additional 500MSEK 2024-2027. The assignment is within budget, e.g. it details a prioritisation of how the authority is to use its funds. The public funding is then expected to be met by the equivalent inkind from industry. The purpose is to bolster the research program Advanced digitalization which in turn aims to contribute to Sweden's ability to deliver advanced digital solutions, strengthen Sweden's position internationally within innovation and research, facilitate competence supply as well as contribute to Sweden's digital transformation. The assignment explicitly mentions AI as a key technology (KN2023/02784). The assignment can be traced back to a previous assignment in 2021 where Vinnova, DIGG, the Swedish Post and Telecom Authority and the Swedish Research Council were asked to put forward a proposal for a strategic program to address the needs for digital transformation of Swedish industry and society (N2021/00041).

The national strategy kick-started a two-year initiative in 2018 within education where Universities were assigned the task of putting up a platform for courses targeting professionals with a degree related to AI (6MSEK) and competence building initiatives in relation to AI (26MSEK). That was followed by a one-year initiative in 2020 for national museums to develop a Swedish version of Dimensions of Testimony to record the testimony of Swedish-speaking survivors of the Holocaust. The new government in 2019 chose to continue the track within competence supply by a joint assignment for

the Swedish Higher Education Authority and the Swedish Agency for Economic and Regional Growth to map and suggest strategies for digital excellence.

	2015	2016	2017	2018	2019	2020	2021	2022	2023 →
	WASP								
		RISE							
				AI Sweden					
Gov.	Social-democrats + the Greens				Social-democrats +/- the Greens				Cons/Lib
				DIGG					
Bus.			-						
					5				
							-		
							1		
							16.5		
							-		
								-	
									-
Educ.				6					
				26					
						2.3			
Infra.				1					
					0.5				
					20				
					18				
						5			
							0.7		
							4		
							8		
							15		
							-		
							-		
								1	
								79.5	

Table 1. A timeline for national initiatives related to AI.

Several authorities have been assigned to evaluate the capability of Swedish actors to apply AI. Statistics Sweden has for instance been awarded 1+4MSEK for statistical purposes related to AI in 2018-2019 and 2021-2022, Vinnova and the Swedish Agency

for Economic and Regional Growth were given 16.5MSEK in 2021 to develop capabilities for research intensive startups to grow as well as the assignment to four authorities to facilitate AI in public administration (8MSEK, 2021-2023). An outcome of the latter was a template for assessing when to apply AI and the web page offentligai.se which gives successful examples of how public administration can develop and use AI. In May 2023 the webpage lists eight examples from both national and municipal administration. The Swedish Authority for Privacy Protection was assigned to raise competence within integrity and data protection in relation to AI development and usage (6MSEK, 2021-2022). Within the assignment a collaboration was carried out with the region of Halland and the University hospital Sahlgrenska in order to explore data exposure across federated AI models.

In terms of supporting national authorities in regard to building a digital infrastructure the by far most resource-intense assignment came in 2022. It encompasses twelve authorities with a budget of nearly 80MSEK with the aim to start building a platform for shared governance of digital services. The new national authority DIGG was also assigned 20+15MSEk between 2019 and 2022 to facilitate sharing of open data in support of using AI in public administration.

5 State of the Nation

This section will present some statistics regarding the impact and uptake of AI in Sweden. Section 5.1 is to a large extent taken from the report describing the Finnish case (Ailisto et. Al., 2023) but complemented with figures regarding Sweden. The subsequent sections then go into detail based on reports from different national authorities. Here the focus is on reports that provide statistics of AI adoption and its effect in order to give some more detail to the international indexes. There are multiple reports with a qualitative frame of analysis that can be accessed from DIGG's website. Comparing these qualitative analyses is out of scope for this contribution.

5.1 International Indexes

Several indexes and country comparisons on AI capabilities, competence and performance exist. They differ in methods, data used, focus and countries included. Indexes and country comparisons relevant for this study are presented here. First, we describe relevant country indexes and comparisons and then summarise their content in Table 2. The data for Finland and the Netherlands is included as benchmark. When applicable, the development over time is presented, see Table 3.

The Global AI index by Tortoise media combines 143 indicators in sub-areas of Talent, Infrastructure, Operating Environment, Research, Development, Government Strategy and Commercial into a single rank number (Tortoise, 2023). The USA is ranked first, followed by China and the UK. The countries of this report rank between 8th and 19th positions, see Table 2.

The Government AI readiness index by Oxford Insights tries to answer how ready is a given government to implement AI in the delivery of public services to their citizens (Oxford Insights, 2021). The index comprises 10 dimensions based on 42 indicators. Finland, the Netherlands, and Sweden rank in positions 4, 5 and 6, respectively. The scores are given in Table 2.

The AI watch index 2021 by European Commission provides an overview of the 22 indicators organised around five dimensions (AI watch, 2021). For this study three relevant indicators were chosen. First, activity in EU-funded AI projects indicates research activity and collaboration. Secondly, the absolute number of AI economic players indicator relates to the general activity level, since it measures the number of three types of economic players: research institutes (including universities), firms and governmental institutions. Thirdly, the number of economic agents divided by GDP normalizes the activity index in relation to population size. Table 1 contains the results.

It is estimated that AI start-ups based in OECD countries acquired VC Investments worth ca. 180 B$ between 2016 and 2020 (Tricot, 2021). The share of US companies is dominant (150 B$) followed by UK (9 B$), Israel, Germany, and Canada, all with investments around 4 B$. It should be noted that China is missing from the list since it is not an OECD country. The VC investments in the countries studied here range from almost 300 M$ (Finland and the Netherlands) to just over 500 M$ (Sweden). The number of AI start-ups and SMEs in 2020 was ca. 80 in the Netherlands, 55 in Sweden and 45 in Finland according to a report prepared for EU (Verbeek and Lundqvist,

2021). According to the same report, all three capitals of the countries fit in the list of ten EU cities with most AI companies. Amsterdam holds the third place; Stockholm is number six and Helsinki number ten.

The AI Vibrancy index by Stanford University's Human-Centered AI ranks 29 countries across 23 indicators (Stanford University, 2021). The indicators describe research and development in terms of academic publication and citation metrics; IP generation; investments and start-ups as well as talent and skills. Rankings are presented in absolute values as well as normalized per capita.

The Digital Economy and Society Index (DESI) is a composite index describing the digitalization in broad terms (DESI, 2023). It includes four areas: Human Capital, Connectivity, Integration of Digital Technology and Digital Public Services. DESI is maintained by EU. As DESI is not focusing on AI, it can be used as a baseline to which AI indexes can be compared. A rank of the countries is shown in Table 2.

Index or comparison	**Scale**	**Finland**	**Sweden**	**The Netherlands**
Global AI index (Tortoise Media)	Rank	13	19	8
Government AI readiness index (Oxford Insights 2021)	0...100	79.2	78.2	78.5
Activity in EU projects (EU)	Number of projects	153	209	384
Number of economic agents per GDP *and* their absolute number (EU)	Agents/GDP & Absolute	0.9 & 226	0.7 & 325	0.5 & 437
VC investments in AI start-ups 2016-20 (OECD)	USD	284 M$	517 M$	286 M$
AI Vibrancy index	Rank 1-29, absolute /per capita	21 / 8	14 / 14	12 / 12
Digital Economy and Society Index (composite)	rank among EU countries	1	4	3

Table 2. Summary of AI-related country indexes

All three countries perform reasonably well in the global indexes. Even if the relatively small size of the countries is considered, as in AI Vibrancy index, Finland, Sweden and

the Netherlands do not position among the top five, but in the middle section of the 29 countries evaluated. However, if only EU countries are included, the three countries position very well in AI Vibrancy index where they occupy 1st, 3rd and 5th, while in DESI they have positions 1st, 3rd and 4th and in Global AI 1st ,5th and 9th. Interestingly, the internal order of countries varies from index to index. This is understandable since different criteria and measures are used in the indexes. It also implies that caution should be exercised when using the indexes to determine AI maturity or success.

Comparison	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Government AI readiness index	11	6		5	6	13
Digital Economy and Society Index	3	3	3	3	4	4
AI Vibrancy (absolute)	20	21	24	23	14	-

Table 3. A comparison of indexes related to AI readiness over time.

Sweden ranks consistently high in Digital Economy and Society Index over time while fluctuating in Government AI readiness. In 2021 Sweden was ranked much higher than previous years in terms of AI Vibrancy. The latter can be explained by a substantial increase in the sub-category AI Hiring where Sweden ranked 22nd out of 22 countries in 2019 and seventh in 2021. There is currently no value for 2022.

5.2 Public administration and Digitalisation in Sweden in 2016

Swedish National Audit Office (Riksrevisionen, 2016) conducted a review of how well the Swedish Government had utilized the possibilities of digitalization to improve public administration. The data was collected through a survey sent out to national administrations and both regional and local municipalities. The audit was motivated by the Government's ambitions in 2012 to be "best in the world" regarding digitalization and the subsequent slips in international rankings since then (the Audit office's report refers to a Government decision on digitalisation within public administration from 2012, N2012/37).

The conclusions of the audit were that the majority of the respondents were not adhering to the government's ambitions and could do more to comply with national objectives. At the same time the government could do more to facilitate interoperability among initiatives and ensure long-term funding. Further, it was stated how important it is to enable digitalization for the benefits of citizens at the same time as safeguarding their integrity. Among the recommendations were to start prioritizing which areas have strategic importance and enable resources for implementation within these areas, there should be an actor that is responsible for facilitating public administration's digitalization through standards and funding, and finally an investigation on institutional changes for facilitating digitalization – such as changes to law, organisation and support systems.

Five years later the report was followed up by the National Audit Office (2021). The report states that the new authority DIGG was an answer to the needs for a national body responsible for facilitating secure, efficient, and innovative digitalisation in order to improve public administration. DIGG would also be responsible for analysing societal digitalization and policies regarding digitalisation. In 2016 an investigation was launched into the constitutional challenges regarding digitalization. One outcome was a new law regarding secrecy in procurement of technical processing or storage of data, another was a clarification on automated decision making. Both reports focus on digitalization in general and make no explicit connections to AI.

The national AI policy was launched without making explicit resources or evaluation criteria, which might explain why it is not mentioned by the National Audit office.

5.3 AI and Swedish Enterprises in 2019

Statistics Sweden conducted a survey in 2019 on AI uptake among Swedish businesses with more than ten employees (SCB, 2020:1). For their purpose AI was defined as a system that demonstrates intelligent behavior by analyzing its context and acting accordingly, under certain levels of autonomy, to obtain specific goals. Given examples of AI systems where both stand-alone software systems such as facial recognition, translation services and chatbots as well as hardware-integrated software as in the case of autonomous vehicles.

The Swedish Agency for Growth Policy Analysis has performed a statistical analysis on what characterizes Swedish businesses who have adopted AI based on the survey data (TVA, 2023). The original survey data was complemented with other datasets regarding companies and employees. For companies the additional data comprises number of employees, geographical location and sector for the year 2019. The productivity for each company is also given for the period 2014 to 2020. For each company a third dataset details the age, gender, salary and educational level for the employees the year 2019. In total 3670 Swedish companies are included in the study. These 3670 companies had filled in the original survey and were present in both complementary datasets for companies and employees.

Among the companies 5% stated that they applied AI in their business and for companies with more than 250 employees the corresponding figure was 30%. AI was primarily used for developing or refining products and services (6% of all companies) customer analysis (3% of all companies) as well as improving internal processes (2%). Some companies have applied AI for more than one reason. In terms of sectors ICT stands out (23% of companies using AI), followed by energy (9%), property and real estate (7%) as well as professional services relating to law, accounting, engineering and architecture (7%). Uptake of AI is most probable in the Stockholm region with only the most southern part of Sweden having a significant lower probability, which according to the report, indicates that geographical location is not a determining factor.

There was a statistical significance between higher salary and educational level of employees for those companies that did use AI than those companies that had not adopted AI. In contrast, the gender and age of the employees did not indicate a statistically significant difference.

The companies applying AI in 2019 had in general a 7% higher productivity in 2020 than those companies that did not apply AI. There is also a strong correlation between using AI in 2019 and having a high productivity that year. Since there is no data on when a specific company introduced AI, regression testing was performed for the period 2014-2020. The outcome shows a variation around 5% more productivity for AI-adopting companies across the years 2014-2018 compared to those companies who had not adopted AI by 2019.

When the companies were asked to check the challenges for adopting AI, employee competences (14% of all companies), the cost for consultants and equipment (12%), knowledge of applicable technologies and solutions (11%) and lack of an AI vision or strategy (10%) ranked highest.

Taken into an international setting the findings resonate with those of OECD in that large companies within ICT and professional services are more likely to use AI (2022). A limitation of the study is that micro enterprises account for 84% of all companies in Sweden in 2021 (TVA, 2023), and companies with less than ten employees are not within the study, while OECD states that AI utilisation could be significantly more common among start-ups with less than ten employees compared to small and medium sized enterprises (2022).

5.4 Application of AI in Private and Public Organizations 2021

In March 2023 Statistics Sweden released a new report focusing on AI uptake in the period 2019 to 2021 (SCB, 2023). The report analyses uptake in both the private and the public sector but refrains from making comparisons across public-private data since the survey questions are not the same and the structural differences between the sectors. The latter is high-lighted by the fact that the public sector was represented by 181 national authorities, 20 regional municipalities and 287 local municipalities. The private sector was represented by approx. 33000 enterprises with 10-49 employees, 5500 enterprises with 50-249 employees and 1000 enterprises with 250 or more employees (approximate figures for 2021). The difference in questions is explained by the new set of questions developed by Eurostat that were used in 2021 instead of the ones developed by Statistics Sweden for previous years.

The report concludes a 1.1 p.u. increase of AI adoption overall within the private sector, from 5.4% in 2019 to 6.5% in 2021. Corresponding change for the public sector was 4.1 p.u., from 22.5% in 2019 to 26.6% in 2021. An important difference between the sectors is that the public sector has fewer and larger entities than the private sector and there is a pattern that large organizations (250 or more employees) are more prone to apply AI than the intervals for 10-49 and 50-249 employees.

In terms of why AI is applied there is a difference between the enterprises in the interval 10-49 employees compared to the other intervals – 67 of these enterprises claim they use AI for marketing, compared to 44% (medium) and 38% (large). On the other hand, the smaller enterprises used AI for improving cyber-security to a lesser degree – 44% (small) compared to 59% (medium) and 63% (large). While 44% might seem like a large figure it represents 2% of the overall population within the category

enterprises with 10-49 employees. In terms of reported challenges, the small enterprises faced the same issues as the medium and large, but to a different degree. The top-three challenges were Lack of relevant expertise (4% small/10% medium/21% large), Incompatibility with existing systems (2%/8%/15%) and Difficulties obtaining data of relevant quality (2%/7%/15%).

For public administration the figures are that 65% of the regional municipalities used AI, up from 55% which corresponds to two regions; the uptake among local municipalities was 23,7% in 2021, an increase with 4.8 p.u. from 2019; 27,1% of the national authorities applied AI, an increase of 2.1 p.u. compared to 2019. The main reasons for applying AI were not clear cut as the five alternatives – Improve knowledge of users, Develop new services, Improve existing services, Improve internal processes, Other – all scored within the range 30-35% in 2021. In this context it is worth pointing out that regions have a stronger emphasize towards developing new services (69%) than local municipalities (22%) and national authorities (37%). Again, the numbers are the percentage of those who stated they applied AI, so that 69% represents nine regions out of 13 regions that apply AI (and not 9 out of 20 regions that answered the survey). In terms of challenges the national authorities were less prone to report challenges with adopting AI (46%), compared to local (61%) and regional municipalities (65%). The main challenge for all three levels of administration was the competences of the employees (local municipalities, 54% / regional municipalities, 55% / national authorities 36%). The regional municipalities also scored aspects of data security and integrity as challenging (55%). This could, according to the report, be explained by public healthcare being the main responsibility of regional municipalities, and subsequently handling personal data.

6 Insights from Interviews

In the beginning was consensus. WASP was conducting fundamental research and the government should complement that with initiatives within infrastructure supporting digitalisation, competence supply targeting professionals who wanted insights into AI, orchestration of the diverse initiatives within the private and public sectors as well as means to transition competences and skills from the private sector to the public sector in applying AI.

Active leadership is needed, both from the political level and from the director-generals within public administration. It seems that digitalisation as such is not a politically charged topic and therefore not election-winning or an important aspect in negotiating Parliament support for a Prime Minister. There is at the same time a will from multiple actors in the ecosystem to take the lead but not to be led, leading to lack of collaboration. The lack of a clear, political vision and shared resources meant that public administration often invested in small and not necessarily successful digitalisation efforts, such as chatbots. On the other hand, there is also the example of the Swedish Tax Agency's protoype chatbot that was made into a regular feature since it was appreciated by the public. A director-general (or equivalent) with an own agenda often made a big difference in how an authority managed its digitalisation and AI efforts.

AI Sweden is seen as both a consolidating actor and too focused on specific regions as well as prone to publicity instead of in-depth contributions. This can partly be an effect of the short-termed financing and involvement from specific regional municipalities in establishing nodes across the country. At the same time the ability to engage and involve new actors has been mentioned and a wish that more municipal science parks had been involved earlier in establishing the nodes. More resources to AI Sweden was not surprisingly also mentioned as a suggestion for the future.

The strong emphasis on the private sector by WASP has opened the question of who is to support the public sector in their transition? As one interviewee phrased it – where are the 6BSEK over 15 years for public administration and their AI needs? During one interview it was mentioned that public administration would come a far way if approximately 50MSEK was invested in an assignment for multiple authorities to establish a way of working with AI as well as the fundamental building blocks, such as translation and transcription services. The work within the national authorities in establishing common ways of working and AI building blocks was also highlighted as recommendations going forward.

The case of Finland was mentioned as an impressive way of handling AI from a national perspective. Specifically, the overall strategy and governance was highlighted while there were a few concerns regarding the lack of pluralism and how much actually happened at ground level. Otherwise, the international aspect was scarce in the interviews. One interviewee mentioned an ongoing EU collaboration and another the ambitions to attract key competence from abroad.

Multiple interviewees mentioned that AI cannot be seen in isolation. Trustworthy and sustainable AI needs to be inter-connected with cyber-security development, data management principles as well as integrated with related disciplines such as robotics,

IoT, life science, automation, mathematics, ethics, legal aspects, information systems and software engineering, among many.

In retrospect, the need for speed was a recurring theme from the perspective of launching a strategy and facilitate a first source of resources for carrying it out – something had to happen, now. One interviewee described the first years as learning to run while putting on your shoes. Not everything was done in the right way but it got the wheels moving. Interestingly, the same feeling of something must happen, now, was given in relation to the current situation. It is better to have a new strategy and get moving rather than spend more time researching what kind of strategy would serve Sweden best and loose valuable time.

While the sense of urgency was obvious in some interviews it was lacking in others. Here the focus was on all the great things that were being accomplished and how there was a sense of progression and continuous delivery of value, both in terms of new digital resources and competences.

Finally, the fragmentation of the public sector was contrasted by the benefits of pluralism. There was a concern that scarce resources were burnt across municipalities developing similar chatbots pointing citizens to the right webpage. At the same time, it was seen as beneficial that not everyone was running in the same direction when there was no clear path forward. Here the pluralism of the Swedish governance structure was seen as a possibility for exploring the options going forward. The different perspectives were also represented in the recommendations for the future – those emphasising inefficiency also advocated enforcing a common strategy through stronger governance while those focusing on the benefits of pluralism asked for more resources facilitating collaboration across both national-municipal boundaries as well as mandates.

7 Finland and the Netherlands

Summary of the reports on the Finnish and the Dutch evaluations.

7.1 Finland

Artificial intelligence entered the national agenda in 2017, when PM Juha Sipilä's government launched national AI strategy programme "Tekoälyaika" (Age of AI, 2017). The goal of the programme was to ensure that Finland becomes one of the frontrunners among countries that apply artificial intelligence. Three important areas were identified: 1) ensuring that companies receive adequate support for the development of AI-based innovations, 2) facilitate the secondary use of public data as it is essential enabler for AI, and 3) prepare society for the AI age and anticipate the changes imposed by AI. The next government led by PM Sanna Marin set up a similar programme AI 4.0 (2020). The name of the programme combines AI and Industry 4.0, and it "identifies objectives and measures that will promote digitalization in Finland. The programme focuses on the development and introduction of artificial intelligence and other digital technologies in companies." Furthermore, the programme should support the EU goal of double transition. The strategy programmes were high-level, and their impact was indirect, for example they did not contain specific budget allocations for RDI programs or guidelines for AI adoption in the public sector.

Below the national strategy programmes, RDI programmes with substantial resources were launched by Business Finland (total budget including company investment was 235 M€ between 2018-21). The programme supported companies aiming at growth and internationalization, i.e., increasing their export as well as research parties collaborating with such companies. In total 347 projects were awarded grants, which were available to individual companies and consortia. The average project size is 677 000 € (Keski-Äijö and Reponen, 2022). According to Business Finland, the programme more than doubled the exports and personnel in Finnish AI companies (2.5-fold increase of exports to 280 M€ by the end of 2020). In addition, Business Finland says that digital B2B services have become a strong area in Finnish exports, partly due to the programme.

Academy of Finland funds the flagship Finnish Center for AI with 16 M€ over an eight-year period. The flagship is a centre of excellence and impact ecosystem run by Aalto and Helsinki universities and VTT. The ecosystem includes some 20 industrial partners. Furthermore, Academy of Finland has funded basic research on AI with more than 10 M€ per annum in different programs and so called free calls.

Other initiatives worth mentioning are the Finnish AI Accelerator for introducing AI to companies and Aurora AI, a broad initiative for the public sector, which did not quite achieve its ambitious goals. A simplified schematic of the Finnish AI landscape with instruments and actors is presented in Figure 1 below.

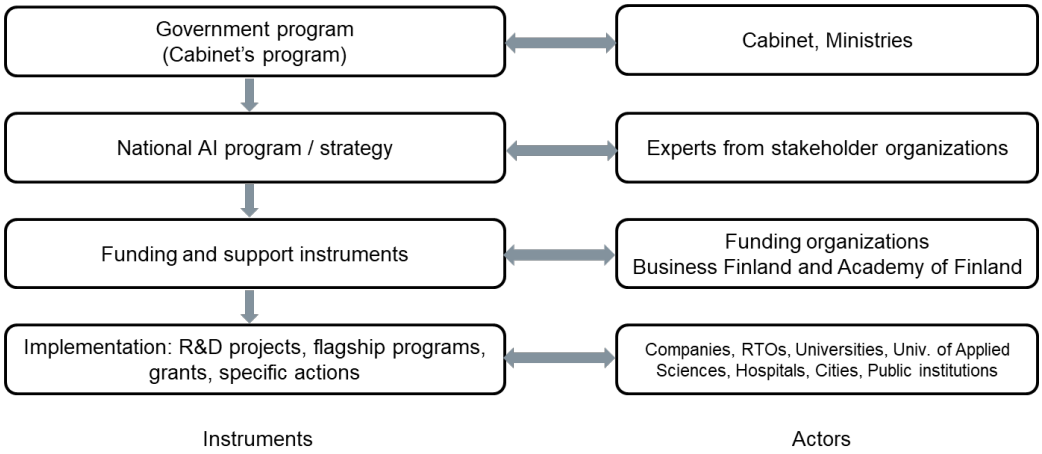

Figure 1. Schematic of instruments and actors in the Finnish AI landscape

The national policies and programmes have had an indirect impact by raising AI to the agenda of decision makers and public discussion. The use of AI solutions in private companies has increased remarkably since 2017, although this is not necessarily the result of the national policies or programmes. However, the direct impact of the programmes appears to be somewhat limited since the programmes did not have mandate or resources to enact their recommendations. Implementation and follow-up mechanisms were lacking. Because of this, some rather obvious opportunities were not used, for example, committing public administration and public healthcare to prepare and deploy interoperable processes, practices, and tools to exploit AI technology.

Finnish AI research is of high quality, when comparing with the size of the population. However, there seems to be some gap between industry and research and thus the impact on business and economy is less than it could be.

The Finnish approach seems to have been more centralized than that of some other countries. That gives advantage in speed and agility, but on other hand, the approach is less inclusive regarding SMEs and civil society. Other aspect, where Finland could improve, is uptake of digitalization and AI in the public sector. For example, the social and healthcare system, which is mainly public but regionally organized, could benefit from tighter collaboration and guidelines given by the government.

7.2 The Netherlands

The initiative for a Dutch national strategy aimed specifically at Artificial Intelligence (AI) was taken by AI voor Nederland (AINED, 2018), a small informal group consisting of organisations representing employers in the private sector, industry, applied and fundamental research. AINED published a document (2018), intended as a call to action to secure the position of the Netherlands in the international AI arena and reap the potential benefits of the technology for Dutch science, economy and society. Together with another report published by thinktank DenkWerk (2018) around the same time, the AINED document inspired the first official AI strategy of the Netherlands government. Entitled Strategic Action Plan Artificial Intelligence (SAPAI), the official government AI strategy was published one year later, in 2019 under the aegis of the Netherlands Ministry of Economic Affairs and Climate Policy. Until SAPAI, AI had not been a standalone government policy priority in the Netherlands, but

featured in other national innovation or industrial policy agendas (in particular in the Dutch ICT & digitalization and the Key Enabling Technologies agendas).

SAPAI outlined the government's ambitions for AI in the Netherlands: as a vehicle "to create and benefit from societal and economic opportunities and protect the public interests, thus contributing to welfare and wellbeing" (SAPAI, 2019). SAPAI set out three strategic action lines: 1) capitalizing on societal and economic opportunities for AI; 2) creating the right conditions for AI research and innovation; and 3) strengthening the foundations for human-centred AI. Two accompanying policy documents expanded on the government's commitment to public values and legal safeguards associated to AI.

Institutionally, SAPAI is not supported by a dedicated government outfit (i.e. something akin to a "Ministry of AI"). Instead, AI policy issues might be addressed by the interdepartmental working group on AI, by the recently (2022) setup department for digitalization (within the Netherlands Ministry of the Interior), by the ministry of Economic Affairs and Climate Policy, or by other national government departments.

The task of putting into practice some of the ambitions formulated in SAPAI was organized as a bottom-up initiative. The Netherlands AI Coalition (NLAIC, 2019) took on the challenge of rallying up and organizing the Dutch AI ecosystem. NLAIC, like AINED, started as an informal group of industry representatives, academic institutions and institutes of applied scientific research, with additional support from the Netherlands Ministry of Economic Affairs and Climate Policy. NLAIC started in 2019 with 65 member organisations and 23,5 M€. of kickstart funding from the Netherlands Ministry of Economic Affairs and Climate Policy. By 2021, the number of member organisations had grown to 250. Structured as a public-private partnership (PPP), NLAIC together with its member organisations define the main themes of their activities (i.e. buildings blocks for AI, such as data sharing, trustworthy AI, human capital, etc.); as well as the sectors of application (i.e. those likely to deliver maximum impact to benefit the Dutch economy and society – see https://nlaic.com/toepassingsgebied). Furthermore, NL AIC also takes on a regional approach, expanding the ecosystem further from regional centres of AI expertise.

NL AIC's strategic R&I investment programme named AiNed is tasked with organizing the actual projects in which members and non-members of NL AIC participate. AiNed received a budget of 204.5 M€ for a period of 7 years from the Netherlands National Growth Fund for phase 1 (including in-kind contributions from research participants the amount is about twice as high while the initial budget was 2.1 B€); and selected the first projects in 2022. The desired impact of projects funded by AiNed is to strengthen the Netherlands' economic position, and to contribute to the development of human-centred AI. The so-called "quadruple helix" is the favoured approach, meaning that projects should aim to involve representatives of four main categories of stakeholders: government, research, industry, and civil society (AiNed, 2022). Furthermore, AiNed projects focus on a subset of the sectors selected by NLAIC. In addition to projects aimed at developing and applying AI-solutions, AiNed finances other types of activities, as well. One example are the so-called ELSA Labs - living labs or innovation labs where ethical, legal and social aspects (ELSA) of AI are explored; places for experimental, iterative and incremental development; environments for collaboration and knowledge-sharing; accelerators of (responsible) innovation.

While activities of NLAIC and its investment programme AiNed focus primarily on the application of AI, scientific research into AI is coordinated by the Dutch Research Council (Nederlandse Organisatie voor Wetenschappelijk Onderzoek, NWO). NWO drafted the Artificial Intelligence Research Agenda for the Netherlands and organized it around specific AI challenges, with the end goal of contributing to the Netherlands' ambition of "being a European leader in AI technology and contributing to the shared European vision of human-centred AI" (NOW, 2019).

Both, however share a number of priorities and approaches to AI research, development and innovation (R&D&I), such as a mission-oriented approach or a "Top sector"-approach (the latter referring to prioritized economic sectors); focus on the EU; on people-centric and trustworthy AI etc.

The R&D&I infrastructure described in the previous paragraphs does not cover all AI-related activities in the Netherlands, nor does it aim to do so. Many such activities preceded it; others continue to emerge and function outside it.

For the latter category, next to self-funded activities, there are various other channels and (policy) instruments available, aiming to encourage (adoption of) innovation. Most of them are generic, rather than AI-specific (for example instruments used by the Netherlands Enterprise Agency (RVO) to help SMEs and start-ups).

Efforts put into promoting and developing AI is beginning to show some results**.**

AI applications are slowly making their way into the private sector, with higher adoption by large enterprises, lower adoption by SMEs, high year-on-year increase across the board, but overall still relatively limited (both in numbers and sophistication of AI).

AI applications are also used in the public sector – in some cases controversially so (SyRI, 2020).

However the gap between AI research and implementations of AI remains significant for now, and activities of R&D&I infrastructures as described above play an important role in bridging this gap.

8 Conclusions

This section gives a summary of the progress made so far in relation to the national AI strategy. We also raise the challenges that prevail today and give a reflection on the size of public investments in AI.

8.1 Absolute and Relative Progress

Since the launch of the national AI strategy progress has been made in AI adaptation across both the private and public sectors. In 2019 5.4% of Swedish companies had adapted AI. For large companies with 250 employees or more the figure was 30%. In 2021 the overall adaptation was 6.5%. For the public sector the increase was from 22.5% in 2019 to 26.6% in 2021 with the regions being the frontrunners.

Among the companies, those who reported to be active within the ICT sector were the most probable to adapt AI. Being located in Stockholm increases the probability of a company having initiated an AI strategy and companies who had adapted AI were in average 5% more effective the following year.

In 2021, WASP had recruited eleven professors and 43 PhDs had successfully defended their theses. Another 364 PhD students were enrolled in the program, of which 104 conducted their research as employed by industry.

According to the international indexes Sweden is slipping in a number of global rankings. If this is due to how progress is measured or if other nations are experiencing a higher rate of progress is not clear to us. Is the same actor assessing what fits within the definition of AI for all nations or is it done by the evaluated? Is the focus on measuring the number of digitalised public services or the quality of the digitalised services? And how does one account for the differences across nations in terms of available services – public/private, national/municipal etc? One of the cautions in terms of the data collected by Statistics Sweden is that the numbers do not include small and micro enterprises. Another caution is that the data represents the questionees' self-assessment which might affect the outcome across organisations and over time.

We have not seen an obvious attempt to assess the national AI strategy. The reports we've read describes the AI maturity and development in Sweden, but not in relation to the AI strategy and the goals therein. The international indexes are not designed to evaluate the Swedish strategy and the strategy is not designed in accordance with the indexes.

An interesting future point of reference will be the metrics and evaluation scheme chosen for the Digital Decade Policy Program to measure the digital progress within the EU. It might be that Sweden is seen in a different light, for better or worse, as new ways of evaluating AI and digitalization are given.

8.2 Public Investment in AI Development

The public sector's three largest explicit contributions towards AI research and application are WASP, government assignments and AI Sweden.

As stated, the WASP program has budgeted 6.2 billion SEK for research into automation and AI. Of that 1.2 billion SEK is inkind from the partners. And as the partners are both private companies and Swedish universities (e.g. national authorities) the budget represents an impressive return of investment on tax money – for every cent the public invests in WASP's AI research, the private sector raises it with a magnitude of one. The exact ratio is not publicly available from WASP but could be calculated by asking each university for their contribution, something we have chosen to leave to future research. The universities within the WASP program are also examples of the pluralistic Swedish government model and how individual authorities have the mandate to act to achieve their aims.

Between 2018 and 2022 the government has invested 200MSEK in assignments targeting AI adoption in both public and private sectors. In 2023 an additional 800MSEK was given to Vinnova for the research program Advanced digitalization which specifically targets AI application within Swedish industry.

Vinnova also funds the most prestigious AI project in Sweden, AI Sweden, with a total of 150MSEK for the period 2018-2024. In addition, three of the 25 targets raised by AI Agenda for Sweden have resulted in opportunities for research funding through the agency. Since Vinnova is both the largest public funder of research programs and funding the largest research project related to AI it has become one of the most influential actors in the Swedish AI ecosystem. The case of AI Sweden also highlights the mandate of the municipalities to strike partnerships with both national authorities and private companies to drive innovation.

8.3 Challenges Remain

While progress is made there are still open challenges. Competence, governance, relevant infrastructure and concrete visions are all aspects of AI adoption that need further considerations. They are of course related to the initial building blocks of the AI strategy in terms of education, research and innovation but have also new features which were not initially included. As such the challenges also serve to highlight how the understanding of AI development and usage has changed over the last five years.

8.3.1 Competence Supply

In terms of competence there is an obvious focus on people capable of developing AI systems. But the need for AI-related competences is broader than so as there are different needs for public administration in assessing which AI technologies are suitable for which kind of assignment, how to develop and comply with relevant policies concerning AI development and data utilization as well as the ability to define value propositions in relation to AI-development. Related competences in cyber-security, mathematics and statistics, IT systems and management, ethics, human factors, legal aspects and so on are also needed for successful development and adoption of AI. And the same goes for the private sector even if the concrete details and contexts will be different.

Another way of phrasing the challenges is that competences in developing AI systems is important in relation to the HOW of AI development, while other competences are needed for questions such as WHY (not) apply AI, AI for WHOM, WHAT kind of AI-

technology and compliance with WHICH policies, such as international standards and ethical guidelines? Our analysis of the impact of the proposed AI Act dives deeper into some of these topics (Burden and Stenberg, 2022).

There are on-going initiatives such as WASP (both in terms of PhDs and WASP's program for AI education), various educational university programs, the topic of policy is included in the strategic research programs as well as the new program on Advanced digitalisation, Elements of AI which is an introductory course given online by Linköping University. To mention a few. AI Sweden is also running a program with a shorter, practical and more targeted educational program for both professionals and those seeking a first profession. More of the same could both serve to direct new people into AI independent of previous education and experience.

8.3.2 Data Governance

Issues related to data governance arise mainly from the reports on perceived challenges of adopting AI. Most noteworthy is the increased recognition of knowing your data within regional municipalities as they are the actor with highest rate of AI adoption. The issues range across the quality of the data as well as aspects of integrity and cyber-security. The topic is also highly relevant in relation to the coming legal requirements on data quality and cyber-security through the AI Act.

The government assignments for sector-specific Datalabs have been conducted and that is a line of work that could be worth looking at again. Not least as the EU Dataspaces initiative will both require new ways of making data available but also assessing the quality and usefulness of possible data sources as data is made into a digital asset on a harmonised market. Again, the public sector perspective is changing with requirements on making data available and the evolving role of data intermediaries.

In terms of integrity and data the interpretation of GDPR in relation to AI-development will play an important role in directing which innovations are worth pursuing. Here governmental assignments such as the one to the Swedish Authority for Privacy Protection (IMY, 2023) is an instrument in defining the innovation space. We have also made inroads into how national law and EU regulations relate to the usage of personal data and AI development (Burden, Stenberg and Olsson, 2023). One of the conclusions is that the reuse of personal data is a key concept in AI development and usage and that new technology opens up for treatments not necessarily represented in the reasoning behind GDPR.

Compliance with cyber-security regulations will be enforced further with the proposed Cyber Resilience Act. The regulation will require CE-marking of both digital and physical components and have an impact on both individual systems and how they interact with systems and actors. In this context the reliance on open source solutions are worth further AI policy research.

8.3.3 Digital Infrastructure

In many cases AI initiatives relates to access to relevant data and data sets. And to share and use data across sectors and actors in a secure and robust way, you need relevant digital infrastructure. This is a theme that comes from the interviews, the reports on AI adoption and which is also present in the Digital Decade in terms of both

regulations and funding opportunities in order to facilitate data as a tradeable asset on the harmonised market.

Concrete examples of EU initiatives that will have an impact on the Swedish infrastructure are the SIMPL platform currently being procured as a middleware layer for the dataspaces and the Interoperability Act. Together they will both place system-specific and legal requirements on different parts of the digital infrastructure.

Access to high-performing computers for the capacity to perform the number crunching needed for data-driven AI systems will also be a key resource. Since this kind of infrastructure scores high not only in capacity but also in energy consumption the development of energy efficient computers and datacentres will be important if AI is not only to be used for sustainable purposes but also is to be developed in a sustainable way. The same reasoning goes for efficient storage of large data volumes on fair contracts. This is an area where EU is investing with the specific aim to facilitate a European digital capacity.

The on-going initiatives towards a shared infrastructure for national authorities (referred to as Ena in Swedish which roughly translates as “unify”) is a step in the right direction but needs funding and access to relevant competences in order to both serve the purposes of public actors as well as be compliant and interoperable with EU initiatives.

8.3.4 Vision and Purpose

The final, and recurring, challenge is the lack of understanding the purpose of adopting AI. Applying an automated speech recogniser to record and transcribe meetings is one thing, understanding how AI can change the internal organisation and processes or facilitate new business models is something else.

Here the initiatives within WASP in terms of research dissemination, public websites such as my.ai.se and offentligai.se as well as the experiences shared within networks and ecosystems play an important role by detailing what can be done and the lessons learnt while doing it.

A missing piece in the jigsaw is the mentioning of how AI can facilitate sustainable and ethical development. According to the EU Commission, AI is the tech to reach growth and sustainability (AI Act, 2021), something that we don’t see in our interviews nor in the official reports. Perhaps having a strategy that emphasises the need to be competitive on a global market and support public administration does not guide enough in enabling sustainability? Even if they are not necessarily in contradiction with each other.

For long it did seem that the proposed AI Act would facilitate ethical AI development with an emphasis on social and economic sustainability (Burden and Stenberg, 2022). The proposed amendment from the European Parliament opens up for an acknowledgement that the ecological aspect also needs to be considered (Parliament, 2023). Together with the research agenda proposed through the introduction of AI regulatory sandboxes it might also be easier for private and public actors to identify the path forward in terms of sustainable development of businesses and public administration and thus when (not) to apply AI.

8.4 Generative AI and Public Awareness

AI as technology and its possible implications on our way of working and humanity's future trended during our work with this report as ChatGPT was launched and created headlines across the globe. In relation to the identified challenges ChatGPT can have a positive effect as it lowers the threshold for trying out AI. It does not require expertise to use, however, understanding how the output is generated and its quality in relation to the ambitions is not a simple task. It is easy to use as a stand-alone web page or can be integrated with existing tool chains and resources through APIs and scripts. And it is currently free of charge. As such it facilitates exploration of possible use cases and an easy way of identifying new value propositions based on AI technology.

Concerns have been raised about how the input is used by OpenAI which poses questions regarding data integrity and cyber-security. It is also worth pointing out that the Council of the European Union and the European Parliament have stated a wish to regulate AI in a way that will affect systems such as ChatGPT. It can be the case that AI applications based on ChatGPT need to be CE-marked and/or comply with technical requirements by law in the future. Or that systems like ChatGPT themselves need to comply with new regulations which can have effects on both how feasible they are to develop and distribute as well as the costs in terms of development and maintenance.

So, while the technology has opened up a discussion on what AI can be and what it can be used for, it is also worth remembering that this will look different in a near future. Systems such as ChatGPT might come with a license to cover the expenses or require that the user has the ability to CE-mark any systems utilising large language models or foundational models.

8.5 Comparison of Strategies

The investigated countries Finland, the Netherlands and Sweden all rank high on international indexes and have a reputation as digitalized countries, this is so also in the European context (see section 5.1). There are of course similarities as well as differences between the countries, and while the study's aim is to high-light and learn from each other there is also an element of cherry-picking experiences to bear in mind, to better understand common ground as well as national characteristics that needs to be considered when assessing the national AI initiatives and their alignment or not with EU AI policy.

From the Swedish perspective there are several take-aways in this respect. Finland has for several years had a high-level AI strategy and have aligned their efforts with what comes out on the EU agenda when it comes to funding research and innovation projects. Finish participation and active involvement has made Finland visible as a partner in consortiums and in influencing for instance the health data space. The effects of the strategy is partly yet to be seen, and depending on the implementation of such an high-level AI policy within levels of society. So far there's a lack of clear indications on AI development or AI usage on the ground.

When it comes to the Netherlands it is worth pointing out the amount of state money into AI research and development (AiNed received approx. 200M€ over seven years), which is roughly the same as within the WASP program in Sweden on an annual basis.

The striking characteristics of the Netherlands is however the chosen governance model for distributing state funding to different AI initiatives, which took time to be inclusive and representative and is still in place though now not with the same emphasis on distributing funds.

In summary, the Swedish model of a strategy without specific funding is not unique as the same was done in Finland. And the amount of funding for AI research seems to be equivalent over the years when Sweden is compared to the Netherlands. Both those countries are doing alright in terms of international indexes. In order to explain the Swedish slip in terms of international indexes it seems a more detailed analysis of the indexes is needed instead of looking for another kind of strategy or more research funding.

The ambition is to return to the cross-country comparison in a fourth report when all three national cases have been concluded.

9 Recommendations

We conclude our report with six recommendations to move the Swedish AI positions forward in relation to a national AI strategy.

9.1 Acknowledge the EU

The Digital Decade comes with new policies relating to AI, not least the AI Act, new possibilities for funding as well as with new resources needed for developing AI systems. The proposed common dataspaces is such a resource that can be an important source for the datasets needed to train and evaluate AI-systems. An important actor in relation to the governance of the dataspaces is the Dataspace Support Center, DSSC, which has the role to complement the European Data Innovation Board, EDIB (Commission, 2021). As a member state Sweden is automatically represented in EDIB but has no representation in DSSC since that required actively seeking membership at the time of launching. We suggest that the next national strategy makes it a priority that Sweden is represented in the bodies and boards governing the digital transition since this gives an insight into emerging topics and a possibility to influence future decisions related to the Swedish strategy.

A new form of investment possibilities are the concepts of Multi Country Projects and European Digital Infrastructure Consortium. These concepts rely on member state participation and thus raise the question of participation in EU research and innovation projects from the level of organisations to the level of member states. If it before was a question for Telia or Ericsson to be involved in research projects on the next generation telecommunications, it is now also a question for Sweden if we are part of the 5G-corridor initiative or not. And in the same way the topic of connected public administration is not only an option for municipalities and national authorities, it is in the context of the Digital Decade also an initiative that Sweden as member state can opt in to or out of. This also raises the question of which cross-border ecosystems we as a nation want to establish and participate within in order to contribute with our strengths, promote interests and take part of future funding opportunities.

In relation to the EU we also see how competences and resources are needed for certification of digital systems in general and AI systems specifically. Here the AI Act and Cyber Resilience Act are closely related since the latter poses options for complying with the former and both pose regulatory requirements to be in order for authorities and companies to CE-mark their systems. If Swedish actors in the innovation ecosystem are to be capable of providing and using AI systems we also need to develop the resources and competences related to certification of digital systems.

Examples of relevant resources are national policies for AI regulatory sandboxes for specific products and systems that complement the sandboxes of the AI Act. We can have complementary policies for testing and developing systems-of-systems such as autonomous machines, digital infrastructure and electrification. This is in-line with the Advanced digitalisation programme, the research conducted within WASP and the resources at the test-site AstaZero, Sweden is also involved in the AI TEFs for health, agriculture and smart cities but not manufacturing. The latter is surprising since it again aligns with the research program Advanced digitalisation. For each TEF there is a

number of related dataspaces that Sweden could take a more active role in developing which would also promote the needs of Swedish export industries and public administration. Taken together, such resources could also be used for testing and certification of digital systems in general and AI specifically.

These examples show how the EU perspective is crucial in understanding the national space for an AI strategy. We therefore suggest that the next AI strategy acknowledges that we are a part of the EU. The alternative is to plan for a Swexit and define the AI strategy accordingly.

9.2 Embrace Pluralism and Facilitate Collaboration

There are multiple examples of how the pluralism within public administration has facilitated successful AI initiatives. Surprisingly, WASP is the most obvious one as it is seen as a private initiative in AI research. But the publicly run universities, individually, have the mandate to collaborate and share a research agenda together with the private funder with an impressive return of investment and research contribution.

Sahlgrenska University Hospital, the Region of Halland and AI Sweden together with the Swedish Authority for Privacy Protection is another example of how the pluralism within public administration enabled different public actors to collaborate on a shared mission as they conducted a research project exploring federated AI development in relation to GDPR together (IMY, 2023).

Trying to make public administration more efficient by clustering all universities into one or align all municipalities until they look like Halland is not a silver bullet. Instead, we suggest embracing the pluralism of Swedish governance as it is both resilient in times where there is no clear path forwards and ensures that decisions are taken close to the involved parties. And if we instead opt to change the governance model we also have to change what we perceive as democracy and change the constitution accordingly.

Our emphasis of pluralism does not mean that there is no room for more efficient public administration or more collaboration among public actors. An informative example is the co-operation between public sector actors in the constellation of e-Sam, looking into areas such as cloud services and legal guidance within digitalization.

Common resources for data-processing and -sharing, shared services such as AI-based translation or text-to-speech, competence clusters for sharing best practice and experiences are all good examples of when it pays to collaborate across administrative borders. It does not matter if those borders are based on sectorial mandates or national, regional or local mandate.

DIGG has a special role to play in this context, both through the general instructions to the authority and through specific government assignments. The latter can also be done in collaboration with other authorities, such as in the case of the assignments on facilitating public administration's ability to apply AI and defining the strategy for advanced digitalisation. A key feature of DIGG is also the instruction to support the

local level governance, the municipalities, hence another key instrument in defining the innovation space (I2021/01825).

Building a shared infrastructure, trust model, competence in CE-marking and so forth to guide and facilitate public administration's adoption of AI does not mean that all public entities are forced to walk in line. When things move to slow for one authority it can take initiatives and others can follow.

We suggest the public sector is mandated as a driver of responsible AI usage in society. Highly digitalized national authorities such as the Swedish Tax Agency and the Swedish Social Insurance Agency, among many, as well as on regional and local level (where AI-services are deployed) have knowledge, competence and long experience of data handling, system development etc but also of transparency and operating in a highly regulated domain. The coming EU regulatory landscape will impact how AI development is done. The public sector has a central role in establishing the prerequisites for public administrations, but also for businesses, and thus the capacity to reap the benefits of AI usage.

On a minor note, statistics need to be both comparable across EU but also reflect national specifics. We also suggest that the public administration of Sweden make it a habit to supply English summaries of their reports. National authorities, regions and municipalities are driving innovation and breaking new ground, both in a national and an international context. However, the outcome is not available for a broader audience. And having an international audience in mind when describing the outcome of an assignment also shifts the focus and facilitates a broader point of reference.

9.3 Ensure Competence and Mandate to Act

It is crucial for businesses and public sector to understand how to navigate coming regulations within the Digital Decade, in order for society to benefit of AI usage.

We suggest a start of the investigation into how the AI Act will relate to Swedish laws and authorities. This may be seen as unorthodox since the act has not yet been decided and there are still specifications to come from the Commission through delegated and/or implementing acts. However, the act will most probably be decided upon this year (2023), and all the details are not necessary to be in place for an Inquiry to start and to be able to investigate, evaluate and suggest which authority is to be competent in relation to the regulation. The mere uncertainty of not knowing the relevant authorities is to business actors often itself a hurdle. The signal that the government is acting to create awareness and clarity around the act and its implications is important, as is to set the prerequisites to build capabilities within the appointed authority as well as the complementary ecosystem around it.

Since CE-marking is to be mandatory for certain AI-systems, we as researchers of AI policy foresee that there is a coming need for building competence within both self-assessment and the certification process. In the time span from now until the AI act comes into force (as it looks by 2026) it is an open question who within northern Europe has the capacity to deliver for instance as a notified body or even just guide software developers through the process. There is a risk of a threshold to get past for industry and business. Planning will help smooth the way to market, and at the same time place Sweden in a sweet spot for AI development.

We have compiled a list of factors of strategic relevance for the evolving landscape of AI-systems within the EU market. These include access to data, computational power, chips and infrastructure but also other crucial bits of the jigsaw of developing and deploying AI-systems: how to set up and be able to conduct necessary tests both in simulation and in real world, how to design and perform relevant certification and how to enable capabilities within market surveillance. Meanwhile the governance model of market surveillance is complicated by the horizontal approach of rules for AI-systems, since the national market surveillance system today is sectorially divided, the governance model to retro-fit for the national competent authority for AI-systems is also expected to be able to balance a surveillance assignment with not only support public and private sector in AI maturity and AI compliance but also the role of developing software in a responsible way.

This aligns with the new emerging role of the national authority (Burden and Stenberg, 2022). The call for bridging the gap between on the one hand new technological advances in product development and on the other hand democratically decided regulation is still heard though not specific to AI usage (Schneier, 2019). However, there is a case for a national strategy to empower public sector as the driver in the new evolving European market landscape. This is so since an enabling factor is to establish clear and transparent intersections between private and public, support sustainable emergent markets and societal needs.

This does not point to a solution of often changed or agile regulation, but rather a business-as-usual traditional approach within public governance: assign appropriate authorities the mandate and the resources to participate in innovation in a clear and transparent manner. It is not easily described or performed when the instruction is related not to support but to surveillance. On the other hand, here Sweden has had a head start, for instance market surveillance authorities such as Transportstyrelsen, IMY, Energimarknadsinspektionen have experiences of hands-on-doing collaboration within research or looking into how to set up innovation arenas etc. And others want to follow.

This means Swedish experiences of collaborative research with several stakeholders including public authorities are highly valuable, both in terms of competence within digitalisation and in co-operation with private sector. From previous research and innovation projects within research and development projects such as policy labs (Burden, Stenberg Carlgren, Sjöblom and Andersson, Burden et al) the safety case argumentation and policy development are characteristics. This is so far not included in the proposed AI Act's articles on regulatory sandboxes.

Transparent and clear assignments (or instructions) for authorities to facilitate and participate in innovation initiatives is one way. These may include participating in EU projects (as Bolagsverket has shown, when it comes to EU digital wallets).

There is also an option for national rules on AI development and taken the concept of AI regulatory sandboxes into consideration as well as the Swedish experiences where public and private sector take part of research projects, gives a time window to explore the possibility to create a national policy on sandboxes until the AI Act is in force.

Seven assignments related to AI (but not necessarily explicitly mentioning AI) can be traced back to the discussions held within the AI Agenda for Sweden.

9.4 Plan to Adapt

We have a national position with a high-level goal when it comes to AI usage. Whether a political statement is called strategy or not, there is a need of a vision for how society is to reap the benefits of AI. We also need a strategy that is flexible and possible to adapt to changes in the outside world or as our understanding of the technology and its benefits and risks mature. This was emphasised in the interviews, and we agree.

It is also evident in the way WASP has adapted over the years. The initial research trajectories have been complemented to encompass human and societal factors besides the initial focus on manufacturing. It is also evident in the role of the EU when it comes to regulation and funding. The EU's priorities change over time, albeit are still firmly grounded in a two-folded strategic transition communicated by the Commission, as the Digital Decade and the Green Deal. At the same time new regulations within the two strategies are proposed and negotiated simultaneously. A similar story is seen in how new ways of funding research are emerging. In short, the actors within and the context around the Swedish innovation system are under constant change and therefore a national strategy needs to be able to adapt as well.

A national strategy needs to be clear enough to formulate a common goal (perhaps more detailed than strengthening Swedish business on a global market and supporting public administration) and flexible enough to accommodate new needs as they arise and build on accomplished gains.

The strategy from 2018 also mentions China as a valuable partner in AI research. The domestic discourse on forming partnerships with Chinese universities and the EU's focus on open strategic autonomy has changed the conditions for bi-lateral research endeavours. Another example of how the national AI strategy has to adapt is shown in how the AI Act will be applicable for certain systems used for civil purposes while military usage is exempt. Thus, research on AI for civil and military purposes will not necessarily share trajectories from idea to innovation.

There will always be a gap between the trends in innovation and the current policies in terms of regulatory compliance and funding, but it can be bridged by means of exploratory policy labs where actors with different interests and mandates together find suitable ways forward (see for instance Andersson et al, 2023; I2021/01825 and IMY, 2023). This is also a method for understanding the impact of disruptive policy arising from the Digital Decade and the Green Deal (Burden and Stenberg, 2022 DA, Burden and Stenberg, 2023).

For a country where the large companies conduct their research and innovation on a global setting it is also difficult to capture the investments on a national level as this is not how the companies keep their internal records. Evaluations based on such metrics can be misleading since companies asked how much they invest on AI research in Sweden might not be able to answer as the figures are for globally distributed teams or for all activities conducted within that country.

In short, we recommend focussing on aims and function instead of prescribing specific ways of achieving the results. The explicit details can then be amended by specific and short-termed assignments, research programs and so forth when needed. However, we also suggest defining a way of evaluating the progress which is configured for the

specific context of Sweden. International indexes are an interesting way of comparing countries but do not necessarily measure progress or breakthroughs. And evaluations do not have to be based on statistics but can instead be done through storylines that reason in terms of longitudinal effects and chains of causality.

9.5 Plan for the Future

AI Sweden as a research project is financed until the year 2025. If national tax money is to continue funding the initiative, we suggest assessing how the brand, resources and the results so far can be taken into the future and become more than the property of a municipality-owned company (or lost). The short-term nature of the research funding was also mentioned during the interviews as a reason that AI Sweden is sometimes more about communication than content even if the contributions in some areas are substantial. Not least the effort in guiding different actors in their first steps into adopting AI are worth mentioning. The need for a long-term plan in terms of national AI coordination is evident and the role of AI Sweden is an important part of that work.

More crucial, the governance model of Sweden's third largest AI contributions in terms of tax money spent results in peculiar ways of orchestrating innovation. For instance, in relation to the research program Start your AI-journey we have a municipality that coordinates a research project funded by Vinnova that in turn coordinates the distribution of the Agency's research funds across Sweden's municipalities as they look to begin their AI journey. It would be more transparent for all involved if that was made explicit in the information regarding Begin your AI-journey or if the governance model of AI Sweden was changed to better reflect its role in the innovation system. We are not advocating a specific solution but want to raise the importance of ensuring that the progress made by AI Sweden is taken care of and that it is transparent who is doing what in the innovation system.

9.6 Define Sustainable and Ethical AI

In times of climate crisis, we find it necessary to emphasises the role of digitalisation as a tool for sustainable development. Economic growth that requires large investments in energy supply needs to not only carry its own environmental impact but also facilitate the transition into a sustainable economy. What is the purpose of digitalising our manufacturing industry if it results in using more energy and limited resources than before? The businesses that contribute to sustainability, but also the sustainable set up of business and diversity among business models that at the same time holds an economic case is a truly competitive strength, especially on a global market arena.

Here the AI Act might become an instrument for driving sustainable development and usage of AI, depending to which extent the Parliament's proposal towards energy efficient AI systems is represented in the final regulation. Independent of the outcome from those negotiations, Swedish public administration has the mandate to include requirements regarding sustainable AI in their procurement. Coming up with a set of general requirements that can be used across a broad spectra of public activity can help to define both innovation and business opportunities.

In this work the legal requirements arising from the Digital Decade will meet those from the Green Deal. To our understanding this is an area where little is done and

Sweden could take a leading role, both within EU and globally. Having national policies in line for sustainable AI sandboxes would also provide a foundation for international collaborations as well as filling the needs in development and testing.

An important aspect in terms of having an international impact is the role of standards. The standardisation work related to AI in general and the AI Act specifically has already started but so far little has been done in terms of ecological sustainability (Burden and Stenberg, 2023). Sweden could be a driver for standards in relation to green AI and digital systems. This would be in line with the strategy from 2018. Government support towards quadruple-helix involvement in standards is also a general way of supporting Swedish organisations without necessarily favourising individual entities. It would also require a close collaboration between public and private actors, something Sweden has an international reputation of being capable of carrying out. And the international contributions would come with synergies if there was a domestic line of work in the same trajectory that worked in tandem.

10 Final Words

From our perspective the recommendations raise two important aspects in relation to a Swedish AI strategy – how to assess the impact of the initiatives and how to prioritise which initiatives to invest in.

It will be difficult for a country of Sweden's size in population and economy to be best in the world in applying AI across domains such as healthcare, energy, manufacturing, public administration, forestry, automotive, education, applied research, skills and employment, smart shipping, combating crime, digital infrastructure and so on. Sometimes it might be enough that the outcome serves a common good and makes Sweden a better place to live and work.

And in order to evaluate if the national initiatives within AI are relevant for the ambitions and aims we need a way of assessing the effect. Relying on international indexes will give an indication regarding Sweden's progress in relation to other countries – according to the underlying model of the index. But that model will not necessarily reflect the Swedish governance model or how international enterprises keep their books.

If multinational companies keep records on what they invest globally in AI or what the operations in Sweden cost, it might be difficult to give reasonable estimates of what their investments are in Swedish AI research. And do we count tax declaration by SMS as one AI service or do we account for the underlying digitalisation and application of AI to make the service possible? At the same time we see how the regions of Sweden are in the forefront of adopting and developing AI and those contributions might not be visible at the national level if you do not know what to look for.

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